

CHAPTER VIII

IAU STYLE BOOK

THE IAU STYLE MANUAL (1989)
THE PREPARATION OF ASTRONOMICAL PAPERS AND REPORTS

Prepared by

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(President of IAU Commission 5)

on behalf of the
EXECUTIVE COMMITTEE
of the
INTERNATIONAL ASTRONOMICAL UNION

Dedicated to the memory of

Donald H. Sadler
(General Secretary of the IAU, 1958–1964)

THE IAU STYLE MANUAL (1989)

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PREFACE

It is a pleasure to contribute a preface to the IAU Style Manual dedicated to the memory of Donald H. Sadler. Dr Sadler, General Secretary of the International Astronomical Union (IAU) 1958-1964, prepared the first "IAU Style Book" in 1961 for use in editing and proofreading the contributions to the Transactions of the IAU. It was republished with amendments by his successor, J.-C. Pecker, in 1966 and in a shortened version by C. de Jager and A. Jappell in 1971. On the invitation of IAU Commission 5, an extensive revision was begun by S. Mitton (Cambridge University Press) but was not completed; the task of revision was passed to G. A. Wilkins just prior to the Delhi General Assembly in 1985. The first draft of the present text was distributed for comment in April 1986; it was primarily intended for use in the preparation of papers for publication in the proceedings of IAU meetings. It was then suggested that an attempt should be made to obtain an agreement with the editors of the principal astronomical journals to use a common set of recommendations in order to simplify the preparation of all astronomical papers. A meeting of editors held in May 1988 reached a wide measure of agreement and a revised draft was prepared for comment during the Baltimore General Assembly.

Since manuscripts for IAU Transactions, Symposia and Highlights are now submitted in camera-ready form, where correction after submission is almost impossible, it was decided that the new Style Manual should include general and detailed guidance on both the drafting of the text and the preparation of the typescript. The increasing use of text-processing software and of high-quality printers, which together give results that are comparable with those from commercial typesetting, has been taken into account. The present Style Manual therefore contains recommendations on style and other information for authors of papers and reports for publication by or on behalf of the IAU. 'Style' is here taken to mean the format and layout of the document together with the conventions regarding designations, references, units etc. IAU publications should maintain consistency and be of pleasing and acceptable appearance. The recommendations take into account the views of the editors of the principal astronomical journals and the recommendations of other major international organisations. It is hoped, therefore, that these recommendations will be widely adopted in all appropriate astronomical publications to the benefit of authors, editors, referees publishers, printers and, most importantly, the readers.

I would like to express the appreciation of the Union to Dr Wilkins for undertaking and bringing this onerous task to a successful completion and to Dr Mitton who made the first start. The preparation of a document of this nature requires that considerable thought be given to establishing conventions which remain unambiguous for long periods of time. Dr Wilkins is to be congratulated on the thorough manner he has brought to the production of the task. It is also a pleasure to record the Union's appreciation of the support Dr Wilkins received from Annette Hedges, Cynthia White and Sue Frizzell at the Royal Greenwich Observatory (UK) in the preparation of drafts and the final camera-ready copy of this Manual. The final text of the Manual benefited from the comments of many colleagues of whom the following deserve special mention:

H. Abt, F. Praderie, J. Shakeshaft, F. Spite and P. A. Wayman.

On behalf of the International Astronomical Union, I would like to thank all who have contributed to the preparation of the Manual and urge all members of the Union to adhere to its precepts in the preparation of their astronomical typescripts.

1988 December

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SECOND PREFACE

The scope of this IAU Style Manual has been extended beyond the original concept, but it has not been feasible to make all the appropriate revisions of the original arrangement and text. Even now, I am aware of some omissions as there has not been sufficient time to develop the additional material as fully as would otherwise have been desirable. I hope that readers will notify me of any errors and omissions which they notice so that a supplement or revised edition may be prepared. I would be glad to receive comments on the general recommendations and suggestions for how this manual might be made more helpful and useful. In particular I would welcome comments and suggestions from readers whose first language is not English.

By the time that this manual is published I will have retired from the Royal Greenwich Observatory, but nevertheless correspondence about it may be sent to me at the address given below.

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**SUMMARY OF RECOMMENDATIONS BY THE INTERNATIONAL ASTRONOMICAL UNION TO AUTHORS
ON THE PREPARATION OF ASTRONOMICAL PAPERS AND REPORTS**

1. PURPOSE

The following recommendations apply in particular to the preparation of camera-ready copy for papers and reports for publication by, or on behalf of, the International Astronomical Union; most of them apply also to other forms of copy and to other publishers. The recommendations are intended to assist astronomers to prepare reports on their investigations and activities in a form that will result in their publication with the minimum of effort and delay and that will be effective in conveying to the readers the essential information about their methods and results. Further details and advice are given in the IAU Style Manual (1989).

2. PREPARATION OF THE DRAFT PAPER

2.1 Planning

Ensure that you are aware of the recommendations concerning content, style and layout before you start to write the manuscript or type the 'compuscript'.

Prepare an outline structure of the paper bearing in mind any particular restriction on length that may apply when the paper is to be published in the proceedings of a meeting.

In general, each paper should include an introduction giving the background and the objectives, a description of the techniques used, a statement of the results obtained, a summary of the conclusions, and a list of references.

2.2 Preliminaries

Choose a clear, informative and concise title that does not include any special symbols nor any acronyms that will be familiar only to specialists.

Write an author statement that includes all those, but only those, who have made significant contributions to the development of the paper; give affiliations and postal addresses.

Draft an abstract that states clearly and concisely the objectives, methods, and principal conclusions; keep within a length of about 200 words, or less for short papers.

Prepare a list of keywords, if required.

2.3 The text

Keep sentences short and simple in construction; avoid unusual words and long compound terms whenever possible.

Be consistent in typographical style (e.g. initial capital letters).

Use SI and other recognised units throughout. Give clear and unambiguous designations for all astronomical objects (e.g. include coordinates in standard format).

Use unambiguous notations and terminology for physical quantities, coordinates and timescales.

Give citations to other useful and relevant papers by identifying the author and year of publication as in Brown 1988; cite more than two authors as Brown et al.

Insert appropriate headings and subheadings with a decimal system of numbering. Cross-references within the text should be by section number.

Do not use footnotes for additional information or references.

2.4 Tables and illustrations

Careful consideration should be given to the choice, content and design of tables and illustrations to ensure that they are appropriate and well presented.

2.5 Checking

Prepare the manuscript and any typescript to be used as printer's copy at double spacing in order to facilitate the marking of corrections and revisions and the insertion of other instructions or comments.

Check the first typescript carefully for content (correctness, completeness and clarity) and typographical style, and mark clearly the changes to be made and other action to be taken during the preparation of the final copy.

Pay particular attention to all numerical information, including designations and references.

Whenever possible, a person other than the first author should also carry out such checking, especially if the paper is to be printed from camera-ready copy provided by the author.

3. PREPARATION OF CAMERA-READY COPY

3.1 Physical quality and format

For the typescript, use either the preprinted sheets supplied by the publisher or other good quality paper of the same size.

Use an electric typewriter with a carbon ribbon or use another type of printer that will produce sharp black characters. A dot-matrix printer should only be used if it produces letter-quality copy.

Type (print) only within the specified type area (150 x 215 mm for IAU Symposia and Highlights; 175 x 250 mm for Transactions), except that in unjustified text it is permissible for lines to extend occasionally over the right-hand margin by two or three characters so as not to break a word unnaturally. The last line may also cross the bottom limit, but letters or lines should not be squeezed together to fit them into the printed outline.

Type at a line spacing of about 4 mm (6 lines per inch) with a character width of about 2 mm (12 characters per inch). Choose a typeface that matches the one currently used in the publications and that distinguishes between the figure 0 and the letter O and between the figure 1 and the lower-case letter L. The line on the preprinted sheet for running-head and page number should be left blank. The typed sheets should be numbered in (blue) pencil in the top right-hand corner.

The typescript must be absolutely clean and any minor corrections of a few characters must be made very carefully; correcting fluid may be used, but it must be thin and dry so that the overtyped characters are of equal density. For larger corrections the whole line should be retyped on a separate sheet of paper; if additional material is to be inserted the following lines must also be retyped to the point where the corrected lines can be inserted without disturbing the remainder of the paragraph. A major omission that would seriously disturb the pagination may be inserted at the end of the paper with an appropriate heading and cross-reference.

3.2 Layout

The first page of each paper in IAU Symposia or Highlights is to include:

The title of the paper in capital letters starting at the left-hand margin and followed by 4 line spaces (blank lines).

The author's name in capital and small letters, indented 10 spaces and followed on the next line by the author's affiliation and full postal address (unless this is given elsewhere in the volume) and then by 4 line spaces.

The abstract, starting with the word ABSTRACT in capitals at the left-hand margin and followed by 2 line spaces and then the heading of the first section of the text.

All section and subsection headings are to start at the left, and have arabic (decimal) numbers, as follows:-

First-level headings in capital letters on a separate line, with two line spaces above and one below.

Second-level headings (one decimal place) in small letters on a separate line, with one line space above and below; bold type may be used.

Lower-level subheadings (two or more decimal places) in underlined small letters, followed by the text on the same line.

New paragraphs are to be preceded by a blank line; the first word is to be indented by 5 spaces (10 mm) unless it follows a heading or starts with a subheading.

All pages should normally be full, except that a new section or subsection should not be started unless there is space for at least two lines of text, and except that there should always be at least two lines at the top of a new page at the end of a paragraph.

Displayed matter, such as mathematical equations, should have one line space above and below and should be indented 5 spaces (10 mm). The numbers of an equation should normally be given in parentheses at the end of the line. Formulae should be spaced so as to avoid ambiguity and to show their structure.

3.3 Tables and illustrations

Tables should normally be typed in the same manner as the text. Columns should be separated by adequate spacing, and not by rules. The caption should precede the table, but auxiliary information may be given below the tabular matter. A narrow table should be centred; the caption should be the same width as the table. Two line spaces should be given between the table and any following or preceding text. If necessary, place a wide table sideways on the page with the top at the left of the upright page; do not include any text (other than the caption and notes) on such a page.

Illustrations should be supplied as original drawings in black ink on good quality paper or as glossy sharp photographic prints or as high-quality computer output from a laser printer. If possible, they should be prepared to a size that is appropriate for reduction with the text, but an unreduced illustration may be supplied separately. Names, numbers on axes or contours, and units should be shown clearly and unambiguously on the drawings. The size of characters and the thickness of lines should be appropriate for reproduction. The caption should be typed under the illustration, usually at the same time as the main text, and to the same width as the illustration. Clear instructions must be given about the placing of separate illustrations.

Tables and figures should be numbered in separate sequences in arabic numerals.

3.4 References

The standard form for reference to a paper in a serial publication is as follows:

Author, A. N., Year. Title of paper. Abbreviated title of serial Volume
number (arabic numerals), first-last page numbers.

If there are several authors, their names should be given in the same form (up to a maximum of eight, then et. al.).

Some journals do not allow the inclusion of the title of the paper; in any case, a very long title should be shortened.

The abbreviations of the title words of serials should follow international standards as exemplified by the list in *Astronomy and Astrophysics Abstracts*.

The title of the serial should be given in italic type and the volume number in bold type if this facility is available; otherwise they should not be underlined.

If it is useful to give a part number, it should be given in parentheses immediately after the volume number.

The standard form for a reference to a book such as a monograph or the proceedings of a conference is as follows:

Author, A.N., Year. Title of book. Place of publication: Name of publisher.

The role of an editor is indicated by giving (Ed.), after the name.

The number of the edition may be given in parentheses after the title in the form (nth ed.).

The details of the conference, including place and date, should be given after the title if they do not form part of it.

The standard form for a reference to a paper in the proceedings of a conference is as follows:

Author, year. Title of paper. In: Editor, (Ed.), year. Title of book. Details of Conference. Place of publication: publisher. First-last page numbers.

If there are several references to the same proceedings, a separate reference may be given for the proceedings, and then the references reduce to:

Author, year. Title of paper. In: Editor year, first-last page numbers.

References are to be arranged in alphabetical order of the name of the author, and in chronological order for each author. If there is more than one reference to an author in one year, then they should be distinguished by giving a letter a, b, c, ... as a suffix to the year. Papers by a single author should be given before those in which that author is the first of two co-authors, and these should be given before these in which that author is the first of more than two co-authors. The usual rules for arranging names in alphabetical sequence should be applied in so far as they are appropriate for multiple authors.

3.5 Checking

The camera-ready copy should be checked carefully to ensure that all corrections marked on the draft have been carried through correctly without introducing any further errors.

The copy should be examined separately to verify that it conforms with the recommendations on style given above.

The abstract and the text should be read again to verify that they are clear, correct and complete.

Final corrections should be made in the manner described above, and should themselves be checked.

4. PACKING AND DESPATCH

The copy should be checked carefully to ensure that it is complete and that all pages of text and any separate illustrations, corrections or other material are clearly and correctly identified.

Camera-ready copy should be protected on both sides by cardboard and placed in a strong envelope of appropriate size or wrapped in carefully sealed paper.

The copy should be sent by airmail (unless local) letter post to the Editor or other person specified by the Editor.

THE IAU STYLE MANUAL (1989)

THE PREPARATION OF ASTRONOMICAL PAPERS, REPORTS AND BOOKS

1. GENERAL CONSIDERATIONS

1.1 Purpose of the IAU Style Manual

The report of a scientific investigation or activity should be prepared in a manner that will result in its publication with the minimum of effort and delay and in a form that will be effective in conveying to the reader the essential information about the method and results of the investigations. The recommendations in this manual are intended to assist astronomers to attain these objectives; they provide general guidance about the appropriate structure of the paper and detailed guidance about typographical style and format. Adherence to these recommendations during the writing of the paper and in the preparation of the typescript will reduce considerably the amount of further effort that will be expended by the author, editor, referees, printer and publisher before the final version of the paper is published. Moreover, their adoption will make it easier for the readers to appreciate the significance of the paper and to satisfy themselves as to the validity of the results.

The recommendations in this manual should be followed by all authors of papers and reports that are intended for publications by, or on behalf of, the International Astronomical Union (IAU). The word 'paper' is hereafter used in a general sense to include not only papers describing new discoveries or reviewing previous work, but also reports of commission meetings and working groups. Many of the recommendations apply to the preparation of books, and some specific guidance is given for the editors of the proceedings of IAU symposia and colloquia. A paper that does not conform with these recommendations may be returned for revision and retyping, and the delay may result in the paper being published late or not at all. The recommendations on content apply to all forms of printing, but the recommendations on format apply in particular to camera-ready copy that is to be used for printing, by photolithography or other similar process, in the Transactions of the IAU, in the proceedings of IAU symposia, or in other IAU publications. Guidance is also given for typescripts that will be used as printer's copy for phototypesetting.

The recommendations of other major international organisations, such as the International Council of Scientific Unions (ICSU) and the International Standards Organisation (ISO), have been followed except in a few cases where it has been considered desirable to conform to common current astronomical practices that do not conflict with practices in related fields. It is hoped that these recommendations will be acceptable to most publishers of astronomical journals so that, for example, authors and typists will not have to use different abbreviations and formats for references when submitting papers to different journals.

This style manual is mainly concerned with the final form of presentation of the paper that is submitted for publication, and so it is intended for use by typists and copyeditors, as well as by authors. In addition, it contains general guidance to authors, editors and referees about structure and content. For simplicity, pronouns of masculine gender are used for persons who may be male or female.

1.2 Responsibilities of the author, editor, referee and publisher

The publication of a scientific paper usually involves four stages:

- (a) the preparation of the copy by the author;
- (b) the validation of the copy by the editor and referee;
- (c) the checking of proofs and the correction of errors; and
- (d) the printing and distribution of the paper by the publisher.

It is important that the separate responsibilities of the author, editor, referee and publisher are properly understood. Most of the following notes are of general application, but some points apply specifically to IAU publications and do not apply to those journals that insist on the use of the house style of the publisher.

A general statement of the obligations of authors, editors and referees (or reviewers) has been issued by the American Geophysical Union (1988); it is reproduced in Appendix A since it is applicable to astronomers as well as to geophysicists. Some, but not all, of the points in it are discussed in more detail in later sections of this manual. The resolution on the improvement of publications that was adopted at the IAU General Assembly in Baltimore in August 1988 is reproduced in Appendix B.

1.21 Author. The author is responsible for submitting the 'copy' for the paper by the scheduled date and in a form that is acceptable to both the editor and the publisher. If the report is the joint work of several persons, they should agree amongst themselves on the contact author who will be responsible for submitting the copy and for any subsequent negotiations with the editor and publisher. The 'copy' will usually consist of a typescript, together with any necessary drawings, photographs and tables, in a format that is specified by the publisher. This material may take the form of camera-ready copy that will be composed, that is set in type (which is now usually on film rather than in metal). It may also, in certain circumstances, be submitted in electronic form, on a magnetic disc or via a computer network.

The author should read carefully any specific instructions provided by the editor or publisher about the length and content of the paper, the format of the copy, and any timetable for submission and subsequent stages of the publication procedure. These instructions may supplement or differ in detail from the recommendations given in this manual.

The author should obtain the agreement of the editor, in advance of submission of the copy, if for any reason he wished to depart from these instructions in any significant way. The author should inform the typist of any special requirements that are not covered by markings on the draft of the report. All authors are advised to seek critical comments from their colleagues about the content and clarity of the text before preparing the copy that will be submitted to the editor. The author is also responsible for obtaining permission to reproduce copyright material, such as Sky-Survey plates.

The author must ensure that any camera-ready copy is of an appropriate technical quality in respect of the sharpness and uniformity of the characters and of the layout of mathematical expressions and tables. Unless the author has the use of suitable equipment he should not attempt to prepare a paper that contains a high proportion of complex mathematical expressions (or otherwise requires the use of different typefaces and sizes, especially symbols, and flexible spacing). Instead, for example, he should submit only a summary of such a paper in the proceedings of a conference and submit the full paper to a journal that is printed by conventional methods.

The responsibility for the accuracy of the copy rests with the author but, if it is possible, the copy should also be checked by another person who has not been involved in its preparation; this is especially true if the information density is high (as in formulae, tables and reference lists) or if time is short. The author (or the 'contact author' for a joint paper) is also responsible for checking, and returning on schedule, any proof that is sent by the editor or publisher in order to allow the author to draw attention to any errors of composition made by the printer. This proof stage also allows opportunities for the detection and correction of errors made by the author or typist and for the improvement of the content or appearance of the paper; amendments on proof are, however, costly, time consuming and a prolific source of further errors, and so the author should endeavour to ensure that the printer's copy is correct and clearly marked to show the author's intentions.

1.22 Editor. The tasks of the editor of, say, the proceedings of a symposium are first of all to plan the structure of the volume and to inform the authors of the conditions that their contributions should satisfy. Secondly, he must decide, perhaps after seeking advice from referees, whether the contributions received meet the required standards for quality of content and presentation. If he is not satisfied he should reject the paper or return it for revision or retyping. An editor should not amend a paper in any significant respect without obtaining the agreement of the author; he should not, for example, make extensive alterations to improve the style and construction of the English without permission. On the other hand he should not accept a paper unless he is satisfied that it is appropriate, soundly based, clearly expressed and carefully prepared in accordance with the instructions given to the author. A paper that reaches unorthodox conclusions should not be rejected merely for that reason; it should be rejected if the author is unable to present the arguments clearly or is unwilling to take into account other relevant evidence.

The editor of a volume that is to be printed from camera-ready copy should not normally accept a paper that is not of an appropriate technical quality. (See the corresponding guidance for authors, above.) If necessary, he should arrange for the preparation of good-quality copy for the summary only, and encourage the author to submit the full paper to a journal printed by conventional methods.

Guidance for the editors of the proceedings of IAU symposia, colloquia and regional meetings is given in the 'Rules for Scientific Meetings' in IAU Information Bulletin 58 (June 1987), 25-31; extracts are given in Appendix C. The editor is expected to prepare an introduction, table of contents and an index to the volume (BSI 1976a).

1.23 Referee. The refereeing, or reviewing, of typescripts prior to publication is an important step in the task of ensuring that published scientific literature is of a high quality. The criteria that are to be used vary according to the purpose of the paper, which may, for example, be concerned mainly with the presentation of the results of original research, with a critical review of past research, or with a proposal for a new observational programme. The editor of the journal or other publication will usually provide a list of points for the referee to consider, but the main criteria are significance, originality and clarity.

All papers should be original in the sense that they do not largely consist of material that has already been (or is to be) published by the author or by another person. The referee should also try to verify that the author has cited relevant work by other scientists and that he has not claimed (directly or indirectly) credit for work for which he was not responsible. (Further guidance on the selection of references is given in section 2.51.)

The referee should verify that the arguments are logical, complete and presented in a manner that will be understandable by the paper's intended readership. He should also look to see that the terminology, notation, units and designations used are in accordance with the recommendations given later in this manual. He should judge the completeness and acceptability of papers that report numerical results by reference to the principles listed in section 2.32; these principles reflect the views of many scientists who have experience in the use and evaluation of published data. A referee is not, however, expected to check every detail of the paper, although he should draw attention to any errors that he notices and he should try to verify that no serious blunders have been made in algebraic or numerical derivations.

Criteria for judgement on significance are not easy to formulate, especially as the importance of an observation or other result may not be apparent until much later when it can be related to other observations or new hypotheses.

1.24 Publisher. The task of the publisher is to ensure, firstly, that the papers are printed in a clear and pleasing format and, secondly, that the complete volume is published and distributed as quickly as possible. The publisher's copyeditor is expected to mark on the copy any further instructions for the printer; these may include minor changes to bring the typescript into conformity with the standard

style for the volume, but he should not alter the text in any significant respect without obtaining the agreement of the editor and the author. The arrangements for proofreading and indexing should be agreed between the editor and the publisher.

2. DRAFTING AN ASTRONOMICAL PAPER

2.1 Planning

Important factors that must be taken into account during the drafting of an astronomical paper are the context in which the paper will be published and the length that will be acceptable to the editor; these factors determine the level of knowledge and understanding by the readers that may be assumed and the style and depth of treatment that will be appropriate. In general, papers in the proceedings of conferences should give fairly broad descriptions of the background, methods and results of the investigations; such papers can be fairly brief and can be evaluated by the editor alone. The detailed report on the investigation that provides the basis for the validation of the data and the justification of the conclusions is best suited to a primary journal where it will be more rigorously refereed and where delays in the completion and acceptance of one paper do not cause delays in the publication of other papers. On the other hand, a conference may be deliberately planned so that some participants are encouraged to develop their subject in depth and so that the proceedings will provide an authoritative review of a particular field. The standard required for the contributions to such volumes will be quite different from those that contain short reports on current research.

In all cases, however, the author should develop the theme and structure of the paper before beginning detailed drafting. The initial outline should include the following items:

- (a) the title of the paper;
- (b) a list of contributors;
- (c) an abstract that summarises the substance of the paper;
- (d) a list of sections and, if appropriate, subsection headings;
- (e) a list of key references;
- (f) a list of figures (drawings and photographs); and
- (g) a list of tables.

This outline should be updated as the drafting progresses and should be used at the end to verify that there are no accidental omissions from the final typescript. A list of keywords, or other indexing information, should be prepared if required by the journal.

In general, appendices (or annexes) should be included only if there are clear advantages either in not incorporating such material in the main structure or in not publishing it in separate papers. Any appendix that might be cited and reproduced separately from the main paper should include an informative title, an author statement, an abstract or brief introductory paragraph, the substance of the appendix, and a list of any necessary references.

2.2 The preliminaries

The title, author statement, abstract, and keywords are particularly important since they will often be reprinted in abstracts journals and stored in bibliographic databases for use in computer-based information retrieval systems; they are also used for the classification and indexing of the paper.

2.21 Title. The title should be clear, informative and concise; it should indicate both the character of the paper and the principal topic discussed in it. Short, eye-catching titles that give an inadequate or misleading impression of the subject of the paper must not be used. A title should not assume that the reader will be aware of the context in which the paper will be printed; rather, the title should be able to stand alone. (Editors of conference proceedings should examine titles of contributions with this requirement in mind.) Special characters that are not

available on ordinary typewriters, and symbols for names of elements, compounds and physical quantities should normally be avoided in titles. Acronyms and abbreviations should only be given where their significance and meaning will be widely understood.

A short title for use as a headline for the right-hand pages should be suggested (or checked for suitability) by the author; it may be assumed that the context, or the names of the authors, will be indicated by the headline on the left-hand pages. These headlines are also known as 'running heads'.

An English translation of the title should be given if the original is written in another language. A French translation may be required for some IAU reports.

2.22 Author. The list of the names of the authors of a joint paper should include only those persons who have made significant contributions to its development. (See also section 2.52.) The list should be arranged in alphabetical order unless the authors consider that a different order is appropriate because of the different contributions to the work; for example, the name of a person who has played a dominant role in the work reported or in the writing of the paper may be listed first. In such cases, the editor should not change the sequence. Each name should be given in the form that the author normally uses for scientific purposes so that attributions in citation indexes will appear together. The affiliation of each author should be given in the form specified by the editor or publisher; the full postal address should be given in the proceedings of IAU symposia and colloquia, and in papers published in most journals.

If a paper has been prepared by an institution or formally constituted workshop group, it is desirable that the principal author or authors should be identified personally in the author statement so as to simplify the citation and refereeing of the paper. The role of the person concerned should be indicated briefly; full information about the status of the paper and of those who contributed to it should be given in the introduction to the paper or in the acknowledgement section, if this is more appropriate.

If a paper is not printed in a latin alphabet, the names of the authors should be transliterated into English in accordance with the appropriate standard; for example, the names of Russian authors should be transliterated from the Russian alphabet according to the scheme given in section 6.31.

2.23 Abstract. Every paper should be accompanied by an abstract in the language of the main text and by an abstract in English if the paper is in another language. For some IAU reports a translation of the abstract into French is also useful; the General Secretary should be consulted in individual cases.

An abstract should state briefly the objectives, methods and principal conclusions of the investigation or paper; it should be concise, clear and as comprehensive as is possible, preferably within a length of about 200 words, or less. (Some journals allow longer abstracts, but any abstract that is longer than this may be arbitrarily truncated in an abstracts journal or bibliographic database.) It should form a continuous text and should not take the form of a list of subject headings; rather, it should summarise in general terms the substance of the paper. Specialist jargon should not be used. Any important numerical result should be given, and the nature and extent of the numerical data given in the paper should be indicated; in general, however, the listing of numerical data in the abstract is to be avoided.

The abstract should be understandable without reference to the main text or external source of information. Bibliographic citations and explicit references to figures and tables should not be given; any necessary citation should be given in full. Mathematical formulae, special characters and abbreviations should be avoided; any abbreviation that is not in wide use, but which it is necessary to use for brevity, should be explained on its first occurrence.

2.24 Keywords. A list of keywords is useful for indexing purposes in abstracts journals (and in the volume in which the paper is printed) and for information retrieval from databases that do not include the abstract. A list of terms that are suitable for this purpose is being prepared by IAU Commission 5; a structured thesaurus is in an earlier stage of preparation. The indexes to Astronomy and Astrophysics Abstracts provide a useful source of keywords. The indexes to previous volumes of the journal in which a paper is to be published should also be consulted.

The combination of a general term with a specific term (for example, stars: chemical composition) often provide an effective way of specifying a keyword that can also serve as a subject heading for the index of the journal.

2.3 The text

2.31 General guidance. It is not the purpose of this manual to provide instruction in the art of writing English prose. It is, however, appropriate to draw attention to a few points that are particularly important for scientific papers that will be written and read by scientists who are not fluent in English.

(a) Different aspects of the paper (such as objectives, methods and results) should be treated systematically in sections with appropriate headings.

(b) Sentences should be short and simple in construction. Any long and complicated sentence should be examined, and then split into shorter sentences, even if this involves inserting a few extra words to link the sentences together.

(c) Short and familiar words should be used in preference to long and unusual words whenever possible. Long compound terms, specialist jargon and slang should be avoided.

In addition to being correct and clear, it is desirable that the text should be consistent in typographical matters such as the use of initial capital letters and the form of abbreviations. Inconsistent or unconventional typographical style, like errors in spelling and syntax, can be distracting to readers even when they are not misleading. The later sections of this manual contain much detailed guidance on such points; for example, the use of capitals for the initial letters of words is discussed in section 6.13. It must be recognised, however, that there are no absolute rules on such matters, and so the guidance given here differs in detail from that given in other publications, such as: AIP 1978; ApJ 1983; Butcher 1981; Hart 1983; Royal Society 1974; Young 1969.

Further guidance on the writing of scientific papers and reports and on English usage is given in many books, including: Barzun & Graff 1977; Booth 1985; CBE 1983; Cochran et al. 1973; Day 1989; Fowler 1965; Gowers 1986; O'Connor & Woodford 1976; Prentice-Hall 1974; Strunk & White 1979.

It is particularly important that mathematical formulae and other symbols are presented clearly and correctly, and that the terminology, notation and designations used for astronomical concepts and objects are precise and unambiguous. These matters are also discussed in some detail in sections 5 and 7 of this manual.

2.32 Data. It is important that a paper that presents numerical data obtained from astronomical observations should contain all the information that is necessary for their use and evaluation. The following principles, which have been developed by experts from many different fields of science, should be followed in the preparation of astronomical papers.

(a) The paper must describe the observational procedures used to obtain the numerical data.

(b) The paper must describe the procedure used to derive the reported results from the actual measurements.

(c) The paper must give the numerical results in a form that is as free from interpretation as possible and in such a manner that the uncertainties of the data can be re-analysed in terms of a hypothesis that is different from that considered by the author.

(d) The data must be presented in such a way that the object, system or phenomena observed and the quantities tabulated can be unambiguously identified and so that the results can be readily related to other data for the same or similar systems.

The basis and implications of these principles are discussed further in the CODATA 'Guide to the Presentation of Astronomical Data' (Wilkins 1982). The recommendations in this manual on designations (section 7.2) and units (section 5.1) are intended to ensure that principle (d) is satisfied.

2.33 Conclusions. In general, each paper should include a final section that contains a general discussion of the principal results and of any further conclusions that can be drawn from them. This section should have a separate heading so that it is clearly distinct from the main text. It should not repeat the abstract, although in many respects it may be regarded as an extended abstract.

2.4 Tables and illustrations

2.41 Tables. Careful consideration should be given to the design of tables in order to ensure that they are appropriate for their purpose. Copy for tables should be prepared in accordance with the recommendations given in section 3.4. The most important use of printed tables in astronomical papers is to provide a precise record of observational data in a form that is convenient for use by others. Tables should not normally be used when the objective is to show to low precision how, for example, the properties of a system vary with the parameters that are used to characterize it; such relationships are usually best shown in graphical form. Redundancy between tables and graphs should normally be avoided. Similarly, tables should not normally be given where the relationship between respondent and argument can be expressed mathematically in a form that can be easily evaluated by calculators or computers.

Tables that are to be printed, or reproduced on microfiche, should be designed so that they will fit conveniently on to the page (preferably in its normal orientation). The characters should be of adequate size, and there should be sufficient space between columns and rows to ensure that there is little risk of confusion in extracting data from the table. The layout should be such that rules are not required to separate adjacent columns or lines. The column headings should be chosen carefully in order to ensure that the significance of each column is clear and the unit of tabulation is unambiguous. For example, it could be given in the form Q/u , where Q is the symbol for the quantity and u is the symbol for the unit, including any appropriate power of ten. The sequence of the tabulation should be chosen to suit the most likely mode of use of the data; if necessary, each line should be numbered serially and appropriate indexes provided. The headings should be repeated if the table occupies more than one page.

Each table should have a caption that includes a title describing the content and purpose of the table concisely but explicitly, and a brief legend giving any explanation that is necessary to define the meanings of the column headings or to specify the basis of the tabulations. Notes on individual entries, including citations, may be given either on the same lines or as footnotes, depending on their length and frequency. More detailed explanatory notes may be given in the text, but ideally it should be possible to use each table without reference to the text; correspondingly, it is usually desirable that the text should be intelligible without explicit reference to the tables.

The editor should be consulted before any extensive table is prepared in final form.

2.42 Illustrations are here regarded as 'figures' or 'plates'. The term 'figure' is used to refer to a line drawing or other graphic image that can be reproduced by the same photolithographic technique as the text. The term 'plate' is used when the image must be reproduced by a special technique (e.g. colour printing) on a separate page; since the extra printing costs may be considerable the editor should be consulted in advance about their inclusion.

Figures should be carefully designed or chosen so that they are suited to their purpose. Graphs, contour maps, outline sketches of equipment, block diagrams of processes, and other line drawings should be kept as simple as possible; in particular, detailed labelling should be avoided so that the lettering on the printed page may be a reasonable size. (It should be borne in mind that such a diagram may be copied for use in a lecture, and so the heights of the letters and numerals should be not less than 5% of the height of the figure). Similarly, photographs should show clearly the object of interest and should not include a lot of confusing or irrelevant detail; colour should not be requested unless it is essential to the understanding of the points being illustrated.

Each illustration should have a caption that includes a concise, informative title and a legend that explains the significance of the symbols and labels used in it. The units in which quantities are measured, the scales of drawings and photographs, and the names of the objects illustrated should be shown clearly and unambiguously. The expressions chosen to label the axes, or to show what is represented by contour lines, should be pure numbers, such as Q/u , where Q is the symbol for the quantity and u is the symbol for the unit. Top and right-hand borders with scale marks should always be given with a graph to facilitate the extraction of numerical values from it. Ideally, the illustration, including its caption, should be useful without reference to the text, although further information may be given there. Excessive redundancy between text and caption should be avoided.

2.5 References, footnotes and acknowledgements

2.51 References. The list of references forms an important part of an astronomical paper. Its primary function in a paper that reports new results is to indicate the sources of information that have been used by the author in developing the new results or on which critical comments have been made. It can also be used to draw attention to other relevant, recent papers that are concerned with the same topic but have not directly influenced the results. The list should not be inflated by including references to all previous work; it is sufficient to draw attention to an earlier paper that contains references to the basic work in the field. In particular, editors and referees should discourage unnecessary citations of earlier papers by the author and his colleagues. Similar considerations apply to review articles; these should comment on the significance of the papers that are cited and then attempt to summarise the current status of the field. For such articles, and for the triennial reports of the presidents of IAU commissions, the aim should be to give complete coverage of useful papers over the period since the previous review was prepared; there is no value in listing papers that give incomplete preliminary accounts of work that has been published in full later or that do not contain any significant new results or insight.

It is now generally recognised that the most effective way of presenting references is by means of a consolidated list after the text of the report, rather than by giving them in the text or as footnotes. Some journals insist on the use of numbered lists in the sequence of citation in the text, but the system adopted in IAU publications is to give the author's surname and the year for the citation, and then to list the references in an alphabetical/chronological sequence as described in detail in section 4.3.

In the IAU Reports on Astronomy it has been the practice to include in the text the author's name followed by the reference number of the entry in Astronomy and Astrophysics Abstracts. This practice is much less convenient for the user and is not now recommended.

2.52 Footnotes. The use of footnotes to provide additional information or to give the author's second thoughts is strongly discouraged. In particular, information pertaining to research grants and other support should normally be included in the acknowledgements at the end of the text of the paper. Important information that is obtained after the submission of the paper and that significantly affects any of its conclusions should be given in a note at the end; attention may be drawn to this addition by the insertion of a simple reference at the appropriate place in the text.

2.53 **Acknowledgements.** Significant contributions by persons other than the authors to the execution of the investigation or the preparation of the paper may be acknowledged at the end of the paper. Supervision by senior staff, as well as the assistance of persons who have carried out routine or technical work under supervision, is often best acknowledged here, rather than by including their names as co-authors. This also applies where a person has provided equipment or software, but has not participated in its use for the investigation being reported. This is also the most appropriate place for recording brief details of research grants or contracts when such an acknowledgement is a condition of the award.

Acknowledgements of the sources of copyrighted material may be given with such items or they may be collected together at the end. Authors are reminded that it is their responsibility to obtain permission to reproduce material from other publications that may be subject to copyright.

3. BASIC INSTRUCTIONS FOR THE PREPARATION OF COPY

3.1 Preparation of typescripts for camera-ready copy

The following instructions apply specifically to the preparation of camera-ready copy by direct typing or with the aid of a word-processing system in which the output device is a typewriter or other printer with a limited choice of typefaces and of character and line spaces. Authors who have the use of typesetting software and laser printers should aim to produce output that corresponds closely in style to ordinary typescripts so that ordinary readers will not be distracted by glaring differences between papers. In particular, the typeface and typesizes (for text and headings) should be similar to those currently used in the series in which the paper is to be printed. Even with these restrictions, the readers will still obtain the subtle benefits of sharper, proportionally-spaced characters and of better facilities for the setting of mathematical expressions.

3.11 General instructions for the typist. The camera-ready typescript must be absolutely clean and free from creases since it will be photographically reproduced. Whenever possible use the special sheets of paper that are issued by the editor or publisher; these show in light blue the frame within which the text must be typed. There are different formats for different series of publications and only the correct style of sheet should be used. If it is necessary to use plain paper, ensure that the typescript is prepared to the correct dimensions on good-quality paper.

Use an electric typewriter or printer that gives sharp characters of even density; dot-matrix printers must not be used unless they are of exceptionally high quality. If possible use an elite typeface (12 characters per inch = 10 ch/21mm), and type the text at single spacing (6 lines per inch = 1 line/4mm) on one side only of the paper. If you have a choice, use a typeface that provides a good differentiation between the numerals zero and one and the letters O and lower case l; avoid using a sans-serif face as these are more difficult to read. If you must use a manual typewriter, use a machine that is in good condition, with clean, sharp type that strikes the paper evenly. If possible, use one-time carbon ribbons which give clean, sharp, black impressions. Normal black ribbons may be used if they are replaced regularly to avoid fading. Unavailable characters or symbols should be drawn with a thin pen and black permanent ink at the correct size; a few special characters may be formed from two standard characters.

3.12 Corrections. Do not use an eraser on the typing sheets, and do not use white correcting fluids for typing over large errors, as these methods result in bad reproduction. A correction facility on the typewriter may be used for small corrections (a few characters). The use of a fluid is permissible for correcting a single character, but it must be thin and dry so that the over-typed character is of equal density. For large corrections (one whole line or more) it is better to type the correct lines on a fresh sheet of typing paper. To correct an omission, retype the line on which it occurs and the following lines to the point where the corrected lines can be placed without disturbing the remainder of the page. Each correction line should be referred to the original typescript by quoting the page

and line-number; it is not necessary to place each correction on a separate sheet. The publisher will mount all corrected lines. Type corrections with the same type-writer and typeface on the same style of paper as the original.

3.13 Layout. Type, as far as possible, to the full width and length of the blue frame on the paper supplied by the publisher or to the specified dimensions. Do not leave extra margins within the blue frame. Text should not be justified (aligned on the edge of the right-hand margin) if a typewriter or printer with fixed-width spaces is used. In unjustified text it may be permissible for lines to extend occasionally over the right-hand margin by two or three characters, so as not to break a word unnaturally. The last line may cross the bottom limit. In no circumstances should letters or lines be squeezed together to fit them into the printed outline. If possible avoid starting a new paragraph on the last line of a page or giving the last line of a paragraph at the top of a new page.

The layout of the preliminaries (title, authors, abstract) and of headings and paragraphs should conform with the instructions provided by the editor or otherwise indicated on the typing sheets. Typical instructions for papers for IAU publications are as follows:

The title should be typed in capital letters starting flush left on the fifth line. It should be followed by at least two blank lines.

The names of the authors and their affiliations and addresses should be typed in capitals and small letters with an indent of 10 spaces (20mm). Each author's initials should precede the surname (family name). A forename (given name) may be given in full only if an author always uses this style. The affiliation should, where possible, be given in English, and should comprise the name of the institution (with department if appropriate) and its location. Full stops (otherwise known as 'periods' or 'full points') should be omitted in acronyms, but should be given after initials and abbreviations; commas should not be given at the ends of the lines. If the authors have different affiliations, there should be one blank line between the information for each author (or set of authors at the same institution). The last affiliation should be followed by at least two blank lines.

The word ABSTRACT should be typed flush left in capitals and the text of the abstract should begin on the same line. The abstract should preferably be composed as a single paragraph.

The instructions on the layout of reports to be published in the Transactions of the IAU are distributed directly to the Presidents of the Commissions.

3.14 Headings and subheadings. In IAU publications the principal sections of the report should be indexed by numbered 'first-order headings' that are typed flush-left in arabic numerals and capitals. Each such heading should be preceded by two blank lines and followed by one blank line.

Subheadings should be numbered decimally (as in this manual) and typed flush-left in small letters (except for the initial capital on the first word). A second-order heading (one decimal place) should be preceded by one blank line and followed by one blank line. A third-order heading (two or more decimal places) should be preceded by one blank line, but the following text should be run on in the same line. In general, it is best to avoid more than three levels of numbered headings; two levels are often sufficient even in reports of medium length.

New paragraphs should be preceded by a blank line and should be indented 5 spaces (10 mm) from the left-hand margin. A series or list of items within a paragraph may be indicated by the use of the letters a, b, c, etc. enclosed in parentheses; the first line for each item should be indented by five spaces (10 mm). The items may be separated by blank lines if this appears to be appropriate.

The publisher will normally be responsible for the insertion of running heads (see subsection 2.21) and page numbers. The sheets (or 'folios') of the typescript should be numbered sequentially from 1 in the top right-hand corner of each sheet, using a light-blue pencil.

3.15 Numbering of tables, illustrations and equations. In general, tables, figures and equations should each be numbered sequentially in Arabic numerals from 1. Illustrations, such as colour photographs, that are to be reproduced on separate pages as 'plates' may be numbered in the same sequence as figures that are to be printed with the text; in such a case, a reference in the text should be given in this form "... in Figure 23 (Plate 3) ...". For books and long papers with many tables, figures or equations it may be more convenient to the readers if a new sequence of numbers is started with each chapter or principal section; e.g., a cross-reference of the form "Table 3-5" would refer to the fifth table in chapter or section 3.

The number of an equation should be given within parentheses at the end of the line concerned, without leaders between the equation and the number; the cross-reference to the equation should not, however, include the parentheses. Individual equations within a group of related equations may be identified by using a decimal notation; e.g., "Equation 27.3" would refer to the third equation in the group of equations identified at the end of last line of the group by (27). It is not necessary to number an equation, or displayed mathematical expression, if there are no cross-references to it or if it could be easily identified by reference to the section in which it occurs.

3.16 Illustrations. Appropriate spaces must be left on the sheets of typescript for figures that are to be reproduced with the text. All such figures must be numbered in sequence, using Arabic numerals, and each must have a caption that is complete enough for the illustration to be appreciated without reference to the text. The caption may be typed at the appropriate place in the typescript even though copy for the figure itself may be provided separately. Recommendations on the preparation of the illustrations are given in section 3.5.

3.17 References. The format of citations in the text and of bibliographic references in the list should follow the recommendations given in section 4, unless the editor has specified a different system.

3.2 Preparation of typescripts for printer's copy.

A typescript that is to be used as printer's copy should be clear and neat so as to reduce the number of errors made by the compositor. (The correction of such errors is costly, time-consuming and a prolific source of further errors.) The typescript should be typed on only one side of the paper, whose size should normally be A4 (296 x 210 mm) or the corresponding American size (279 x 216 mm). It should be double-spaced (3 lines per inch = 1 line/8mm) throughout, with adequate margins of at least 40 mm at the left and bottom. Otherwise, the instructions given in the preceding section usually apply.

Corrections must be legible and are best given at the appropriate place in the text, rather than in the margin. Instructions should be given in simple words, rather than by the use of proof-correction marks. White correcting fluid may be used freely, but heavily corrected pages should be retyped. Some publishers pass the typescripts through OCR (optical character recognition) readers to avoid the need for manual input of the text by the compositor, and so authors should aim to produce typescripts with the minimum of handwritten corrections.

Special characters and mathematical equations may be written in by hand using black ink. Greek letters and unusual symbols should be identified separately by marginal notes written in pencil. Further guidance on the presentation of mathematical formulae is given in section 5.2.

Notes for the attention of the editor should be clearly distinguished from text that is to be set in type: for example, they may be encircled and preceded by the words To Editor.

Extra copies should be supplied in accordance with the requirements of the journal.

3.3 Submission of copy in electronic or magnetic forms

Some publishers of astronomical journals and books are considering how best to utilise the new techniques for the transmission of information by electronic means (public telephone system or computer network) or in magnetic forms, such as diskettes (floppy discs) generated by desk-top computers. The former is appropriate when the 'electronic copy' is to be used to generate typescripts for consideration by the editor and referees; subsequent communications about the paper can also be by electronic-mail and the final version can be used directly by the printer either for the production of camera-ready copy or for input to a typesetting system. Diskettes may also be used to avoid the necessity for the printer to keyboard the paper from printer's copy. Diskettes are also appropriate if the author is able to use text-processing software to generate a 'compuscript' that contains all the control characters required to specify the typographical format in full detail. (Such control characters may be lost or changed if compuscript files are transmitted by electronic means.) The author must ensure that the diskette and the compuscript file are fully compatible with the system to be used by the printer. The journal editor or the publisher may be expected to supply appropriate instructions, and possibly software, for the system concerned.

3.4 Preparation of copy for tables

3.41 Tables must be carefully designed to suit the method of printing, as well as to be appropriate to their purpose as discussed in section 2.4.

Short tables may be typed directly in camera-ready copy in the appropriate places and with their captions. Tables that do not require the full width of the page should be centred between the margins of the type area. Each table caption should be typed above the table and to the same width. The caption should include the number of the table (in Arabic numerals) and a concise, informative title; further explanatory notes may be given either immediately after the title or after the table. The body of the table should be typed at single spacing (unless it includes subscripts or superscripts) with blank lines between every five lines (or other appropriate small number) to give greater legibility. At least two, preferably three, blank spaces should be allowed between successive columns. Camera-ready copy for large tables that occupy one page or more will usually be produced directly by a computer printer to save time in preparation and checking. Care must be taken to ensure that such print-outs have good contrast and are of constant density. If possible the caption and column headings should be printed at the same time; otherwise care should be taken to ensure that these are typed in a similar style and density.

Tables that are to be used as printers' copy should be typed at double spacing on separate sheets with their captions. Explicit instructions must be given for column headings, for spacings between columns and blocks of lines, and for any other special features of the table, such as the use of different founts for arguments or certain respondents. The most appropriate place for the table should be indicated in the margin of the typescript.

Large tables will usually be required in camera-ready form even if the text is to be composed by the printer. Such tables will usually be reduced in size before they are printed and this should be taken into account in their design. The reduction is usually to 70% of the original size for tables prepared on typewriters. Very wide tables should be avoided, but if necessary a table may be reproduced in landscape (broadside) format with its top along the left-hand margin of the page.

3.42 Rules. If rules are to be included on camera-ready copy (and they are best avoided), they should be drawn by an expert with the proper tools to ensure uniformity of width and density. Great care is required to ensure that the rules are parallel or perpendicular to the lines of the table.

3.5 Preparation of copy for illustrations

3.51 Line drawings must be submitted as originals, drawn in black ink on good-quality tracing paper, draughtsman's film or white matt paper, or as glossy photographic prints. Photocopies, multiliths, Verifax or Xerox copies are not normally acceptable substitutes. In computer-drawn figures it is vital to ensure that the plotter or matrix printer produces clean black lines of an appropriate width and uniform density.

Drawings for camera-ready copy must be finished to a size that is compatible with the permitted typing area. The drawings will be reduced photographically with the typescript, and the size of lettering and the width of the lines must take this into account (see also subsection 2.42). Lettering should be done with a lettering stencil or with press-on lettering; free-hand or typewritten lettering is not recommended.

Drawings for submission with printer's copy should be finished to a size that will allow for a substantial reduction to the final printed size, which may be 50% (or less) of the original size. The thickness of lines and the size of the lettering must take this into account; there should be consistency in thickness and size between all elements in the illustrations. The scale of a drawing or photograph should be indicated in a manner that is independent of the reduction factor.

Each illustration for camera-ready copy should be mounted so that the edges of the illustration (and not the edges of the paper on which it is drawn) are appropriately indented (say 20mm) with respect to the margins or adjacent text. The caption should be typed below the figure and to the same width. Large illustrations may be aligned on the left-hand margin; if it is necessary to turn it to landscape (broadside) format then the top of the illustration should be at the left-hand margin of the page. If, for any reason, it is impossible to provide artwork of the correct finished size, leave enough space in the typescript for the incorporation of the illustration and supply the artwork to the publisher, who will take care of the photographic reduction and mounting.

Illustrations for printer's copy (or unmounted illustrations for camera-ready copy) must be numbered carefully (in Arabic numerals) and the appropriate orientation indicated if there can be any doubt about it. The place where each illustration would be best inserted should be indicated by a circled note in the margin of the typescript. Captions should be typed on a separate sheet of paper.

3.52 Photographs. The reproduction of photographs necessarily involves a slight loss of quality, particularly if the picture has to be enlarged, and so photographs should be supplied as original prints that are large and glossy and that have good contrast in tone ranges and between subject and background. Photocopies of prints are not acceptable. Photographs of illustrations from printed books and journals do not reproduce well and should be avoided if possible.

Any additional lettering, arrows, or scales should be marked on transparent overlays with register marks. Be careful not to mark or score the photographs or to dent them when writing on the back. The photographs should, however, be appropriately numbered on the back by writing lightly with a soft lead pencil, never with a ballpoint pen; the appropriate orientation should be indicated if there can be any doubt about it. Captions must be typed on separate sheets of paper; scale factors should not normally be given in captions as the final reduction factor may not be the same as that expected. Paperclips, pins and staples should not be used to attach overlays or captions to the photographs, which should be protected by keeping them between sheets of cardboard.

3.6 Title pages for proceedings of IAU symposia and colloquia

Editors of the proceedings of symposia and colloquia that have been sponsored by the IAU should ensure that the title page contains all the information necessary to identify the conference by the title, or by number, or by place and date. The title page should also give the name(s) and affiliation(s) of the editor(s) and the name and place of the publisher, which may be an observatory or other non-commercial organisation. The basic recommended format (where nn represents a number in Arabic numerals) is as follows:

NAME OF UNION IN ENGLISH AND FRENCH

TITLE OF CONFERENCE
IN LARGE CAPITALS

PROCEEDINGS OF THE nnTH SYMPOSIUM OF THE
INTERNATIONAL ASTRONOMICAL UNION
HELD IN PLACE, COUNTRY
nn-nn MONTH 19nn

Details of cooperating ICSU organisations if appropriate

EDITED BY

NAME IN CAPITALS
Affiliation, Place, Country

and

SECOND EDITOR
if appropriate

NAME OF PUBLISHER
Place(s) of publication

It is desirable that full information be given on a separate title page when the papers are published in a regular or special issue of a journal or other serial; such a page is useful for classification and abstracting purposes and if the material is rebound as a separate book. This title page should also specify the name, volume and date of the journal or serial; this additional information should be given after the name of the editors.

If appropriate, the support of other organisations should be indicated by the words "Organized by the IAU in cooperation with ..." in which the list of organizations is limited to the Scientific Unions, the Scientific Committees and Inter-Union Commissions of ICSU. Participation of UNESCO will be acknowledged by the following wording at the foot of the title page, "Published for the International Council of Scientific Unions with financial assistance from UNESCO".

3.7 Checking and correcting copy

All copy should be carefully checked before it is sent to the printer, either for reproduction or composition. Any errors left in camera-ready copy will probably appear in the printed version (unless they are noticed by the editor or copyeditor) since proofs are not normally supplied to authors. Non-trivial errors on printer's copy are likely to appear in print unless an adequate time is allowed for proofreading; trivial errors may be noticed on proof but their correction may itself lead to other errors in the printed version. Checking should be carried out in separate stages; for completeness, for sense, and for detail.

3.71 Sense. A referee or a colleague who comes fresh to the paper is usually in a better position than the author to notice any error or omissions of a general character. A sentence may be ambiguous or may not convey the idea intended by the author; a figure may not actually illustrate the effect claimed in the text; a significant factor may have been overlooked either in the investigation itself or in the paper on it; the abstract may not be a proper summary of the paper; or the conclusions may not be justified in the main text. For these reasons the paper should be read critically in order to find faults of this kind before the final copy is sent to the printer.

3.72 Detail. The checking to find errors of detail should be carried out quite separately from the more general checks. If possible, separate examinations should be made for the following types of error:

(a) Errors in numerical values, including dates, in the text, tables and figures: the typed values should be checked independently of the manuscript whenever this is possible; tables should be checked systematically.

(b) Errors in, or omission of, the units associated with numerical values, especially in figures and tables; also the use of units that are not in accordance with the recommendations given in section 5.1.

(c) Errors in references: names, titles, dates, volume numbers and page numbers should be checked against the sources cited and not against other lists; the abbreviations for the titles of serials should follow the recommendations given in section 4.4. It is not unknown for authors to make errors in references to their own papers!

(d) Errors in spelling and in grammar: these may not appear to be important, but their presence is often indicative of a lack of care in other aspects of the preparation of the report, and they may be taken to indicate a lack of thoroughness in the investigation to which the report refers.

(e) Errors and ambiguities in formulae and equations: these may be detected by consistency checks or by reference to original sources.

(f) Errors and ambiguities in the designations of astronomical objects: the principles and recommendations given in section 7 should be followed.

Urgency of publication is no justification for a lack of care and attention in the preparation of a typescript for publication; rather it should be seen as a reason for taking care at all stages of the work.

3.73 Completeness. The most basic check is to ensure that the copy is physically complete; even for camera-ready copy it is necessary to ensure that no pages of text, corrections or tables have been mislaid. For printer's copy it is also necessary to check that the preliminaries, photographs, overlays, and captions are all present. For long papers it may be worthwhile to highlight on a spare copy of the text all citations and cross-references to other text, tables and figures, and then to verify systematically that all are satisfied; this will also guard against any failures to carry through any changes in the numbers of sections, tables or figures.

4. CITATIONS AND LISTS OF REFERENCES

The style of citations and bibliographic references described here must be used in all IAU publications; it is known as the Harvard system. There is, however, no system of referencing that is accepted by all international organisations, journal editors and publishers. It is hoped that the system recommended here will be adopted by editors of major astronomical journals; it is intended to simplify both typing and typesetting, and to be appropriate for computer-based information-retrieval systems. It follows in general form the standards adopted by many national and international scientific organisations (BSI 1976, 1978, 1984; ICSU AB 1978; ISO 1972, 1974).

4.1 Form of citations in the text

The citation in the text should be sufficient only to identify the appropriate entry in the list of references or to indicate the source of information that cannot be retrieved by the readers. In the former case the citation should identify the author and give the year of publication since these two items are used to determine the sequence of references in the list; the following rules should be followed:

(a) If the name of the author occurs naturally in the text, the year should be given afterwards in parentheses. Otherwise the name of the author and the year should be given in parentheses at the appropriate place in the text, without any punctuation mark between them.

(b) If there are two authors, their names should be linked by an ampersand (&) or by the word 'and' if the symbol & is not available on the typewriter.

(c) If there are three or more authors, the name of the first should be followed by the abbreviation 'et al.', meaning 'and others', even if other such citations refer to papers by the same first author with different sets of other authors.

(d) If two or more authors have the same family name and the references are to the same year, their initials should be given after the family name; otherwise, initials should be omitted in the citation.

(e) If there are two or more references with the same author (or joint author) and year, the letters, a, b, c, ... should be appended to the year to distinguish between them.

(f) If several citations for one author (or joint author) occur at the same place in the text, the years should be separated by commas; the name should not be repeated.

(g) If two or more citations for different authors occur at the same place in the text, they should be separated by semi-colons.

(h) If the citation is to a paper (or other source of information) that does not explicitly name the person (or persons) who have written or edited the paper, the citation should give a short name that is sufficient to identify the corresponding entry in the reference list where the full details are given. This short name could be, for example, the acronym for the organisation concerned or the name of the chairman of a working group; otherwise the author should be given as 'Anon'.

(i) If there are several citations to different places in the same source document, it is helpful to give in each citation the relevant page number after the year. If there are many citations to the same document it may be worthwhile to refer to it in such a way that it is not necessary to repeat the name of the author and the year on each occasion.

(j) The names of authors of papers that are not printed in a latin-type alphabet should be transliterated in accordance with the recommendations given in section 6.3.

Citations that refer to information that has not been published or that is not otherwise available for reference should give appropriate information about the source in the text, usually in the form: name of person concerned, the year, and the type of communication; examples include: 'in preparation', 'unpublished work', 'personal letter', 'oral communication'. This does not apply if a paper is 'in press' in the sense that it has been accepted and all bibliographic details except volume and page numbers can be given. A reference may be given if the meeting at which the information was presented can be specified or if an abstract of a paper has been published. If the source of information is an unpublished document that is available for reference (or copying) in an archive or library, then the identification number and place should be given in the list of references in an appropriate format.

Terms such as 'ibid.', 'idem', 'op.cit.' and 'loc. cit.' should not be used; they are often confusing and changes in the text can make them erroneous if they are not carefully checked.

4.2 Format of bibliographic references

The information to be given in a bibliographic reference depends on the type of publication concerned.

(a) A full reference to a paper in a serial publication should give the following elements: (1) the name of the author(s) and the year; (2) the title of the paper; and (3) the abbreviated title and volume number of the serial, together with the number of the first and last pages separated by a hyphen. The title of the paper can provide useful information for editors and referees as well as for readers; it is, however, the general practice in IAU publications and in many astronomical journals to omit the title of the paper. Titles of papers may be given in IAU publications if they do not cause the camera-ready copy to run over to another page. The title of the serial should be abbreviated in accordance with the recommendations in section 4.41 unless the publisher insists on the use of a different system. Some journals give only the first page number, but the inclusion of the last page number can be very helpful to readers who do not have easy direct access to the serial concerned.

(b) If the reference is to a monograph by the author cited, then it should contain the following elements: (1) the author and year; (2) the title of the monograph and the edition, if relevant; and (3) the place of publication and the name of the publisher. If the publisher operates in several places it is sufficient to give the name of the first place listed after the publisher's name on the title page of the book. The name of the town should be followed by the name of the country unless it is a well-known city. The name of the town may be omitted if it is included in the name of the publisher. The international standard book number (ISBN) may be given as an aid to identification.

(c) If the reference is to a paper within a book edited by others, then the following elements are to be given: (1) author and year; and (2) the reference for the book as in (b), followed by the page numbers concerned. If, as often occurs, there are several references to papers in the same book, then the length of the reference list should be shortened by giving in each case the second element in the form of a citation to a separate reference for the book. In both forms the second element should be preceded by 'In:'. If the journal allows the inclusion of the title of paper itself, then this should be given after the first element.

(d) If the reference is to a paper that is published in a book as part of the record of the proceedings of a conference, then the reference should include the name(s) of the editor(s), the title of the book, the identification of the conference if this is not included in the title, the place and date of the conference, and the identification of the publisher (place and name).

The names of the authors should normally be given in the list of references in exactly the same form as in the original papers, except that the initials should always be given after the surnames, which should be followed by commas when transpositions have been made. In multi-authored papers all names after the first eight should be omitted and replaced by 'et al.'.

The items within each element of the reference should be separated from each other by commas; the end of each element should be indicated by a full stop. The title of serials and books should not be underlined in camera-ready copy; they may be typed in italic if this facility is available to the author. Volume numbers should be given in arabic numerals; they should not be underlined, although they may be made bolder. Underlining on printer's copy to indicate changes of typeface should normally be left to the copyeditor.

Examples of the application of these recommendations are to be found in the list of references at the end of this manual. It is recommended that authors should always refer to the instructions provided by the editor, or to previous issues of the serial, or to other similar books by the same publisher, in order to establish the format to be used in any particular case.

4.3 Sequence of references

In IAU publications, in which the citation in the text is based on the name of the author(s) and the date, the sequence to be adopted in the list of references is based, firstly, on the alphabetic sequence of the surnames of the first authors, and secondly, on the numerical sequence of the date for each author. The standard alphabetic sequence to be used is as follows:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Accents and other diacritical marks should normally be ignored. Any prefix (such as 'van') should be regarded as a part of the surname; a space within the surname should be sorted before A; and any hyphen should be ignored. No distinction is to be made between upper and lower-case letters.

All references with the same first author should be collected together, giving firstly those where he is the sole author, arranged in chronological sequence, then those where there are two authors, arranged firstly in the alphabetical sequence of the names of the second author, and secondly in chronological sequence, and finally those where there are three or more authors; within the latter group the sequence may be solely by date, regardless of the names of the other authors, since they are not specified in the citation in the text. If there are two authors with the same surname then the sequence should be that of their initials. On the other hand, initials should be ignored if the surname of one author begins with the surname of another author; the shorter name should precede the longer name.

The following example illustrates the use of these rules for the sequence of references and for punctuation in the element giving the author(s) and the date.

| | |
|--|-------------------------------------|
| In the list of references | Citation in the text |
| Brown, R., 1977. | Brown (1977) <u>or</u> (Brown 1977) |
| Brown, R., 1978. | Brown (1978) |
| Brown, R., Green, B. V., 1976. | Brown & Green (1976) |
| Brown, R., White, C., Green, B. V., 1974 | Brown et al. (1974) |
| Brown, R., Black, A. T., White, C., | Brown et al. (1975) |
| Green, B. V. 1975. | |
| Browning, A., 1972. | Browning (1972) |

4.4 Abbreviations to be used for the titles of serials

4.41 Standard rules. In the preparation of camera-ready copy for IAU publications, the titles of serials should be abbreviated in accordance with the list given in Astronomy and Astrophysics Abstracts, which is in turn based on the recommendations of the appropriate international organisations (e.g., see ICSU AB 1978). The following guidelines should be adopted for any words not included in this list: (a) articles, conjunctions and prepositions should usually be ignored; (b) a sufficient number of letters of other words should be included to suggest to a scientist the full words and to avoid ambiguity; and (c) the names of places, except principal capital cities, should be given in full. The initial letters of the abbreviations for an adjective should be given in lower case (small type), except where it forms part of a proper name. An acronym should not normally be used for the name of an organisation unless it is so used in the full title of the serial. If a title consists of one word it is usually given in full. A list of the principal abbreviations that are recommended for use in astronomical publications is given in Table 1A.

Table 1. Abbreviations used in references to serial publications

A. Abbreviations recommended for use in astronomical publications

| Word/Root | Abbreviation | Word/Root | Abbreviation | Word/Root | Abbreviation |
|----------------|--------------|----------------|--------------|-------------------|--------------|
| Abstract- | Abstr. | Interna- | Int. | Prelimin- | Prelim. |
| Academ- | Acad. | Interi- | Inter. | Preprint | Prepr. |
| Annal- | Ann. | Interplanetary | Interplanet. | Proceedings | Proc. |
| Annu- | Annu. | Ionos- | Ionos. | Publica- | Publ. |
| Astrometr- | Astrometr. | Itali- | Ital. | Publika- | Publ. |
| Astronom- | Astron. | Jahrbuch- | Jahrb. | Quarterly | Q. |
| Astrophys- | Astrophys. | Joernal- | J. | Quantit- | Quant. |
| Atmos- | Atmos. | Jornal- | J. | Rapport | Rapp. |
| Bericht- | Ber. | Journal- | J. | Record- | Rec. |
| Bibliot- | Bibl. | Japan | Jpn. | Relativit- | Relativ. |
| Bibliogra- | Bibliogr. | Laborat- | Lab. | Report | Rep. |
| Bolet- | Bol. | Lette, Lettr- | Lett. | Reprint | Repr. |
| Bulletin | Bull. | Libra- | Libr. | Research | Res. |
| Catalog- | Cat. | London | Lond. | Review-, Revue- | Rev. |
| Celestial | Celest. | Magnet- | Magn. | Royal | R. |
| Centr- | Cent. | Mathemat- | Math. | Satellite | Satell. |
| Colloqui- | Collog. | Mechani- | Mech. | Scien- | Sci. |
| Comput- | Comput. | Meddel- | Medd. | Scripta, Scritt- | Scr. |
| Conferen- | Conf. | Memento | Mem. | Socie- | Soc. |
| Contributions | Contr. | Memoir | Mem. | Solar | Sol. |
| Current | Curr. | Memorand- | Memo. | Southern | South. |
| Depart- | Dep. | Monat-, Month- | Mon. | Spectroscop- | Spectrosc. |
| Dominion | Dom. | Natur- | Nat. | Sternwarte- | Sternw. |
| Deutsch | Dtsch. | National- | Natl. | Supplement | Suppl. |
| Edit- | Ed. | Notas | Notas | Survey | Surv. |
| Electroni- | Electron. | Note | Note | Sympos-, Sympoz- | Symp. |
| Engineer- | Eng. | Notes | Notes | System- | Syst. |
| Ephemeri- | Eph. | Notices | Not. | Techne- | Tech. |
| Experiment- | Exp. | Nouve- | Nouv. | Technolog- | Technol. |
| Facol-, Facul- | Fac. | Numeri- | Numer. | Telescop- | Telesc. |
| Fascicul- | Fasc. | Observ- | Obser. | Theoret-, Theori- | Theor. |
| Francais- | Fr. | Offic- | Off. | Terrestr- | Terr. |
| Giornale | G. | Optic-, Optik- | Opt. | Transactions | Trans. |
| Gazet- | Gaz. | Osserva- | Oss. | Travaux | Trav. |
| General | Gen. | Pacific | Pac. | Union | Union |
| Gesellschaft | Ges. | Paper-, Papier | Pap. | United | U. |
| Geschichte | Gesch. | Particle | Part. | Universi- | Univ. |
| Handb- | Handb. | Philosoph- | Philos. | Variable | Var. |
| Incorporated | Inc. | Photography- | Photogr. | Zeitschrift- | Z. |
| Inform- | Inf. | Photometr- | Photom. | Zentral | Zent. |
| Institut- | Inst. | Physi- | Phys. | Zhurnal | Zh. |
| Instrument- | Instrum. | Planetary | Planet. | | |

A full list of recommended abbreviations is given in Astronomy and Astrophysics Abstracts.

B. Short abbreviations used in some astronomical publications.

| | | | |
|-----------|----------------------------|--------------|----------------------------|
| A.A.A. | Astron. Astrophys. Abstr. | Bull. A.A.S. | Bull. Am. Astron. Soc. |
| A.J. | Astron. J. | B.A.A.S. | Bull. Am. Astron. Soc. |
| A.Q.n. | Astrophys. Quant., nth ed. | M.N.R.A.S. | Mon. Not. R. Astron. Soc. |
| Ap.J. | Astrophys. J. | M.N. | Mon. Not. R. Astron. Soc. |
| Astr. Ap. | Astron. Astrophys. | Pub. A.S.P. | Publ. Astron. Soc. Pacific |
| A & A | Astron. Astrophys. | P.A.S.P. | Publ. Astron. Soc. Pacific |

4.42 Other rules. Some journals insist on the use of other rules; some allow or require the use of very short forms for certain journals that are well-known to professional astronomers. A list of such short forms is given for information in Table 1B; these forms should not, however, be used in IAU publications. Such forms may cause difficulties for scientists and librarians who may not be familiar with them, and they may be missed or cause confusion in literature searches using computers. Their use may be justified in review articles containing many references, such as the IAU triennial reports, but the meanings of such short forms should be given at the head of the list of references.

4.5 Series of books

Series of books that may be treated as serial publications include:

Annual Reviews of Astronomy and Astrophysics. Editors: Burbidge, G. R., Layzer, D., Phillips, J. G., (from 1974,). Annual Reviews Inc., Palo Alto, California, 1963 onwards.

Abbreviation: Annu. Rev. Astron. Astrophys.

Handbuch der Physik (Encyclopedia of Physics). Editor: Flügge, S. Springer-Verlag, Berlin, 1955 onwards.

Abbreviation: Handb. Phys.

Highlights of Astronomy. Published for the International Astronomical Union. Reidel, Dordrecht-Holland, 1968 onwards at intervals of 3 years.

Abbreviation: Highlights Astron.

Landolt-Börnstein: Numerical data and functional relationships in science and technology. New series, Editor-in-chief: Hellwege, K.-H., Group VI: Astronomy, astrophysics and space research. Springer-Verlag, Berlin, 1965, 1981 onwards.

Abbreviation: Landolt-Börnstein, New Series, Group VI.

Vistas in Astronomy. Editor: Beer, P. Pergamon Press, Oxford, 1955 onwards.

Abbreviation: Vistas Astron.

5. UNITS, SYMBOLS AND FORMULAE

5.1 Units

5.11 SI Units. The international system (SI) of units, prefixes, and symbols should be used for all physical quantities except that certain special units, which are specified later, may be used in astronomy, without risk of confusion or ambiguity, in order to provide a better representation of the phenomena concerned. SI units are now used to a varying extent in all countries and disciplines, and this system is taught in almost all schools, colleges and universities. The units of the centimetre-gram-second (CGS) system and other non-SI units, which will be unfamiliar to most young scientists, should not be used even though they may be considered to have some advantages over SI units by some astronomers. The IAU Executive Committee has recommended (see Appendix B) that astronomers should complete the change-over quickly, and so, for example, reports and papers for the IAU General Assembly in 1991 should all use SI units or other recognised units.

General information about SI units can be found in the publications of national standards organisations and in many textbooks and handbooks (e.g., Anderson 1981b, Bell & Goldman 1986, Drazil 1983). There are three classes of SI units: (a) the seven base units that are regarded as dimensionally independent; (b) two supplementary, dimensionless units for plane and solid angles; and (c) derived units that are formed by combining base and supplementary units in algebraic expressions; such derived units often have special names and symbols and can be used in forming other derived units. The units of classes (a) and (b) are listed in Table 2. The units of class (c) of greatest interest to astronomers are given in Table 3 for those with simple names and symbols, and in Table 4 for those with compound names and symbols. In forming compound names division is indicated by per, while in the corresponding symbols it is permissible to use either a negative index or a solidus (oblique stroke or slash); thus the SI unit of velocity is a metre per second and the corresponding symbol is m s^{-1} or m/s .

The space between the base units is important in such a case since ms^{-1} could be interpreted as a frequency of 1000 Hz; a space is not necessary if the preceding unit ends in a superscript; a full stop (period) may be inserted between units to remove any ambiguity; the solidus should only be used in simple expressions and must never be used twice in the same compound unit.

Table 2. The names and symbols for the SI base and supplementary units.

| Quantity | SI Unit: Name | Symbol |
|---------------------------|---------------|--------|
| length | metre | m |
| mass | kilogram | kg |
| time (1) | second | s |
| electric current | ampere | A |
| thermodynamic temperature | kelvin | K |
| amount of substance | mole | mol |
| luminous intensity | candela | cd |
| plane angle | radian | rad |
| solid angle | steradian | sr |

(1) The abbreviation sec should not be used to denote a second of time.

Table 3. Special names and symbols for SI derived units.

| Quantity | SI Unit: Name | Symbol | Expression |
|-----------------------|---------------|----------|----------------------|
| frequency | hertz | Hz | s^{-1} |
| force | newton | N | kg m s^{-2} |
| pressure, stress | pascal | Pa | N m^{-2} |
| energy | joule | J | N m |
| power | watt | W | J s^{-1} |
| electric charge | coulomb | C | A s |
| electric potential | volt | V | J C^{-1} |
| electric resistance | ohm | Ω | V A^{-1} |
| electric conductance | siemens | S | A V^{-1} |
| electric capacitance | farad | F | C V^{-1} |
| magnetic flux | weber | Wb | V s |
| magnetic flux density | tesla | T | Wb m^{-2} |
| inductance | henry | H | Wb A^{-1} |
| luminous flux | lumen | lm | cd sr |
| illuminance | lux | lx | lm m^{-2} |

Table 4. Examples of SI derived units with compound names.

| Quantity | SI unit: Name | Symbol |
|-------------------------|--|----------------------------------|
| density (mass) | kilogram per cubic metre | kg m^{-3} |
| current density | ampere per square metre | A m^{-2} |
| magnetic field strength | ampere per metre | A m^{-1} |
| electric field strength | volt per metre | V m^{-1} |
| dynamic viscosity | pascal second | Pa s |
| heat flux density | watt per square metre | W m^{-2} |
| heat capacity, entropy | joule per kelvin | J K^{-1} |
| energy density | joule per cubic metre | J m^{-3} |
| permittivity | farad per metre | F m^{-1} |
| permeability | henry per metre | H m^{-1} |
| radiant intensity | watt per steradian | W sr^{-1} |
| radiance | watt per square metre per steradian | $\text{W m}^{-2} \text{sr}^{-1}$ |
| luminance | candela per square metre | cd m^{-2} |

Table 5. SI prefixes and symbols for multiples and submultiples.

| Submultiple | Prefix | Symbol | Multiple | Prefix | Symbol |
|-------------|--------|--------|-----------|--------|--------|
| 10^{-1} | deci | d | 10 | deca | da |
| 10^{-2} | centi | c | 10^2 | hecto | h |
| 10^{-3} | milli | m | 10^3 | kilo | k |
| 10^{-6} | micro | μ | 10^6 | mega | M |
| 10^{-9} | nano | n | 10^9 | giga | G |
| 10^{-12} | pico | p | 10^{12} | tera | T |
| 10^{-15} | femto | f | 10^{15} | peta | P |
| 10^{-18} | atto | a | 10^{18} | exa | E |

Note: Decimal multiples and submultiples of the kilogram should be formed by attaching the appropriate SI prefix and symbol to gram and g, not to kilogram and kg.

5.12 SI prefixes. Decimal multiples and submultiples of the SI units, except the kilogram, are formed by attaching the names or symbols of the appropriate prefixes to the names or symbols of the units. The combination of the symbols for a prefix and unit is regarded as a single symbol which may be raised to a power without the use of parentheses. The recognised list of prefixes and symbols is given in Table 5. These prefixes may be attached to one or more of the unit symbols in an expression for a compound unit and to the symbol for a non-SI unit. Compound prefixes should not be used.

5.13 Non-SI units. It is recognised that some units that are not part of the international system will continue to be used in appropriate contexts. Such units are listed in Table 6; they are either defined exactly in terms of SI units or are defined in other ways and are determined by measurement. Other non-SI units, such as Imperial units and others listed in Table 7, should not normally be used.

Table 6. Non-SI units that are recognised for use in astronomy.

| Quantity | Unit: Name | Symbol | Value |
|--------------|--------------------------|---------------------|--|
| time (1) | minute | min or ^m | 60 s |
| time (1) | hour | h or ^h | 3600 s = 60 min |
| time (1) | day | d or ^a | 86 400 s = 24 h |
| time | year (Julian) | a | 31.5576 Ms = 365.25 d |
| angle (2) | second of arc | " | ($\pi/648\,000$) rad |
| angle | minute of arc | ' | ($\pi/10\,800$) rad |
| angle | degree | ° | ($\pi/180$) rad |
| angle (3) | revolution (cycle) | ^c or c | 2 π rad |
| length | astronomical unit | au | 0.149 598 Tm |
| length | parsec | pc | 30.857 Pm |
| mass | solar mass | M _☉ | 1.9891 × 10 ³⁰ kg |
| mass | unified atomic mass unit | u | 1.660 540 × 10 ⁻²⁷ kg |
| energy | electron volt | eV | 0.160 2177 aJ |
| flux density | jansky (4) | Jy | 10 ⁻²⁶ W m ⁻² Hz ⁻¹ |

(1) The alternative symbol is not formally recognised in the SI system.

(2) The symbol mas is often used for a milliarcsecond (0".001).

(3) The unit and symbols are not formally recognised in the SI system.

(4) The jansky is only used in radio astronomy.

(5) The degree Celsius (°C) is used in specifying temperature for meteorological purposes, but otherwise the kelvin (K) should be used.

5.14 Time and angle. The units for sexagesimal measures of time and angle are included in Table 6. The names of the units of angle may be prefixed by 'arc' whenever there could be confusion with the units of time. The symbols for these measures are to be typed or printed as superscripts immediately following the numerical values; if the last sexagesimal value is divided decimally, the decimal point should be placed under, or after, the symbol for the unit; leading zeros should be inserted in sexagesimal numbers as indicated in the following examples.

$$2^a 13^h 07^m 15.259 \quad 06^h 19^m 05.18 \quad 120^\circ 58' 08.26$$

These non-SI units should not normally be used for expressing intervals of time or angle that are to be used in combination with other units.

In expressing the precision or resolution of angular measurement, it is becoming common in astronomy to use the milliarcsecond as the unit, and to represent this by the symbol mas; this is preferable to other abbreviations, but its meaning should be made clear at its first occurrence. The more appropriate SI unit would be the nanoradian (1 nrad \approx 0.2 mas). In general, the degree with decimal subdivision is recommended for use when the radian is not suitable and when there is no requirement to use the sexagesimal subdivision. If it is more appropriate to describe an angle in terms of complete revolutions (or rotations or turns or cycles), then the most appropriate symbol appears to be a letter c; this may be used in a superior position as in 1^c = 360° = 2 π rad = 1 rev, but it may be used as in 1 c/s = 1 Hz.

The use of units of time for the representation of angular quantities, such as hour angle, right ascension and sidereal time, is common in astronomy, but it is a source of confusion and error in some contexts, especially in formulae for numerical calculation. The symbol for a variable followed by the superscript for a unit may be used to indicate the numerical value of that variable when measured in that unit.

5.15 Astronomical units. The IAU System of Astronomical Constants recognises a set of astronomical units of length, mass and time for use in connection with motions in the Solar System; they are related to each other through the adopted value of the constant of gravitation when expressed in these units (IAU 1976). The symbol for the astronomical unit of length is au; the astronomical unit of time is 1 day (d) of 86 400 SI seconds (s); the astronomical unit of mass is equal to the mass of the Sun and is often denoted by M_{\odot} , but the special subscript makes this symbol inconvenient for general use.

An appropriate unit of length for studies of structure of the Galaxy is the parsec (pc), which is defined in terms of the astronomical unit of length (au). The unit known as the light-year is appropriate to popular expositions on astronomy and is sometimes used in scientific papers as an indicator of distance.

The IAU has used the julian century of 36 525 days in the fundamental formulae for precession, but the more appropriate basic unit for such purposes and for expressing very long periods is the year. The recognised symbol for a year is the letter a, rather than yr, which is often used in papers in English; the corresponding symbols for a century (ha and cy) should not be used. Although there are several different kinds of year (as there are several kinds of day), it is best to regard a year as a julian year of 365.25 days (31.5576 Ms) unless otherwise specified.

It should be noted that sidereal, solar and universal time are best regarded as measures of hour angle expressed in time measure; they can be used to identify instants of time, but they are not suitable for use as precise measures of intervals of time since the rate of rotation of Earth, on which they depend, is variable with respect to the SI second.

5.16 Obsolete units. It is strongly recommended that the non-SI units listed in Table 7 are no longer used. Some of the units listed are rarely used in current literature, but they have been included for use in the study of past literature. Imperial and other non-metric units should not be used in connection with processes or phenomena, but there are a few situations where their use may be justified (as in 'the Hale 200-inch telescope on Mount Palomar'). The equivalent value in SI units should be given in parentheses if this is likely to be helpful.

Table 7. Non-SI units and symbols whose continued use is deprecated.

| Quantity | Unit: Name | Symbol | Value |
|----------------------------|---------------------|----------|--|
| length | ångström | Å | $10^{-10}\text{m} = 0.1 \text{ nm}$ |
| length | micron | μ | 1 μm |
| length | fermi | | 1 fm |
| area | barn | b | 10^{-28}m^2 |
| volume | cubic centimetre | cc | 10^{-6}m^3 |
| force | dyne | dyn | 10^{-5}N |
| energy | erg | erg | 10^{-7}J |
| energy (2) | calorie | cal | 4.1868 J |
| pressure | bar | bar | 10^5Pa |
| pressure | standard atmosphere | atm | 101 325 Pa |
| acceleration (gravity) | gal | Gal | 10^{-2}m s^{-2} |
| gravity gradient | eotvos | E | 10^{-9}s^{-2} |
| magnetic flux | gauss | G | corresponds to 10^{-4}T |
| density | | | |
| magnetic flux | gamma | γ | corresponds to 10^{-9}T |
| density | | | |
| magnetic field strength | oersted | Oe | corresponds to (1000/4 π)A m^{-1} |

(1) Non-metric units, such as miles, feet, inches, tons, pounds, ounces, gallons, pints, etc., should not be used except in special circumstances.

(2) There are other obsolete definitions and values for the calorie.

The definitions of the SI units and an extensive list of conversion factors for obsolete units are given by Anderson (1981b). In particular, wavelengths should be expressed in metres with the appropriate SI prefix; e.g., for wavelengths in the visual range the nanometre (nm) should be used instead of the ångström (Å), which is a source of confusion in comparisons with longer and shorter wavelengths expressed in recognised SI units. The notation of the form λ followed by a numerical value (which represents the wavelength in angstroms) should also be abandoned. The name micrometre and symbol μm should be used instead of micron and μ . In all cases, the spelling metre should be used for the unit, while the spelling meter should be used for a measuring instrument (as in micrometer). The word kilometre should be pronounced ki-lo-me-te, not kil-lom-e-ter.

If wavenumbers are used they should be based on the metre, not the centimetre; in any case the unit (m^{-1} or cm^{-1}) should be stated since they are not dimensionless quantities. The uses of frequency (in Hz) at radio wavelengths and energy (in eV) at X-ray wavelengths are appropriate for some purposes, but they serve to obscure the essential unity of the electromagnetic spectrum, and so it may be helpful to give the wavelength as well at the first occurrence; the correspondences between these units and wavelength are as follows:

$$\begin{aligned} \text{wavelength in metres} &= 2.997\,924\,58 \times 10^8 / \text{frequency in hertz} \\ \text{or} &= 1.239\,842\,4 \pm 3 \times 10^{-6} / \text{energy in electron-volts} \end{aligned}$$

5.17 Magnitude. The concept of apparent and absolute magnitude in connection with the brightness or luminosity of a star or other astronomical object will continue to be used in astronomy even though it is difficult to relate the scales of magnitude to photometric measures in the SI system. Magnitude, being the logarithm of a ratio, is to be regarded as a dimensionless quantity; the name may be abbreviated to mag without a full stop, and it should be written after the number. The use of a superscript (") is not recommended. The method of determination of a magnitude or its wavelength range may be indicated by appropriate letters in italic type as in *U*, *B*, *V*. The photometric system used should be clearly specified when precise magnitudes are given.

5.2 Symbols, formulae and technical abbreviations

5.21 Symbols. Particular attention must be paid during the preparation of both camera-ready copy and printer's copy to the presentation of symbols, especially if the typewriter or printer being used has only a normal keyboard. In preparing a manuscript for a typist, the author should be careful to distinguish between the following characters which may be confused when written carelessly or in script.

| | | | | | | | | | | |
|---|---------------|---|--------|-------|----------|--------|---|---------|---|----------|
| a | α | C | c | G | σ | 6 | g | q | k | κ |
| l | I | l | N | π | o | o | p | ρ | Q | 2 |
| r | \surd | S | s | 5 | t | τ | u | \surd | U | V |
| w | (λ) | X | χ | Z | z | 2 | 1 | 7 | O | O |

The author should mark clearly subscripts and superscripts, and distinguish between a subscript figure 1 and a comma, and between a superscript figure 1 and a prime ' (single quote).

Most typewriters and printers do not distinguish between the figure one and the lower-case letter L; or between the figure zero and the letter O; or between hyphens, dashes and minus signs. These ambiguities are of no consequence on camera-ready copy if the meaning is clear from the context, but the differences can be important in designations, and so authors should guide the reader if confusion could occur. Printer's copy should be marked appropriately so that the compositor will use the correct typefaces.

Characters or symbols that are not available on the typewriter or printer (either directly or by combining two simpler characters) should be drawn carefully on camera-ready copy with a thin pen and black permanent ink. This applies also to printer's copy that contains only simple mathematical formulae and few special symbols.

5.211 Variables. Characters for mathematical variables that are to be set in italic should be marked by underlining in pencil in the text, but it is not normally necessary to mark such characters in displayed equations since the compositor should be aware of the standard rules. Functional operators, such as sin, cos, exp, ln, are always set in roman type. Characters for variables that are to be set in bold type should be marked by a wavy underlining, or by a general instruction that is unambiguous. Underlining on camera-ready copy is best avoided, but it may be necessary in some cases to avoid ambiguity.

5.22 Formulae. Authors should lay out formulae in such a way as to simplify the typing or composition and to avoid ambiguity; for example:

xy^{-1} or x/y is usually preferable to $\frac{x}{y}$; $\exp(-t_1^2)$ is preferable to $e^{-t_1^2}$ exponents should be used in preference to root signs, as in $x^{1/n}$; the arguments of operators (or standard functions) should be placed in parentheses when they contain several terms, as in $\sin(a+bt)$; spaces of various lengths (1, 2 or 3 typewriter spaces) may be used to show the structure of mathematical expressions.

On printer's copy, complex mathematical formulae should be written out carefully by hand since it is then possible to indicate more clearly the required spacing and layout; even so the author should clarify any possible ambiguities (in subscripts, superscripts, Greek letters and other special symbols) by appropriate markings in pencil. Further guidance on the setting of mathematics is given by, for example: ApJ 1983; BSI 1961; Chaundy et al. 1954; Royal Society 1974.

5.221 Brackets. The normal sequence of use of brackets is as follows: parentheses (); square brackets []; braces { }. These may be followed by larger sizes of these brackets in the same sequence. On camera-ready copy it is often sufficient to use only parentheses; greater care is then required in checking the copy to ensure that the numbers of left and right parentheses are equal. Angular brackets are often used to indicate an average or for some other specialised purpose.

5.222 Numbers. In order to reduce the risk of error, numbers that consist of more than 4 figures should normally be separated by spaces into groups of 3, counting from the decimal-point position. The decimal-point should be indicated by a dot at half the height of the figures, or by a full stop (or by a comma in French and some other languages); neither commas nor full stops should be used as group markers. Thus 38 932.071 17 is preferred to 38932.07117, while 38,932.071,17 and 38.932,071.17 are deprecated. It should be noticed that the integral part of a julian date is often split as a group of 3 figures followed by a group of 4 figures. Numbers in the text should not be broken at the ends of lines, and small numbers (less than say 13) should normally be written in words except when they are followed by the symbol for a unit; thus, three stars but 3 pc. The zero before the decimal point in numbers such as 0.123 should not be omitted.

5.223 Mathematical signs. The following list shows the standard signs for the most common mathematical operations and relations. Some of these signs are sometimes used with different meanings.

| | | | |
|-----------------------------|---|--------------------------|---|
| plus, add | + | smaller (less) than | < |
| minus, subtract | - | larger (greater) than | > |
| multiply | × | smaller than or equal to | ≤ |
| divide | / | larger than or equal to | ≥ |
| equal to | = | much larger than | ≫ |
| identically equal to | ≡ | tends to (approaches) | → |
| corresponds to | ≈ | of the order of | ~ |
| approximately equal to | ≈ | plus or minus | ± |
| not equal to | ≠ | proportional to | ∝ |
| scalar product (of vectors) | • | infinity | ∞ |
| vector product | × | | |

The letter x may be used as the sign for the multiplication of two numbers, but it should not be used in symbolic formulae, when a full stop is usually preferable. A full stop should not be used in numbers such as 3×10^6 . The sign \sim is often used for 'asymptotically equal to'.

5.23 Chemical and spectroscopic symbols. The symbols for chemical elements are printed in upright type; the first letter only is a capital, as in Ca, and the symbol is not followed by a full-stop. The nucleon number may be indicated as a left superscript, as in ^{198}Hg , while the atomic number may be indicated by a left subscript, as in $^{80}_{80}\text{Hg}$.

Singly-ionized atoms should be indicated by plus and minus signs as superscripts, as in H^+ , Cl^- ; multiple charges should be indicated by the appropriate arabic number before the sign, as in Ca^{2+} , Fe^{3+} . The use of roman numerals is still common in astronomy, but should be abandoned, except perhaps in such terms as 'HII regions'.

Spectral lines are, in general, indicated by roman capitals with perhaps a Greek suffix (which is not now written as a subscript), as in $\text{H}\alpha$. Energy levels are printed in italic, but may be typed in roman without underlining in camera-ready copy, unless this would cause confusion in the context concerned.

5.24 Particles and quanta. Upright letters are used to indicate the various types of particle and quanta. Capital Greek letters are used for hyperons and lower-case Greek letters are used for mesons. Lower-case letters are used for nucleons.

| | | | | | | | |
|---------|---|----------|---|------|-------|----------|-------------|
| neutron | n | electron | e | pion | π | neutrino | $\bar{\nu}$ |
| proton | p | deuteron | d | muon | μ | photon | γ |

The charge of a particle is indicated by the appropriate sign as a superscript, as in π^+ , π^- , π^0 . If no sign is shown then p and e refer to positive protons and negative electrons, respectively. Antiparticles are indicated by an overline above the symbol for the particle, as in $\bar{\nu}$ for an antineutrino.

The symbols representing the particles involved in a nuclear reaction should be specified in the following format:

| | | | |
|---------|--|---|---------|
| initial | $\left(\begin{array}{l} \text{incoming particle(s),} \\ \text{or quanta} \end{array} \right)$ | $\left(\begin{array}{l} \text{outgoing particle(s)} \\ \text{or quanta} \end{array} \right)$ | final |
| nuclide | | | nuclide |

For example: $^{14}\text{N} (\alpha, p) ^{17}\text{O}$ $^{59}\text{Co} (n, \gamma) ^{60}\text{Co}$

5.25 Astronomical symbols and names. In general, the special symbols for the names of planets and certain astronomical phenomena, such as conjunctions, should not be used. (A key should always be given if any such special symbols are used.) The names of planets, bright-stars and other individual objects should be spelt with initial capital letters, but adjectival forms should begin with a small letter, as in: Jupiter, jovian satellites; the Galaxy, galactic coordinates.

In the column headings of tables, for example, the following symbols may be used for the names of the principal planets:

| | | | | | | | |
|----|---------|----|------------|---|---------|---|---------|
| Me | Mercury | E | Earth | J | Jupiter | U | Uranus |
| V | Venus | EM | Earth-Moon | S | Saturn | N | Neptune |
| | | Ma | Mars | | | P | Pluto |

The Bayer designations of bright stars should be printed in upright type with lower-case Greek letters followed by the standard three-letter abbreviations for the names of the constellations that are given in Table 11. If Greek type is not available, the English name of the Greek letter should be spelt out in full. The English names for the letters of the Greek alphabet are given in section 6.32. General rules for the designation of astronomical objects are given in section 7.

The spectral classifications of stars and other similar symbols and abbreviations should be printed in upright type, as in B5 and cG2. Abbreviations for the names of catalogues are expressed in upright type without full stops, as in FK5 and SAO.

5.26 Dates and times. The instant at which an event (such as an observation) occurred is usually best represented by giving either the julian date (JD) with an appropriate number of decimal places or the calendar date followed by the time of day in conventional form. In an astronomical context the calendar date is best expressed in the sequence year-month-day; and this sequence should always be used in accordance with the international standard (ISO 2014: 1976) if the date is expressed in purely numerical form. The months and days should be represented by two-digit numbers from 01 to 12 for January to December, as in Table 8, and from 01 to 31 for the days of the month; roman numerals should not be used. This sequence is the most convenient for use in computers; for example, dates (including time of day) can be sorted into chronological sequence by treating them as if they were decimal numbers; it also avoids the ambiguity associated with the alternative systems used in Europe and the USA in which, for example, 5/3/88 could mean either 5 March or May 3, 1988. On the printed page the elements of the date (and time) should be separated by spaces or hyphens. In appropriate contexts, such as in ephemerides, the value for the day of the month may be outside the normal range; it is then understood to refer to the preceding or following month; for example, 1988 December 31 may be represented as 1989 January 0. Abbreviations for the names of the months are given in Table 8.

Table 8. Abbreviations for the names of the months.

The recommended abbreviations for the names (in English and French) of the months of the julian and gregorian calendars are given below; 3/4-letter abbreviations should be used in text, but the language-independent two-letter abbreviations may be used in tables.

| | English | French | | English | French | |
|----|---------|--------|----|---------|--------|----------|
| 01 | Jan. | Jan. | JA | 07 | July | Juil. JL |
| 02 | Feb. | Fev. | FE | 08 | Aug. | Aout AU |
| 03 | Mar. | Mars | MR | 09 | Sep. | Sep. SE |
| 04 | Apr. | Avr. | AR | 10 | Oct. | Oct. OC |
| 05 | May | Mai | MA | 11 | Nov. | Nov. NO |
| 06 | June | Juin | JN | 12 | Dec. | Dec. DE |

It is essential that the basis of the date and time system used for reporting observations or predictions be clearly stated since no system is free from ambiguity. The current gregorian calendar was first introduced in 1582 but the julian calendar continued to be used in some countries for several centuries. The julian calendar may be used for specifying calendar dates before it was adopted; it is then referred to as the julian proleptic calendar. References to calendar dates earlier than, say, 1800 should specify which calendarial system is being used. The calendar year 1 BC is followed by the year AD 1 in ordinary historical usage; for astronomical purposes it is convenient to denote the year 1 BC as year 0 and, more generally, the year n BC as year -(n-1).

The precision with which the time should be specified varies according to the circumstances, but it should be borne in mind that an observation may be used in many different contexts. For most purposes, current observations should be reported in the system of coordinated universal time (UTC), but the difference from universal time (UT) is less than one second and may often be ignored. Observations that are timed very precisely and that span several years may be better reported in the system of international atomic time (TAI) since this is free from step-adjustments. Current papers that deal with observations made before 1972 should specify what assumptions, if any, have been made in reducing the timescale used in the original record to that used in the new paper. For example, the adopted values of the difference between clock time and UT or between ephemeris time (ET) and UT should be stated.

The following acronyms for timescales are to be used in all languages.

| | | | |
|-----|----------------------------|-----|----------------------------|
| UT | universal time | TAI | international atomic time |
| UTC | coordinated universal time | TDT | terrestrial dynamical time |
| ET | ephemeris time | TDB | barycentric dynamical time |

In conversions from calendar date and time to julian date it must be remembered that the julian day begins at 12^hUT (noon on the Greenwich meridian), whereas current calendar days begin at 0^hUT. This difference arose from an earlier use of astronomical days which began at noon so that the same calendar date could be used throughout the night when observations were made in Europe. The scale of Greenwich mean time (GMT) was first used in connection with astronomical days but was later (especially from 1925 onwards) used in connection with civil days beginning at midnight; this name should no longer be used for reporting the times of astronomical observations.

The julian-day system may be used in conjunction with other time systems such as ephemeris time and international atomic time. The name julian ephemeris day (JED) was introduced for the former, but it is now more appropriate to use the abbreviation JD together with the abbreviation for the timescale; thus the column heading in a table could be JD (TAI) while for individual values the timescale may be indicated after the numerical value.

The modified julian date (MJD) is in widespread use for current dates to provide a shorter number for which the decimal part is zero at 0^h UTC (or TAI or UT, as specified); MJD is equal to JD minus 240 0000.5.

Certain 'epochs' (or instants of time) have a special significance in relation to the definition and use of celestial reference systems, and are indicated by adding the suffix .0 or .5 to the number for the year. They may be defined either in terms of the besselian or tropical year or in terms of the julian year, and so the appropriate letter B or J should precede the numerical value which specifies the epoch, which may be either the beginning or middle of a besselian or julian year, as in the following statements.

| | | | | |
|---------|---|-----------------|---|-----------------|
| J1900.0 | = | 1900 Jan. 0.5 | = | JD 241 5020.0 |
| B1950.0 | = | 1950 Jan. 0.923 | = | JD 243 3282.423 |
| J1986.5 | = | 1986 July 2.625 | = | JD 244 6614.125 |
| J2000.0 | = | 2000 Jan. 1.5 | = | JD 245 1545.0 |

These dates refer to instants of UT unless another timescale is indicated; when a precision of better than 0^a.001 is required the timescale should be specified. Such dates may be understood to refer to besselian epochs for years before 1984 if no prefix letter is given. The letters B and J are often used to indicate that positions are referred to the reference systems for B1950.0 and J2000.0, respectively, but they have a much wider use.

5.27 Notation. In general, the notation adopted for physical quantities and mathematical variables should be that in common use in the subject area of the paper. Nevertheless the meaning of each symbol should be carefully defined when it is first used. If the notation is necessarily extensive and complex, a list of the symbols and their significance should be given at the end of the paper just before the acknowledgements.

6. LANGUAGE, SPELLING AND translITERATION

6.1 Use of various languages

6.11 Languages used by IAU. The scientific and administrative reports of the IAU are printed in English or in French, sometimes in both languages. Proper names and bibliographic references should be transliterated into the Latin alphabet where necessary. Certain items, such as speeches at official opening ceremonies, may be published in other languages and alphabets (or ideographs). American or British spelling and syntax may be used in English texts provided that one system is used consistently in each text and that no ambiguity of meaning is introduced.

6.12 Accents and diacritical marks should be given whenever this is customary; they should be marked carefully on camera-ready copy using a thin pen if they are not available on the typewriter or printer. Accents are usually omitted from capital letters in French.

6.13 Initial capitals. The use of capitals for the initial letters of words is much more common in English (and German) than in French. It is recommended that the following rules be adopted in both languages in IAU publications. The initial letter of a word should be typed or printed as a capital in the following cases: the first word of a sentence or title; names and titles of persons, but small letters are usually used in separated prefixes (as in de Sitter); individual astronomical objects (such as Earth, the Solar System, Orion, the Crab Nebula, Galactic Centre); geographical places (countries, towns); names of particular organisations (such as Commission 5), meetings (such as the General Assembly) and posts (such as the President), when referring to specific occasions or persons; titles of serial publications; names of individual objects or instruments (Voyager 2); and trade names. An initial capital letter is not required when the name of a person (or object) is used as an adjective or as the name of unit, unless it forms part of the name of an individual object (Isaac Newton Telescope). Initial capital letters should not be used for physical quantities and concepts such as right ascension; in English they are, however, normally used for languages and nationalities. Initial capitals are usually used in references to tables, figures and equations in order to highlight them.

6.14 Hyphens are used for three principal purposes: (a) to form a compound word that represents a new concept, (b) to link words that are used together as an adjective, and (c) to indicate that a word has been split at the end of a line. There are, unfortunately, no rules that are usually accepted and free from difficulties, but some general guidance may be given for each type of usage.

(a) There appears to be a growing tendency to omit the hyphen when two words are combined together to form a new concept, such as database or postcode; many common combinations continue, however, to be printed as two separate words. Hyphens are usually omitted after prefixes, even in such words as coordinate.

(b) A hyphen should normally be included in a compound adjective when one of the two words is a noun, as in second-degree harmonic and 4.2-metre telescope, even though the two words would not otherwise be joined by a hyphen.

(c) Long words at the ends of lines may be split between syllables in order to avoid excessive interword spacings in justified text; a hyphen is then inserted at the end of the line, not at the beginning of the next line. Each part of the word should include at least three letters.

6.15 Inverted commas or primes are used to indicate the beginning and end of a direct quotation from another text and to highlight a particular word or phrase. If a quotation is displayed there is no need to enclose it in inverted commas; it may be indented or printed in a smaller typeface. Attention may be drawn to a word or phrase by printing it in italics. These different usages of inverted commas may be distinguished by the use of double primes as in "This is a quotation", and by the use of single primes to indicate a 'highlight', a colloquialism, or the title of a book. It should be noticed that the punctuation of the main sentence should be outside the inverted commas. Single primes should be used for both usages if the typewriter does not have a double prime as a single character.

6.2 Names and abbreviations

6.21 Abbreviations and acronyms. In general, abbreviations of individual words or names should be followed by a full stop and a space, but the full stop is usually omitted if the last letter of the abbreviation is also the last letter of the word. Acronyms should, however, be spelt without any separation (by a space or a full stop) between the letters, and without terminating full stops. Acronyms or other abbreviations that have come into common use and are read as ordinary words may be typed or printed in lower-case letters, except that the initial letter may be capitalized under the rules given above (as in Lageos).

The name of an organisation to which several references are to be made should be given in full (with its usual acronym) on its first occurrence. New or specialised acronyms or abbreviations should only be introduced if it is clear that the benefits of brevity will outweigh the disadvantage of unfamiliarity to the readers.

Lists of some acronyms in common use in astronomy and related fields are given in Table 9 (organisations) and Table 10 (activities and publications). The names of constellations should be abbreviated only to the three-letter forms given in Table 11.

6.22 Names of persons. In scientific papers the names of persons are usually given without courtesy titles or initials unless the latter are required to distinguish between persons with the same surname. In reports of meetings, titles (in abbreviated forms) and initials may be given on the first occurrence of the name, but they should be omitted thereafter. The standard abbreviations for titles are as follows.

| | | | | | | |
|----------|-------|----|----|-----|------|----|
| English: | Prof. | Dr | Mr | Mrs | Miss | Ms |
| French: | Prof. | Dr | M. | Mme | Mlle | |

6.23 Names of countries and places. In the text of a paper the names or abbreviations of countries, states and cities should be expressed in the form used in the country concerned or in the form commonly used in the language of the text. In mailing addresses the local spellings should be given; postcodes or zipcodes should be included where known. Examples include:

| | | | | | | |
|-------------|---------------------|---------|---------|---------|--------|----------|
| English: | Brussels | Cologne | London | Munich | Moscow | Warsaw |
| French: | Bruxelles | Cologne | Londres | Munich | Moscou | Varsovie |
| Local form: | both and Brussel | Köln | London | München | Moscva | Warszawa |

The recommended names and abbreviations for the German republics are as follows:

| | | |
|----------|-------------------------------------|-----|
| English: | Federal Republic of Germany | FRG |
| | German Democratic Republic | GDR |
| French: | République Fédérale d'Allemagne | RFA |
| | République Démocratique d'Allemagne | RDA |
| German | Bundesrepublik Deutschland | BRD |
| | Deutsche Demokratische Republik | DDR |

Table 9. Acronyms for the names of organisations.

Most of the following acronyms for the names of organisations are in common use, but the meanings of these and other similar acronyms should be given on first use in any context where they may not be familiar to most readers.

| | |
|---------|---|
| AAS | American Astronomical Society |
| AG | Astronomische Gesellschaft (Germany) |
| AGU | American Geophysical Union |
| AIAA | American Institute of Aeronautics and Astronautics |
| AIG=IAG | Association Internationale de Geodesie |
| ASA | American Standards Association |
| ASA | Astronomical Society of Australia |
| ASP | Astronomical Society of the Pacific |
| ASSA | Astronomical Society of South Africa |
| BAA | British Astronomical Association |
| BIH | Bureau International de l'Heure |
| BIPM | Bureau International des Poids et Mesures |
| CCIR | Comité Consultatif International des Radiocommunications |
| CDS | Centre de Données Stellaires (Strasbourg, France) |
| CETEX | Committee on Contamination by Extraterrestrial Exploration |
| CNRS | Centre National de la Recherche Scientifique (France) |
| CODATA | Committee on Data for Science and Technology (ICSU) |
| COSPAR | Committee on Space Research (ICSU) |
| CSIRO | Commonwealth Scientific and Industrial Research Organization |
| EPS | European Physical Society |
| ESA | European Space Agency |
| ESO | European Southern Observatory |
| FAGS | Federation of Astronomical and Geophysical Data Analysis Services |
| GSFC | Goddard Space Flight Center (USA) |
| IAG | International Association of Geodesy |
| IAGA | International Association of Geomagnetism and Aeronomy |
| IAF | International Astronautical Federation |
| IAU | International Astronomical Union |
| ICSTI | International Council for Scientific & Technical Information |
| ICSU | International Council of Scientific Unions |
| ICSU-AB | Abstracting Board of ICSU; now replaced by ICSTI |
| IEEE | Institute of Electrical and Electronics Engineers (USA) |
| IERS | International Earth Rotation Service |
| INSPEC | Information Services for the Physical and Engineering Communities |
| IPMS | International Polar Motion Service; now replaced by IERS |
| ISO | International Standards Organization |
| ITU | International Telecommunication Union |
| IUCAF | Inter-Union Committee on Frequency Allocation for Radio and Space Science |
| IUCI | Inter-Union Committee on the Ionosphere |
| IUCS | Inter-Union Commission on Spectroscopy |
| IUCSTP | Inter-Union Commission on Solar-Terrestrial Physics |
| IUGG | International Union of Geodesy and Geophysics |
| IUHPS | International Union of History of Philosophy of Science |
| IUPAC | International Union of Pure and Applied Chemistry |
| IUPAP | International Union of Pure and Applied Physics |
| IUTAM | International Union of Theoretical and Applied Mechanics |
| IWDS | International Ursigram and World Days Service |
| JOSO | Joint Organisation for Solar Observations |
| JPL | Jet Propulsion Laboratory (USA) |
| MIT | Massachusetts Institute of Technology (USA) |
| MPI | Max Planck Institut (Germany) |
| NASA | National Aeronautics and Space Administration (USA) |
| NSF | National Science Foundation (USA) |
| RAS | Royal Astronomical Society (UK) |
| RASC | Royal Astronomical Society of Canada |
| RASNZ | Royal Astronomical Society of New Zealand |

Table 9. Acronyms for the names of organisations (continued).

| | |
|---------|--|
| SAAO | South African Astronomical Observatory |
| SAF | Société Astronomique de France |
| SAI | Societa Astronomica Italiana |
| SAC | Smithsonian Astrophysical Observatory (USA) |
| SERC | Science and Engineering Research Council (UK) |
| SPARMO | Solar Particles and Radiation Monitoring Organization |
| UAI=IAU | Union Astronomique Internationale |
| UN | United Nations |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| URSI | Union Radio-Scientifique Internationale |
| WDC | World Data Center |
| WMO | World Meteorological Organization |

Table 10. Acronyms for astronomical activities and publications.

The following acronyms for some astronomical activities and publications are in common use, but the meanings of these and other similar acronyms should be given on first use in any context where they may not be familiar to most readers.

| | |
|--------|---|
| AAA | Astronomy and Astrophysics Abstracts |
| AGKn | Astronomischer Gesellschaft Katalog Nummer n |
| AJB | Astronomischer Jahresbericht |
| APFS | Apparent Places of Fundamental Stars |
| BD | Bonner Durchmusterung |
| BSC=BS | Bright Star Catalogue (Yale) |
| CD | Cordoba Durchmusterung |
| CMB | Cosmic microwave background |
| CPD | Cape Photographic Durchmusterung |
| FKn | Fundamental Katalog Nummer n |
| GC | General Catalogue (Washington, 1937) |
| GCVS | General Catalogue of Variable Stars |
| HD | Henry Draper Catalogue |
| HDE | Henry Draper (Catalogue) Extension |
| HEAO | High-Energy Astronomical Observatory |
| HR | Hertzsprung-Russell |
| HR | Harvard Revised Photometry Catalog |
| HST | Hubble Space Telescope |
| IC | Index Catalogue of nebulae ... |
| IDS | Index Catalogue of Visual Double Stars |
| IGY | International Geophysical Year (1957/8) |
| IQSY | International Quiet Sun Years (1964/5) |
| IRAS | Infra-Red Astronomy Satellite |
| ISY | International Space Year (1992) |
| IUE | International Ultraviolet Explorer satellite |
| MERIT | Monitor Earth-Rotation and Intercompare the Techniques of observation and analysis (1980/7) |
| NGC | New General Catalogue of nebulae ... |
| MHD | Magnetohydrodynamics (also known as hydromagnetics) |
| PZT | Photographic zenith telescope |
| QSO | Quasi-stellar object |
| SAO | Smithsonian Astrophysical Observatory Star Catalog |
| SI | Système International des Unités |
| SIMBAD | CDS database: Set of Identifications, Measurements and Bibliography for Astronomical Data |
| SRS | Southern Reference System |
| VLBI | Very-long-baseline radio interferometry |
| ZAMS | Zero-age main sequence |

Table 11. Names and standard abbreviations of constellations.

The following list of constellation names and abbreviations is in accordance with the resolutions of the International Astronomical Union (Trans. IAU, 1, 158; 4, 221; 9, 66 and 77). The boundaries of the constellations are listed by E. Delporte, on behalf of the IAU, in, *Delimitation scientifique des constellations (tables et cartes)*, Cambridge University Press, 1930; they lie along the meridians of right ascension and parallels of declination for the mean equator and equinox of 1875.0.

| Nominative | | Genitive | Nominative | | Genitive |
|------------------------------|-----|-------------------|-------------------------------|-----|-----------------|
| Andromeda | And | Andromedae | Lacerta | Lac | Lacertae |
| Antlia | Ant | Antliae | Leo | Leo | Leonis |
| Apus | Aps | Apodis | Leo Minor | LMi | Leonis Minoris |
| Aquarius | Aqr | Aquarii | Lepus | Lep | Leporis |
| Aquila | Aql | Aquilae | Libra | Lib | Librae |
| Ara | Ara | Arae | Lupus | Lup | Lupi |
| Argo ¹ | Arg | Argus | Lynx | Lyn | Lyncis |
| Aries | Ari | Arietis | Lyra | Lyr | Lyrae |
| Auriga | Aur | Aurigae | Mensa | Men | Mensae |
| Bootes | Boo | Bootis | Microscopium | Mic | Microscopii |
| Caelum | Cae | Caeli | Monoceros | Mon | Monocerotis |
| Camelopardalis | Cam | Camelopardalis | Musca | Mus | Muscae |
| Cancer | Cnc | Cancri | Norma | Nor | Normae |
| Canes Venatici | CVn | Canum Venaticorum | Octans | Oct | Octantis |
| Canis Major | CMA | Canis Majoris | Ophiuchus | Oph | Ophiuchi |
| Canis Minor | CMi | Canis Minoris | Orion | Ori | Orionis |
| Capricornus | Cap | Capricorni | Pavo | Pav | Pavonis |
| Carina | Car | Carinae | Pegasus | Peg | Pegasi |
| Cassiopeia | Cas | Cassiopeiae | Perseus | Per | Persei |
| Centaurus | Cen | Centauri | Phoenix | Phe | Phoenicis |
| Cepheus | Cep | Cephei | Pictor | Pic | Pictoris |
| Cetus | Cet | Ceti | Pisces | Psc | Piscium |
| Chamaeleon | Cha | Chamaeleontis | Piscis Austrinus ² | PsA | Piscis Austrini |
| Circinus | Cir | Circini | Puppis | Pup | Puppis |
| Columba | Col | Columbae | Pyxis | Pyx | Pyxidis |
| Coma Berenices | Com | Comae Berenices | Reticulum | Ret | Reticuli |
| Corona Austrina ² | CrA | Coronae Austrinae | Sagitta | Sge | Sagittae |
| Corona Borealis | CrB | Coronae Borealis | Sagittarius | Sgr | Sagittarii |
| Corvus | Crv | Corvi | Scorpius | Sco | Scorpii |
| Crater | Crt | Crateris | Sculptor | ScI | Sculptoris |
| Crux | Cru | Crucis | Scutum | Sct | Scuti |
| Cygnus | Cyg | Cygni | Serpens ³ | Ser | Serpentis |
| Delphinus | Del | Delphini | Sextans | Sex | Sextantis |
| Dorado | Dor | Doradus | Taurus | Tau | Tauri |
| Draco | Dra | Draconis | Telescopium | Tel | Telescopii |
| Equuleus | Equ | Equulei | Triangulum | Tri | Trianguli |
| Eridanus | Eri | Eridani | Triangulum | TrA | Trianguli |
| Fornax | For | Fornacis | Australe | | Australis |
| Gemini | Gem | Geminorum | Tucana | Tuc | Tucanae |
| Grus | Gru | Gruis | Ursa Major | UMa | Ursae Majoris |
| Hercules | Her | Herculis | Ursa Minor | UMi | Ursae Minoris |
| Horologium | Hor | Horologii | Vela | Vel | Velorum |
| Hydra | Hya | Hydrae | Virgo | Vir | Virginis |
| Hydrus | Hyi | Hydri | Volans | Vol | Volantis |
| Indus | Ind | Indi | Vulpecula | Vul | Vulpeculae |

¹In modern usage Argo is divided into Carina, Puppis, and Vela.

²Australis is sometimes used, in both nominative and genitive.

³Serpens may be divided into Serpens Caput and Serpens Cauda.

Note also: LMC Large Magellanic Cloud SMC Small Magellanic Cloud

6.3 Transliteration

6.31 Transliteration of Russian alphabet. The list given in Table 12, which is used in *Astronomy and Astrophysics Abstracts*, should be used for the transliteration of the Russian alphabet.

Table 12. The Russian alphabet.

| | | | | | |
|---|---|----|---|---|------|
| А | а | а | П | п | р |
| Б | б | б | Р | р | г |
| В | в | в | С | с | с |
| Г | г | г | Т | т | т |
| Д | д | д | У | у | у |
| Е | е | е | Ф | ф | ф |
| Ё | ё | е | Х | х | kh |
| Ж | ж | zh | Ц | ц | ts |
| З | з | z | Ч | ч | ch |
| И | и | и | Ш | ш | sh |
| Й | й | j | Щ | щ | shch |
| К | к | к | Ы | ы | y |
| Л | л | л | Ь | ь | ' |
| М | м | м | Э | э | eh |
| Н | н | н | Ю | ю | yu |
| О | о | о | Я | я | ya |

6.32 Greek alphabet. The list given in Table 13 shows the English names for the letters of the Greek alphabet and indicates some alternative forms of the letters.

Table 13. The Greek alphabet.

| | | | | | | | |
|--------------|---------|-------------------|--------|--------------|---------|--------------|---------|
| α A | alpha | η H | eta | ν N | nu | τ T | tau |
| β B | beta | θ θ | theta | ξ E | xi | υ Y | upsilon |
| γ Г | gamma | ι I | iota | \omicron O | omicron | ϕ Ф | phi |
| δ Δ | delta | κ K | kappa | π Π | pi* | χ X | chi |
| ϵ E | epsilon | λ Λ | lambda | ρ P | rho | ψ Ψ | psi |
| ζ Z | zeta | μ M | mu | σ Σ | sigma# | ω Ω | omega |

* π ('curly pi') is an alternative form of π for use in mathematics.

ς is an alternative form of σ .

7. DESIGNATION OF ASTRONOMICAL OBJECTS

7.1 General principles

7.11 Nomenclature. All authors should be careful to ensure that they use clear and unambiguous designations for the astronomical objects that they list or discuss, and referees should refer back any papers or tabulations that do not provide satisfactory designations (e.g., see Jaschek 1986). The most appropriate form of designation varies according to the type of object. Solar-system objects are usually designated by simple 'names' that may be alphabetic, numeric or alphanumeric in form; some objects have two names that are of equal standing, while others are given temporary names when they are first observed and permanent names of a different form when their properties have been established. There are standard procedures for the assignment of such names, but for galactic and extragalactic objects the situation is much more complicated and simple names are usually only appropriate for a very limited number of the brightest stars or most interesting objects of each type. Other objects are often identified by means of a sequence number in a catalogue or report, which is itself usually specified by an acronym or other code. Such identifiers when used with a cross-identification index provide access to current general catalogues, which give precise positional data and other information about stars, and also to specialised lists or catalogues, which contain data on stars and non-stellar objects that have particular characteristics, such as variable stars or globular clusters. The identifier of an object in a specialist list is often treated as the usual name of the object, but one object may appear in several such lists and the same acronym may be used for different lists. The resulting duplications and ambiguities lead to much confusion and error (e.g., see Lortet & Dickel 1984). Much effort has been devoted to gathering information about past practices and to devising better systems for the designation of stellar and non-stellar sources of radiation (e.g., see Dickel et al. 1987).

7.12 Information about the many different ways of referring to stars and non-stellar celestial objects (excluding solar-system objects) is gathered together in 'The First Dictionary of the Nomenclature of Celestial Objects' and its Supplement (Fernandez et al. 1983; Lortet & Spite 1986). These volumes should be consulted before any new abbreviation or system of designations is introduced or if help is needed in identifying objects with unknown or ambiguous names or designations. Updates of the dictionary are to be published from time to time. Cross-identification indexes are available at several data centres, and in addition the Strasbourg Data Centre (CDS) provides in the SIMBAD database a dictionary of synonyms, which have been drawn from a list of about 400 different catalogues; SIMBAD is remotely accessible through public networks.

7.13 Generalised designations. Designations by name or catalogue reference number are not satisfactory for general use for large numbers of objects or for new types of objects. It is recommended that authors use more informative designations that specify both the essential characteristics of the object (by means of an alphanumeric codename) and its position to a precision that is sufficient to distinguish it from other objects of the same type. Authors should not, however, introduce new designations for objects for which satisfactory designations already exist. The inclusion of positional information in designations will make it easier to guard against unnecessary duplication in respect of objects of the same type and to look for identities between objects of different types.

A new catalogue which provides additional information about previously known objects should give positional information and at least one earlier designation. New acronyms or abbreviations to indicate the codenames of types of objects, catalogues, authors, observatories or instruments should not be introduced unnecessarily and they should be sufficient to avoid ambiguities; a minimum of two letters should be used for each. Numerals may be included in acronyms, but special characters should be avoided. Full bibliographic information should normally be given about non-standard catalogues or reports from which data have been taken.

The following precepts should be followed in constructing the positional component of a new designation:

- give truncated coordinates (not rounded);
- give explicitly leading zeros and the sign of declination or latitude;
- give decimal points if appropriate, but do not include spaces between the numerals;
- give right ascension (in time units) before declination (in arc units) in the format hhmmss.ss±ddmmss.s, or give galactic longitude and latitude (both in degrees and decimals) with the prefix G in the format Gddd.dd±dd.dd; and
- precede the right ascension with the letter J to indicate that the position is for the reference system of julian epoch J2000.0 or with B for the system of besselian epoch B1950.0.

Designations including positions should not be changed each time better positions are determined. Supplementary indicators may be added to distinguish between close objects, to indicate association with a larger body, or to specify other object parameters.

The designations of individual objects inside a larger object should specify first the larger object followed by a colon (:), and then an appropriate type or catalogue codename and the coordinates or number for the object itself.

Temporary designations may be based on identifications on a finding chart; it is important that the coordinate system, scale and orientations (N-S and E-W) of the chart be indicated clearly.

A Working group of IAU Commission 34 has developed a note on "specifications concerning names, designations, and nomenclature for astronomical radiation sources outside the solar system"; it is reproduced in appendix D. The generalised form of a designation is specified as

$$\text{Origin}\wedge\text{Sequence}\wedge(\text{Specifier})$$

where \wedge denotes a blank space; an origin and a sequence must be given, but a specifier is optional. The origin is the codename for the catalogue or type of source; the sequence is the reference number in the catalogue or the positional information; while the specifier contains supplementary information to assist in the identification of the source. The note contains examples and other guidance.

7.2 Designation of objects in the Solar System

7.21 Planets, satellites and rings. There is an IAU Working Group for Planetary System Nomenclature that is responsible for the adoption of names for the surface features of planets and satellites and for newly discovered members of the planetary system (excluding minor planets and comets). Satellites are also designated by numbers that are assigned in the chronological sequence of discovery. Discovery claims should be sent with appropriate details to the IAU Telegram Bureau. The decisions of the Working Group are reported in the Transactions of the IAU from time to time.

7.22 Minor planets (asteroids) and comets. Numerical designations are assigned to minor planets (otherwise known as asteroids) when reliable orbital elements have been determined. The observers, or persons who determined the orbits, are allowed to propose names, usually of persons or mythological characters, that are subject to confirmation by Commission 20; proposals should be sent to the Director of the IAU Minor Planet Center.

Newly discovered comets are assigned temporary designations each consisting of the year of discovery followed by a lower-case letter that indicates the chronological sequence of the discoveries. When the discovery is confirmed the comet is also usually known by the name(s) of the discoverer(s). Subsequently, permanent numbers

(in roman capitals) are assigned; they indicate for each year the chronological sequence of the passages of all of the observed comets through perihelion; periodic comets are distinguished by the code P/ in front of the year.

7.23 Meteors. Meteor showers are usually given names according to the constellations in which their radiant points occur or according to the name of the comet with which they are associated (because of an agreement in orbital elements).

Fireballs are usually identified by the dates on which they were seen. Large meteorites are usually identified by the names of the places near where they were found. Meteor craters are also identified by geographical locations.

7.3 Designation of objects outside the Solar System

7.31 Bright stars. About 1000 stars have individual proper names that are derived from early Arabic names or that have been assigned in recent times because of their peculiar characteristics or value for particular purposes (such as astronavigation). A more precise identification of the star should always be given if such a name is used, especially as the names are often different in English, French, and other languages. About 900 such names are listed in the Yale Bright Star Catalogue (BSC, Hoffleit 1982), which gives information about over 9000 stars brighter than magnitude 6.5; it also gives names based on the Bayer system (Greek letter followed by constellation name) or on Flamsteed's catalogue (number and constellation). About 1500 bright stars are listed in the Astronomical Almanac; the tabulation gives the corresponding Bayer, Flamsteed and BSC designations, as well as the mean position and other information about each star.

The 'classical' and other catalogues that are often used for the designation of stars brighter than about magnitude 10 are represented by the following abbreviations.

| | | | | | |
|------|----|-----------|-----|-----|-----|
| AGKn | BD | BSC or BS | CD | CPD | FKn |
| GC | HD | HDE | NZC | SAO | ZC |

The full names of these catalogues are given in Table 11. These abbreviations may normally be used in IAU publications without further explanation; other abbreviations for these catalogues must not be used. These abbreviations should not be used for other catalogues, but ZC is already in use for the Zwicky catalogue of clusters of galaxies.

7.312 Faint stars. For stars not included in the catalogues listed above and for which designations have not been given in other catalogues, it is recommended that designations be assigned in the form of an acronym and position in the standard form specified in section 7.12.

7.313 Double stars. The standard form for the name of a component of a double or multiple star is IDS hmmm.mNddmmA, where the position is given by equatorial coordinates for the equinox of 1900.0, N or S is used to indicate northern (+) or southern (-) declinations, and A or B or C ... specifies a component. The IDS catalogue is updated at the U.S. Naval Observatory as WDS. The brighter double stars have alternative designations in bright-star catalogues, as well as in special lists of double or variable stars.

7.314 Variable stars. The 'classical' names of variable stars not having Bayer-type names consist of the name of the constellation preceded by (a) a code of one or two capital letters or (b) the letter V followed by a number. Harvard designations consisting of the letters HV followed by a numerical code have also been widely used for faint variables. The General Catalogue of Variable Stars and SIMBAD provide other designations and cross references. When it exists the classical name should be used in titles.

7.315 Novae. When a nova is discovered it is given a designation of the form Nova Constellation Year. The year is followed by a lower-case letter if more than one nova is discovered in a constellation in the same year. A nova may subsequently be assigned a standard designation as a variable star.

7.316 Supernovae. The IAU Central Telegram Bureau provides temporary designations for supernovae based on the year and order of discovery in the form SN1985A, SN1985B, ... SN1985Z and as required SN1985aa, SN1985ab, ... SN1985az, SN1985ba, ... This system provides continuity with the list established by Zwicky. An archival list is maintained at the California Institute of Technology.

7.317 Supernova remnants. It is recommended that designations of the form SNR followed by the position with respect to the system of J2000.0 be used for newly discovered supernova remnants.

7.318 Planetary nebulae. Planetary nebulae are usually designated by a name consisting of the code PN followed by its galactic coordinates in degrees (without a decimal point) and a serial number. The appropriate stellar designation should also be given when available.

7.319 Stellar Clusters. Some clusters have proper names. Many open clusters and globular clusters of stars are identified by their numbers in Messier's catalogue (for the brightest) or by their numbers in the New General Catalogue (NGC) and supplementary Index Catalogues (IC). There are also other lists; the current standard designation takes the form Chhmm:ddd, and should be given.

7.320 Galaxies. Some galaxies have proper names, but in general bright galaxies are also identified by their Messier, NGC or IC numbers.

7.331 Radio sources. At first, radio sources were named by giving the constellation name followed by a capital letter. Then the reference numbers in the 3rd Cambridge catalogue were commonly used to give designations such as 3C 273. The IAU adopted at Delhi (1985) a resolution concerning the nomenclature for radio sources in accordance with the general principles given in section 7.1. In particular it recommended the use of designations for newly catalogued sources in the form of a catalogue acronym followed by the right ascension and declination with respect to the reference system of J2000.0.

7.331 Pulsars. For this particular type of radio source the position should be preceded by the acronym PSR. Older names, such as CP1919 for the first pulsar that was discovered, are now obsolete.

7.332 Quasars. At present there is no special standard form for the designation of quasars.

7.34 X-ray sources. At first X-ray sources were designated by the constellation abbreviation followed by the letter X and a sequence number within the constellation, as in Sco X-1. Now designations are taken from the catalogues for the surveys by particular satellites.

7.35 Other types of objects. A wide variety of systems are in use for the designation of other types of celestial objects; many are specific to the wavelength of observation. Advice on specific problems is available from the persons listed at the end of Appendix B, where references to information about existing designations are also given.

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AGU GUIDELINES FOR PUBLICATION

The following 'Guidelines for Publication' have been issued by the American Geophysical Union in EOS (1988 October 11) and are appropriate to astronomy as well as to geophysics.

A. Obligations of Editors of Scientific Journals

1. An editor should give unbiased consideration to all manuscripts offered for publication, judging each on its merits without regard to race, gender, religious belief, ethnic origin, citizenship, or political philosophy of the author(s).
2. An editor should process manuscripts promptly.
3. The editor has complete responsibility and authority to accept a submitted paper for publication or to reject it. The editor may confer with associate editors or reviewers for an evaluation to use in making this decision.
4. The editor and the editorial staff should not disclose any information about a manuscript under consideration to anyone other than those from whom professional advice is sought.
5. An editor should respect the intellectual independence of authors.
6. Editorial responsibility and authority for any manuscript authored by an editor and submitted to the editor's journal should be delegated to some other qualified person, such as another editor or an associate editor of that journal. Editors should avoid situations of real or perceived conflicts of interest. If an editor chooses to participate in an ongoing scientific debate within his journal, the editor should arrange for some other qualified person to take editorial responsibility.
7. Unpublished information, arguments, or interpretations disclosed in a submitted manuscript should not be used in an editor's own research except with the consent of the author.
8. If an editor is presented with convincing evidence that the main substance or conclusions of a paper published in an editor's journal are erroneous, the editor should facilitate publication of an appropriate paper pointing out the error and, if possible, correcting it.

B. Obligations of Authors

1. An author's central obligation is to present a concise, accurate account of the research performed as well as an objective discussion of its significance.
2. A paper should contain sufficient detail and reference to public sources of information to permit the author's peers to repeat the work.
3. An author should cite those publications that have been influential in determining the nature of the reported work and that will guide the reader quickly to the earlier work that is essential for understanding the present investigation. Information obtained privately, as in conversation, correspondence, or discussion with third parties, should not be used or reported in the author's work without explicit permission from the investigator with whom the information originated. Information obtained in the course of confidential services, such as refereeing manuscripts or grant applications, should be treated similarly.

4. Fragmentation of research papers should be avoided. A scientist who has done extensive work on a system or group of related systems should organize publication so that each paper gives a complete account of a particular aspect of the general study.
5. It is inappropriate for an author to submit manuscripts describing essentially the same research to more than one journal of primary publication.
6. A criticism of a published paper may sometimes be justified; however, in no case is personal criticism considered to be appropriate.
7. To protect the integrity of authorship, only persons who have significantly contributed to the research and paper preparation should be listed as authors. The corresponding author attests to the fact that any others named as authors have seen the final version of the paper and have agreed to its submission for publication. Deceased persons who meet the criterion for co-authorship should be included, with a footnote reporting date of death. No fictitious name should be listed as an author or co-author. The author who submits a manuscript for publication accepts the responsibility of having included as co-authors all persons appropriate and none inappropriate.

C. Obligations of Reviewers of Manuscripts

1. Inasmuch as the reviewing of manuscripts is an essential step in the publication process, every scientist has an obligation to do a fair share of reviewing.
2. A chosen reviewer who feels inadequately qualified or lacks the time to judge the research reported in a manuscript should return it promptly to the editor.
3. A reviewer of a manuscript should judge objectively the quality of the manuscript and respect the intellectual independence of the authors. In no case is personal criticism appropriate.
4. A reviewer should be sensitive even to the appearance of a conflict of interest when the manuscript under review is closely related to the reviewer's work in progress or published. If in doubt, the reviewer should return the manuscript promptly without review, advising the editor of the conflict of interest or bias.
5. A reviewer should not evaluate a manuscript authored or co-authored by a person with whom the reviewer has a personal or professional connection if the relationship would bias judgment of the manuscript.
6. A reviewer should treat a manuscript sent for review as a confidential document. It should neither be shown to nor discussed with others except, in special cases, to persons from whom specific advice may be sought; in that event, the identities of those consulted should be disclosed to the editor.
7. Reviewers should explain and support their judgments adequately so that editors and authors may understand the basis of their comments. Any statement that an observation, derivation, or argument had been

previously reported should be accompanied by the relevant citation.

8. A reviewer should be alert to failure of authors to cite relevant work by other scientists. A reviewer should call to the editor's attention any substantial similarity between the manuscript under consideration and any published paper or any manuscript submitted concurrently to another journal.

9. Reviewers should not use or disclose unpublished information, arguments, or interpretations contained in a manuscript under consideration, except with the consent of the author.

D. Obligations of Scientists Publishing Outside the Scientific Literature

1. A scientist publishing in the popular literature has the same basic obligation to be accurate in reporting observations and unbiased in interpreting them as when publishing in a scientific journal.
2. The scientist should strive to keep public writing, remarks, and interviews as accurate as possible consistent with effective communication.
3. A scientist should not proclaim a discovery to the public unless the support for it is of strength sufficient to warrant publication in the scientific literature. An account of the work and results that support a public pronouncement should be submitted as quickly as possible for publication in a scientific journal.

Resolution A3: Improvement of Publications

The XXth General Assembly of the International Astronomical Union

recognising

- the need to develop clear lines of communication between the various branches of astronomy and other related scientific disciplines;
- the desirability of promoting ease of access to information contained in the astronomical literature;
- the advantages that would follow from a reduction in the variety of the editorial requirements for the submission of papers and reports; and
- the importance of identifying astronomical objects by clear and unambiguous designations; and

noting

- the growth in the cadre of young scientists trained in the use of the International System (SI) of units and widespread adoption of SI in other scientific and technical areas; and
- the substantial measure of agreement that has been reached during the drafting of the new IAU Style Manual for the preparation of astronomical papers, reports and books;

recommends

that the authors and the editors of the astronomical literature adopt the recommendations in the IAU Style Manual, which is to be published in the Transactions of the Union and reprinted for wide distribution and greater convenience;

in particular, it urges authors and editors:

1. to use only the standard SI units and those additional units that are recognised for use in astronomy, as recommended by Commission 5;
2. to adopt the conventions for citations and references that are given in the IAU Style Manual and that are exemplified in Astronomy and Astrophysics Abstracts; and
3. to ensure that all astronomical objects referred to in the literature are designated clearly and unambiguously in accordance with the recommendations of the Union.

Note:

The Executive Committee recognises that the replacement of CGS by SI units will require an adjustment of practice on the part of many astronomers; this will no doubt take time. Consequently, we urge that the total conversion from CGS to SI units by all organs of communication shall be accomplished by the time of the next General Assembly (1991).

In the meantime we request that the major journals should publish, once a year, a table of conversions between CGS and SI units, as provided by Commission 5.

SI

International System (units)

CGS

Centimeter, Gramme, Second (units)

EXTRACTS FROM IAU RULES FOR SCIENTIFIC MEETINGS

The following notes on the publication of the proceedings of conferences sponsored by the IAU have been taken from the 'Rules for Scientific Meetings' given in IAU Information Bulletin 58 (June 1987). Some additional notes are given in No. 61 (Jan. 1989).

Proceedings of IAU Symposia

The IAU believes that the Proceedings of Symposia remain of general interest for a considerable period of time and that early publication in uniform style to a high standard is desirable. Publication and distribution have therefore been entrusted to a commercial publishing house.

The main responsibility of the IAU as joint publisher is the maintenance of a high standard of scientific value, originality and accuracy. The commercial publishing house has been contracted to ensure early publication and thereafter to take financial responsibility.

The Executive Committee, by approving the choice of Editor or Editors, places the main burden of maintaining the required scientific standard on one or two IAU members on the understanding that they are familiar with the scientific matter of the Symposium and are persons with some experience in editorial tasks. The Editors receive no financial remuneration for their service to the Union.

It is essential that the Editor, or one of two Joint Editors, should have an excellent knowledge of the English Language.

The Editor is responsible for the scientific value, the appearance and rapid delivery to the Publisher (usually within three months of the end of the Symposium) of the copy for the Proceedings. The main editorial tasks are:

- (a) To inform participants in ample time before the meeting in what general form their contributions should be submitted and what arrangements have been made with the publisher for receipt of camera-ready copy. The number of printed pages available to each contributor should be determined in good time.
- (b) To inform the participants about IAU rules for publication of IAU Proceedings and to emphasize that any contributed papers must be refereed before acceptance for publication.
- (c) In advance of the Symposium, in close consultation with the SOC and LOC, to agree and arrange the precise details for recording and reporting the scientific discussion that takes place at the meeting. Difficulties in this respect must not cause undue delay in preparing for publication - it is better to sacrifice discussion rather than hold up publication.
- (d) To arrange with members of the SOC for the refereeing of any contributed paper if an Editor is unable to do so.
- (e) To reduce the length of papers and discussion, to avoid duplication and to improve presentation where necessary.
- (f) To check whether IAU rules have been followed in each contribution and to arrange for re-typing if necessary.
- (g) To write the Introduction, Table of Contents, and obtain a Final Summary of the Symposium, maintaining uniformity with recent IAU Symposium Proceedings.
- (h) To maintain all necessary contact with the Publishing House, in accordance with current "Instructions for Editors" available from the Assistant General Secretary.
- (i) To maintain close contact with the Assistant General Secretary on all matters affecting progress of publication arrangements, especially keeping him informed of the material sent to the publishers and of any unexpected delays or alterations. In general, the Editor will not be able to allow time for substantial revision.

In the proceedings of Symposium volumes, Invited Reviews and Invited Papers will be allowed extended publication subject to a maximum number (decided by the SOC and Editor) of camera-ready pages. Editorial discretion will be used to ensure that material previously published elsewhere is not duplicated. It should be noted that in extenso algebraic derivations, lists of observations and other tabular data are inappropriate in a Symposium volume.

The SOC has discretion to make the decision whether or not the contributed papers (oral and poster) are published in the Symposium proceedings. If a decision to publish is taken, then contributed papers (including posters), after editorial refereeing, will be published in not more than two camera-ready pages. Should the SOC decide that any contributed paper is given more extended publication, the same rules as for invited reviews and invited papers will apply.

It is the policy of the IAU and that of their publishers to publish in camera-ready form. It is found that such a policy gives reasonable uniformity of appearance combined with speed of production. Authors will be sent camera-ready sheets, instructions for their use and the total amount of space available to them, by the publishers prior to the Symposium. The final camera-ready manuscripts should be sent to the Editor(s) either before the beginning of the Symposium or handed over at the Symposium. Papers not available to the Editor(s) in camera-ready form by the end of the Symposium will be deemed to have been withdrawn from publication.

In order to obtain a presentation that will indicate that the volumes of IAU Symposia form a series, it is requested that Editors adhere to the following recommendations:

(The title page should have the format specified in section 3.6)

The Editor's introduction should mention circumstances of the organization of the Symposium, and should list the supporting organizations and the members of the Scientific and Local Organising Committees. It should express appreciation to those to whom it is due. The support of the IAU and other Unions, etc., should be recognized as well as that of other international, national, or local organizations.

(The Editors should provide an alphabetical index of names and subject headings in accordance with the instructions of the publishers.)

Symposium volumes should be published 6-8 months after the Symposium.

Participants obtain some free reprints of their contributions and other copies can be ordered. All IAU members can purchase Symposium volumes at reduced prices.

Proceedings of IAU Colloquia

The publication of IAU Colloquia should follow the same guidelines as for IAU Symposia. However, unless produced by the IAU publisher, the relevant manuscripts need not be in camera-ready form and some variation is allowed. Manuscript length is at the discretion of the SOC who have responsibility for the decision on whether or not to publish and the format of the publication. However, in order to facilitate archival retrieval all published IAU Colloquia proceedings must adopt the same form of Title Page. The title page should follow the same format as for Symposia replacing "Symposium" by "Colloquium" as appropriate.

Proceedings of IAU Regional Meetings

If it is decided to publish the proceedings of a Regional Meeting, the same guidelines as for an IAU Symposium or Colloquium should be followed as far as is practicable given the format of the meeting and the method of publication adopted. In order to facilitate archival retrieval the title page should indicate explicitly below any other title of the meeting.

Proceedings of the ... Regional Meeting of the International Astronomical Union, held in "place", "country", "date"

followed, if appropriate by the words "Organized by the IAU in cooperation with ...".

Recognizing the need for clear and unambiguous nomenclature of all astronomical sources of radiation, the prolific increase in the number of identified sources, and the requirements for data storage and information retrieval, the following set of specifications (developed and endorsed by the International Astronomical Union) is recommended for use throughout the field of astronomy for radiation sources outside the Solar System. All authors of papers and contributors to data bases of any kind are urged to adhere to these specifications, since otherwise significant data may be irretrievably lost. When existing designations are used in listings, they should never be altered. Object listings should contain a second designation and/or positional information for objects with unfamiliar names.

The *designation* of an astronomical source shall consist of the following parts:

Origin Δ Sequence Δ (Specifier)

Note that the triangle (Δ) is used here to denote a blank space; the parentheses are required if a specifier is included. *Origin* and *sequence* are essential, *specifier* is optional; the number of blanks may be larger in machine-readable files to right justify numerical or tabular data.

The following *examples* illustrate the recommended form of astronomical designations:

NGC Δ 205
PKS Δ 1817-43
CO Δ J0326.0+3041.0
H2O Δ G123.4+57.6 Δ (VLSR=-185)

The *origin* is a "word" or acronym to specify the catalog or collection of objects. It may be constructed from catalog names (e.g., NGC, BD), the names of authors (RCW), types of objects (PSR, PN), types of sources (13CO, HCN), instruments or observatories used (1E, IRAS), etc.

The following rules apply to the construction of *new* origins:

- *Origin* shall consist of at least two characters.
- *Origin* shall consist of letters and/or numerals only; special characters should be avoided.
- *Origin* shall be unique, i.e., the appropriate reference literature (see below) should be checked to avoid duplication with existing catalog designations, constellation names, abbreviations of object types, etc.
- The authors of a new catalog shall specify in their article which acronym is to be used in *origin*. Users shall never abbreviate *origin*.

The *sequence* is normally a numerical field to uniquely determine the object within a catalog or collection. It may be a sequence number within a catalog (e.g., HD Δ 224801), or it may be based on coordinates.

If coordinates in any form are used to encode an object, the following rules apply:

- Coordinates shall be preceded by a code for the reference frame, specifically G for galactic coordinates, and B for Besselian 1950 or J for Julian 2000 equatorial coordinates if confusion might be possible.
- Coordinates shall be specified as LLL.ll±BB.bb for galactic coordinates and for equatorial coordinates as HEMMSS.s±DDMMSS.s, without spaces; fewer digits may be used as appropriate.
- Coordinates shall be truncated (not rounded), thus defining a unique (small) field on the sky in which the object is located.
- Coordinates shall contain leading zeroes if necessary, and the plus or minus sign: ±BB.bb or ±DDMMSS.s.
- Coordinates used in designations shall be considered as names; therefore, they shall not be changed even if the positions become more accurately known (e.g., at a different epoch: BD -25 765 stays, even though its declination is now -26°).
- If at some stage subcomponents or multiplicity of objects is recognized, the best designation solution is to name these subcomponents with letters or numerals, which then are added to *sequence* with a colon, e.g., NGC 1818:B12.

The *specifier* is optional and allows one to indicate association with larger radiating sources (e.g., MΔ31, WΔ3) or to indicate other object parameters. However, they are *not* required syntax and are enclosed in parentheses.

Examples of complete designations are:

| Designation | Position | |
|--------------------------------|-------------|-------------|
| | RA (2000) | DEC (2000) |
| OriginΔSequenceΔ(Specifier) | | |
| BD -3 5750 | 00 02 02.4 | -02 45 59 |
| H20 B0446.6+7253.7 | 04 46 37.3 | +72 53 47 |
| AC 211 (=1E 2127+119; in M 15) | 21 30 15.54 | +11 43 39.0 |
| PM G001.2-00.3 | 17 49 36.9 | -28 03 59 |
| R 136:a3 | 05 38 42.4 | -69 06 03 |

There exists a multitude of improper, confusing or unclear designations in the literature. General rules and advice on how to generate designations can be found in "The First Dictionary of the Nomenclature...", cited below. Examples of improper use of designations are:

| | |
|---------------|-------------------------------------|
| BD 4° 14 | declination sign is missing |
| N221 | unclear source: NGC, or N in LMC ? |
| IRAS 5404-220 | leading zero missing; poor position |
| P 43578 | one-letter origin is ambiguous |

THE IAU STYLE MANUAL (1989)

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