10. COMMISSION DE L'ACTIVITE SOLAIRE

PRÉSIDENT: Professor Dr A. B. Severny, Director of the Crimean Astrophysical Observatory of the Academy of Sciences of the U.S.S.R., Pochtovoe, Crimea, U.S.S.R.

MEMBRES: Allen, Mlle Bell, Bogorodsky, Mme Brück, Bruzek, Cardus, Cimino, Contino†, Coutrez, Das, d'Azambuja, Djurkovic, Mme Dodson-Prince, Dollfus, Eigenson, Ellison, Giovanelli, Gnevyshev, Gullón, Kiepenheuer, Kopecky, Krat, Kristenson, Krook, McMath, Macris, Menzel, Mergentaler, Miyamoto, Mohler, Mustel, Notuki, Öhman, Richardson, Roberts, Rösch, A. H. Shapley, Shklovsky, Mme Slonim, Smerd, Stepanov, Svestka, Tandberg-Hanssen, Trellis, Waldmeier, Wayman, Zirin.

La Commission a une Sous-Commission: 10*a*

INTERNATIONAL CO-OPERATION, GENERAL REMARKS

The world-wide co-operation in pooling and publishing of the data about solar activity is now being continued on a level, lower than during the IGY period, but still higher than before IGY. One of the most successful of the co-operative efforts during IGY-IGC was the solar patrol. There were 19 cinematographic and 25 visual stations (90% coverage of possible hours was achieved during IGY period), and the data of this patrol are still being forwarded at the present time to World Data Centres (WDC). The publications of the World Data Center A (Boulder) are going on successfully. The publication of preliminary *Daily Maps of the Sun* by the Fraunhofer Institute has been continued and final Daily Maps for the period of IGY have been prepared. The publication of the 'Bulletin of Solar Data, U.S.S.R.' (*Solnechnye Dannye*) has also been continued with the omission of some data about solar radio-emission. The final daily maps of sunspot magnetic fields have been prepared for the whole period of IGY (Crimean Astrophysical Observatory). One volume of *Cartes Synoptiques de la Chromosphere* (Observatoire de Paris) covering the period January 1955–June 1957 has been completed. The Meudon daily maps and those of the Japanese have now ceased publication, but the *Bulletin of Solar Phenomena* is published quarterly from Tokyo Astronomical Observatory. The publication of the *Quarterly Bulletin of Solar Activity* has been delayed by the late receipt of radio-emission data from World Data Centres. Some other publications of solar data, based on the activity of national observatories, are going on regularly.

Many people have expressed the feeling that the great achievements in co-operative work during IGY should be kept and even improved. In particular, the opinion has been expressed that the needs of space research and world magnetic survey require a continuation of the solar patrol during sunspot minimum. The future of this big co-operative work should be one of the most important problems to consider at the next IAU meetings.

The present report, based mainly upon the separate reports of the members of Commission 10 and of observatories, is an attempt to give a brief summary of scientific activity in the field of problems of the physics of solar activity. Problems which are more closely connected with the 'quiet' Sun, as well as problems of solar activity studied at solar eclipses, have not been included in this report. A large amount of work connected with radio-emission from active Sun, as well as with terrestrial effects of solar activity, has also not been included in this report, because of its more close connection with the field of activity of Commission 40 (Radio Astronomy) and of the Inter-Union Commission on solar-terrestrial relations. The report is also restricted to those investigations, which have been carried out since the last IAU meeting. We also cannot be sure that the report is complete enough, mainly because of the lack of clear demarcation lines among the three solar commissions. Some inadvertent gaps, may be connected with this fuzziness in areas of responsibility.

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Considerable progress in observational work and equipment should be pointed out. A great deal of research work carried out since the last IAU meeting is related to atomic processes and the hydro-magnetics of solar plasma with its specific features—in our opinion, two basic aspects of the physics of solar activity. The recent discovery of high-energy protons produced by solar flares is an additional evidence that the physics of solar activity is involved in the physics of high energies. One of the biggest problems we are facing is to understand the source of these energies. Although we are as yet far from a complete understanding of many phenomena in this field, the physical pictures of some processes are beginning to clear. For instance, the importance of magnetic fields in non-stationary processes in active regions such as prominences and flares and, perhaps, plages has been recognized. There is also a feeling of inadequacy of current treatments when we deal with peculiarities of spectra connected with non-stationary and violent motions observed in active regions. A new technique has revealed new peculiarities in active regions which may be characterized by the words 'fine structure' such as, for instance, the fine structure of emission, motions and magnetic fields in active regions etc. But further progress here is strongly limited by imperfect seeing conditions and the only way to overcome these difficulties is probably connected with the use of balloons and tools of space research. In connection with all said above, the importance of continuous records of solar far ultra-violet, X-rays and high-energy protons published during the period in question cannot be over-estimated for the study of solar activity.

A. EQUIPMENT

Two new solar tower telescopes started to work—one in Italy (Observatorio Astronomico di Roma, main mirror 45 cm and focal length 28 m, (**1**)) and the second in the U.S.S.R. (Institute for Earth Magnetism, near Moscow, main mirror 38 cm and primary focus 17 m). A Lyot-type filter transmitting 4 coronal (λλ 5303, 5694, 6374, 6702) and three chromospheric (λλ 5890, 5896, Hα) radiations devised by A. Dollfus (**2**) showed its perfect properties.

Three solar magnetographs with some new improvements are described (**3, 4, 5**). New ingeneous spectro-heliographic technique for investigations of solar magnetic fields and radial velocities has been developed by R. Leighton (**6**). A polarimeter permitting detection of the slightest (10^{-5}) degree of polarization and transverse magnetic fields (at the sensitivity ≈ 40 gs) has been tested (**7**). P. Treanor applied the Babinet compensator and some other polarizing optics to measure the orientation of magnetic lines of force, (**8**). A new type solar flare photometer using a double image prism and Savart polariscope has been constructed by Y. Öhman (**9**).

B. SUNSPOTS

1. *Statistics and general considerations*. Statistical study of solar activity for the years 1958 and 1959 are carried out (**1**). Some evidence was found that zones of activity, remaining stationary in latitude, develop in each hemisphere (**2**). The existence and behaviour of secondary high latitude zones of spot activity is examined in (**3, 4**). The magnetic type of spot group was found to be the most important criterion for predicting geomagnetic effects (**5**). The complex structure of the velocity field of macroscopic motion has been obtained from the latitude drifts of sunspots (**6**). According to (**7**) the Wolf number and total area of sunspots are not adequate to a study of the solar activity. As primary characteristics the frequency of origin of sunspot-groups and their average importance has been proposed. Considerations of solar activity in regard to the numbers, area and motions of sunspots are contained in (**8**). Some suggestions relating to the sunspot cycle have been made (**9**).

2. *Magnetic fields, Evershed effect, physical state of spots*. In (**10**) and (**11**) it has been found that magnetic fields of uni-polar spots may be represented as 'fans', broken sometimes into

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separate tubes of force. The distribution of field strength follows Broxon's law closely (see also A, (**8**)). The fine structure of the Evershed effect—the asymmetry of the line ('flags'), degenerating sometimes into a secondary satellite—has been revealed and examined in (**10**) and (**12**). This effect may be connected with penumbral filaments examined in (**13**). The fine structure with characteristic size $\approx 5'' - 10''$ of the magnetic field and the appearance of transverse fields inside umbrae has been observed, with special attention to the possible effects of de-polarization (**14**). The existence of strong transverse fields inside umbrae has also been stated in (**15**). Complex structure in sunspot umbrae, the most important being an umbrae granulation, has also been found in white light (**16**). From the asymmetry of the D sodium-line inside spots, the gradient of magnetic field is estimated $\approx 1{\cdot}0 - 1{\cdot}8$ gs/km (**17**). The Wilson effect and the appearance of a facular material on the limbward side of spots near the limb have been observed (**18, 19**). Some data, relating to the physical state of gases inside spots have been obtained in (**20, 21**). The enhancement of coronal $\lambda 5303$ above sunspots has been pointed out (**22**). Rare phenomenon of appearance of red regions in sunspots is described (**23**).

3. *Theory.* A model of solar magnetic field based on observations with the magnetograph and some current theories is worked out. The model accounts for the reversal of the main dipole for the sunspot polarity laws, and for a number of the more incidental features of solar activity (**24**).

C. FACULAE AND FLOCCULI (PLAGES)

1. *General considerations.* An inverse relationship between polar faculae and solar activity was found (**1**). The strongest correlation between the mean area of Ca plages and the mean flux of radio-emission was found for 1000 Mc/sec (**2**).

2. *Magnetic and velocity fields.* The close correspondence between magnetic fields and calcium plage regions has been confirmed by several authors (**3, 4, 5**). Some decrease of brightness of Ca plages at sufficiently high field-strengths ($>$ 70 gs), leading to formation of ring-shaped plages has been pointed out (**5**). Fields up to 200 gs were found in extensive plage regions (**4**) and the strength of transverse fields may reach $\approx$ 100 gs (**6**). Descending motions with mean velocity $1{\cdot}7$ km/sec over 80% of the area of the disk occupied by Ca plages have been observed. At the photospheric level (faculae) the direction of motion closely follows the magnetic polarity for strong fields and only descending motions are observed in the case of weak fields (**7**). Hydro-magnetic mechanisms for heating of flocculi have been considered in (**5**) and (**8**).

3. *The physical state.* According to (**9**) there are no marked differences in behaviour of line profiles of ions and neutral atoms in grains of continuous emission of faculae. The optical depth at which these grains appear was estimated in the range $0 < \tau < 1$, (**9, 10**).

The separation of the emission peaks of the H and K lines in flocculi decreases with increasing intensity of either K_3 or K_2 when we pass from the undisturbed disk to *plages* (**11**). The behaviour of the bright reversal of the infra-red Ca II lines $\lambda\lambda$ 8498, 8542, 8662 in flocculi is similar to that observed in H and K lines (**12**).

The brightest parts of the corona as seen in white light are generally associated with active regions and plages as well, according to (**13**).

4. *Chromosphere in active regions.* The vortex structure has been found to consist of dark elongated structures (probably spicules) arranged in the form of hedges, long threads connecting, usually, spots of opposite polarity, some threads in the form of loops, bright regions in $H\alpha$ and K_3 in very vicinity of spots (**14**). Simultaneous records of magnetic fields and radial

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velocities in active regions show in 30 cases out of 37 that neutral points of magnetic field are found close to or on neutral line of velocity maps (**15**).

D. FLARES

1. *Statistics.* The statistic of solar flares for the period 1945–54 is carried out in (**1**). The distribution of 8403 observed flares among spot-groups of various Mount Wilson magnetic classes has been considered in (**2**). The E – W asymmetry in the number of solar flares varies with the phase of 11-year cycle according to (**3**). In 85% of 177 cases (1952–57) the green corona showed a small maximum of intensity in the vicinity of flares observed near the limb (**4**).

2. *Direct observations* (*Hα-films*). The most important common result of several investigations consists in revealing new evidence of extremely rapid explosion-like phenomena accompanying the development of flares. According to the published data, these observations are as follows. The great majority of 180 Hα-limb flares appear as a brilliant hill with a sharp conical top, the upper front of which undergoes rapid dilation and then contraction lasting sometimes 1^m-2^m, the corresponding velocities being up to 600 km/sec and accelerations up to 10^6 cm/sec^2. Pulsations of flare-jets are sometimes also observed (**5**). A study shows that bright ejections out of flares sometimes appear practically instantaneously (**6**). The motion of the luminous front in the flare of 1956 August 31 showed some properties which are similar to those of a shock front (**7**). In the flare of 1958 August 7 the bright emission material was moving at a velocity $\approx$ 300 km/sec (**8**). At the time of maximal intensity of some outstanding flares (1960 April 1 and 1960 June 1) the striation pattern of the Hα chromosphere around spot-groups underwent a sudden transformation, losing its characteristic structure during $\approx 15^m$; the effect is ascribed to a sudden change during the flare flash of the magnetic field (**9**). Many flares recorded with high spatial and time resolution exhibit an explosive phase, lasting a few seconds and visible as a rapid expansion of the flare borders in a preferred direction or as a sudden brightening of the flare. Travelling disturbances and dark clouds propagating outward from flare with velocities from 500 – 2000 km/sec are observed (**10, 11, 12**). In this connection the origin of surges from expanding flares should also be mentioned (**13**). In contrast with these rapid developing flares, so called mushrooms, appearing as microflares on the disk, show mean ascending velocities of only $\approx$ 25 km/sec (**14**). The observations of flares in white light have been reported in (**15, 16**). It has been revealed that important flares are usually preceded by smaller flares or brightening of plages in the same active region (**17**).

3. *Magnetic fields connected with flares.* The possible connection of the generation of flares with magnetic fields has been examined in a set of papers. A comparison of *positions* of flares with the distribution of magnetic polarities shows that flares appear close to or on the zero line of magnetic field (**18, 19**). The location of the main bright centres of flares at their beginning coincides in 46 cases out of 61 with neutral points of magnetic maps recorded with a magnetograph. The comparison of magnetic maps before and after the flare shows in 7 cases out of 8 the simplification of the field in the region of a flare (**20**). Some disaccordance between observers exists with regard to the *changes* of magnetic field in connection with flares. For example, no appreciable changes of field in the course of the 3 + flare of 1959 July 16 are found (**21**). In another observation, there are also no definite indications of changes in the field during a 1 + flare, but the measurements obtained 4 hours before the flare show much stronger field and field-gradients (**22**). Polarimeter measurements of transverse fields before and after an important flare showed that the field changes slightly in the exact place of the flare, but there is considerable destruction of the field in the region outside the flare itself (**23**). Similar magnetograph observations of longitudinal fields in many flares showed well defined rearrangements and shifts of magnetic hills, as well as of small sunspots, surrounding flares. The

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shifts are mainly in the direction of the region of the flare. By comparison, observations when no flares appear show that these hills and spots are practically motionless (**24**). Sudden changes in the configuration of sunspots when a flare takes place in the vicinity are also observed in (**25**).

4. *Spectra and physical state.* A new spectrograph with echelle grating is used to obtain simultaneously the spectra of flares in the range $\lambda\lambda$ 3500–6700; a catalogue of nearly 500 emission lines in a flare is presented (**26**).

The nature of the broadening of emission lines has been considered in a great number of papers. The most characteristic result is concurrence between Doppler and Stark broadening of the hydrogen emission. Stark broadening is definitely ruled out for moustaches (or bombs) and the far wings of Balmer lines (up to H_{12}) at the flash or maximum intensity phase of several big flares (including limb flares). The profiles of these lines and some other strong lines such as H and K, D_3, λ 4471 are in good agreement with Doppler broadening caused by macroscopic motions with velocities ranging from 30 to 300 km/sec (**27, 28, 29**). The run of emission in these cases may also be equally well represented as originating in luminous jets possessing a gradient of velocity along the jet (**30**). But for some flares the profiles of Balmer emission are compatible with the Stark-effect (**31**) and this leads to electron density $n_e \approx 10^{13}$ cm^{-3} and N_2 ranging from 10^{15} to 10^{17} cm^{-2} (**24**), (**28**). The reason why these above-mentioned two types of broadening appear is as yet not clear. The Balmer decrement (**28**) or the run of half-width's (**32**) leads to a comparatively low excitation temperature T_{ex} (7000° in (**28**) and 5600° in (**32**)). To bring such low values of T_{ex} into agreement with the above data derived from profiles, the growth of excitation inside the flare is proposed (**28**), (**31**), or we can assume that a flare is composed of a great many thin ($\approx$ 10 km) thread-like condensations (**32**). In one interesting case a limb flare was observed to condense directly out of a bright coronal cloud and this was accompanied by a great increase in the intensity of the coronal lines $\lambda\lambda$ 4086, 5694 of Ca XIII and Ca XV (**33**). On the other hand, Balmer-continuum observations for two limb flares showed that kinetic temperature in these objects is less than $\approx$ 20 000° (**34**).

For the D_3 Helium line, self-absorption is important (**27**), (**35**). Observations in two flares of the He II line λ4886, with special attention to its fine structure, show that its profile is in good agreement with the supposition that $L\alpha$ is responsible for excitation of the fourth quantum level. The temperature in the region of He II emission is estimated to be $\approx 2{\cdot}5 \times 10^4$ °K (**36**). An estimate of the emission in the resonance He I-line λ584, He II λ304 and $L\alpha$ in flares at T_{kin} ranging from 10^4 to $2{\cdot}5 \times 10^4$ °K was found to be in agreement with rocket observations (**37**).

The observed distribution of energy in the continuous spectrum of flares considered as the long wave-length Bremstrahlung tail and extrapolated to the X-ray region, leads to values consistent with rocket experiments (**38**). In flares (as well as in flocculae) the behaviour of rare earth emission is similar to that of H and K emission, but in flares they are stronger where Hα-wings are narrower and they attain maximum emission later than Ca^+ and Hydrogen (**39**). Some other interesting features in the spectra of flares have been described in (**40, 41, 42**).

The connection between flares and moustaches or bombs has been considered. Disk distribution, life-time and spectra showed that bombs are not precursors of solar flares and their positions neither indicate the exact position where flares will break out, nor where flares will not appear, but that these phenomena should be considered as distinctive features of the growth of active centres (**43**). On the other hand the very broad emission wings in big flares are sometimes resolved with good seeing into separate moustaches (**27**).

5. *Theoretical considerations.* The generation of flares as a result of the inter-action of two twisted magnetic loops of opposite sense and opposite twist has been considered. The annihila-

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tion of the longitudinal component of the field leads to a sudden constriction of the current and to a dissipation of energy (**44**). The contraction of flare plasma near the neutral point of cusped magnetic fields may lead to the appearance of cumulative jets of luminous material (**5**). Cosmic ray protons from a flare are considered to arise from impulsive thermo-nuclear reactions in the region of collision of two shock fronts in the neutral point of the magnetic field, and to be accelerated by successive reflections from magnetic mirrors carried behind these shocks (**45**). Magnetic trapping in the solar atmosphere of such protons may be effective as shown in (**46**).

E. PROMINENCES AND FILAMENTS

1. *Direct observations.* The following is a brief summary of separate interesting observations. The motions in separate prominences have been studied in a series of the papers (**1**). Thread-shaped loops observed in the photosphere and showing strong changes of magnetic field often coincide with the site of flares (**2**). The difference between dark and bright surges is confirmed: bright surges at the limb were more frequent in 1958–59 than dark surges on the disk (**3**). Variation in contrast of a considerable number of filaments across the disk showed a minimum intensity at $\approx 7°$ east of central meridian, when filaments were situated to the west of spot groups (**4**). The daily sidereal angle of rotation of polar filaments has been determined (**5**).

2. *Spectra and physical state.* A series of coronograph studies of spectra of active prominences have been carried out (**6, 7, 8**). Among the principal conclusions of this work are: (1) There appear to be two distinct classes of prominence spectra: a 'hot' class (temperatures over 50 000°), characterized by relative intense He I and He II emission and weak metallic line emission, and a 'cool' class (temperatures around 10 000°), similar to the chromospheric spectrum at the height $\approx$ 1500 km, with weak He II and strong metals. (2) Lines of He II show greater broadening than He I, and point to origin in a different region. (3) Loop prominences show much closer connection with the corona than surges do. Closely connected with these results are the results of spectral study of a brilliant coronal prominence of 1957 April 16 (**9**). The equivalent widths of H and K lines were ≈ 35 and central intensities ≈ 20 times of average quiescent prominence. Hα profiles yields $T_{\mathrm{kin}} \approx 150\,000$ °K and H and K lines $\approx 10^6$ °K. Non-thermal processes such as spiraling motions of Ca II ions (see (**10**)) are invoked to explain such a broadening. For the very bright prominence of 1956 September 5 the profiles of metallic lines, Paschen lines and higher terms of Hydrogen as well as some of parahelium can be explained by the Doppler effect at $T_{\mathrm{kin}} = 6150$, turbulent velocity $v_t = 5{\cdot}7$ km/sec, electron density $n_e = 10^{13}$ and the number of two-quantum atoms $N_2 \approx 5 \times 10^{14}$ (**11**). From the study of far wings of Balmer lines in prominences the conclusion was reached that the prominence material is concentrated in condensations with the size of $\approx 3 \times 10^7$ cm (electron concentration being $\approx 10^{13}$) and separated by a distance of $\geqslant 10^8$ cm (**12**). Balmer continuum in prominences is best visible in objects of high Hα intensity indicating that high intensity is mainly due to high density of matter. The temperature determined is ≈ 5000 °K (**13**). Echelle spectrograms of 10 quiescent and bright prominences have been carefully investigated including sometimes the line profiles for more than 30 emission lines. The following main results have been obtained: (1) The broadening of the lines is produced by Doppler effect and radiation damping. (2) The kinetic temperatures range between 5500 and 10^4 °K and turbulent velocities from 3 to 7 km/sec. (3) The low levels of Hydrogen are excited by the prominences' own radiation and higher one—by electron impact (**14**). Connection of prominences with corona has been considered in several papers. A new kind of chromospheric condensation possessing low electron temperature and high density has been found. The spectrum of these condensations has much in common with the spectra of metallic prominences, except Hydrogen emission which is markedly less pronounced (**15**).

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The prominences showing high degree of fragmentation and large internal motions are most prevalent in the regions of bright coronal emission (**16**). A further study has shown that the presence of quiescent prominences is generally associated with diminution of λ 5303 emission. This diminution is roughly proportional to the prominence dimension in the line of sight (**17**). A close correspondence in motions of coronal emission λ 6374 and of prominences has been found. The intensity of λ 6374 increases with the approach to a prominence (**18**).

3. *Theories*. The problem of condensation of prominences out of coronal plasma due to magnetic contraction has been considered (**19**). The loss of energy by radiation in contracting part of plasma is shown to be sufficient to release the high thermal energy. The similar consideration is presented in (C 14). The relation of flares to loop prominences has been discussed (**20**). According to (**21**) a quick formation of loops may be accompanied by X-rays, radio-emission and acceleration of particles up to energies 10^{10} eV. The filamentary structure of solar prominences has been discussed in (**22**). The magnetic field strength in eruptive prominences according to (**23**) is higher than in quiescent ones. The life-time of a prominence increases with size and decreases with the field strength of the prominence. The diamagnetic phenomena in prominences due to inhomogeneous magnetic field is considered in (**24**).

F. REQUESTS AND SUGGESTIONS TO BE CONSIDERED

1. The future of the solar patrol—to what extent it should be reduced (if necessary) or broadened and improved. (Proposals of M. G. J. Minnaert, M. A. Ellison, Boulder meeting on 28 October 1960, H. Dodson-Prince and of the group 'Soleil' of the Comité National Francais d'Astronomie).

2. The problem of the content and prompt compilation of the *Quarterly Bulletin*. (The proposals of the group 'Soleil' of the Comité National Francais d'Astronomie and of the Boulder meeting on 28 October 1960, and M. G. J. Minnaert and M. A. Ellison).

3. The problems of the continuation of publications of sunspot magnetic fields (polarities and field strengths), of quick reporting of areas and magnetic types of sunspot groups and of establishing an agreed system of assigning catalogue or serial numbers to each spot, similar to the former Mount Wilson Number, are put forward by the Boulder meeting on 28 October 1960 and by McMath Hulbert Observatory.

4. The organization in 1962 of continuous and detailed observations of magnetic fields in active regions is proposed by the group 'Soleil' of the Comité National Francais d'Astronomie.

5. The group 'Soleil' of the Comité National Francais d'Astronomie, pointing out the importance of observations of the corona in white light, expresses the need to make comparable the observations carried out at different observatories.

6. The importance and need to have some publication, containing daily original spectroheliograms, are expressed by the Solar Commission of Academy of Sciences, U.S.S.R.

7. L'Observatoire de Meudon request that the annual subvention of 2700 gold francs agreed to since 1925 by the IAU for the publication of *Cartes synoptiques de la Chromosphère solaire* should be renewed until the next General Assembly.

A. B. SEVERNY
President of the Commission

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10*a*. SOUS-COMMISSION DE CINEMATOGRAPHIE DES PHENOMENES SOLAIRES

PRÉSIDENT: Dr W. O. Roberts, High Altitude Observatory of the University of Colorado, Boulder, Colorado, U.S.A.

MEMBRES: Gnevyshev, McMath, Rösch, Severny, Waldmeier.

An historic goal of the Sub-Commission has been the co-operative preparation of a high-quality, continuous, unbroken 24-hour cinematographic record of solar flare activity covering a substantial period of time. The Sub-Commission meeting at Moscow entrusted to a special working committee the preparation of the first example of such a film, covering a span of 14 days or longer during the IGY. The working committee now has such a film, but for a period in the IGC-59, under preparation, as indicated in the report appended. It is hoped that a viewing of the film will be possible at the eleventh General Assembly, thus culminating a first approach to a long-standing objective of the Sub-Commission.

A second working committee of the Sub-Commission has also actively pursued objectives defined during the tenth General Assembly. This committee, under the chairmanship of J. Rösch, has conducted an inter-comparison of coronal intensity data observed simultaneously at different coronal observatories, and has exchanged preliminary findings with participating observatories. A detailed report from the working committee is planned for the eleventh General Assembly.

The centralization and exchange of solar data endorsed at the Moscow meeting has been accomplished in effective measure at the IGY World Data Centers and otherwise. Much of this material will appear in the *Annals of the IGY*, and other Data Center publications. The centralization of films has been carried on in a limited way. In certain instances participating

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