

IAU Symposium

291

20 - 24 August 2012
Beijing, China

Proceedings of the International Astronomical Union

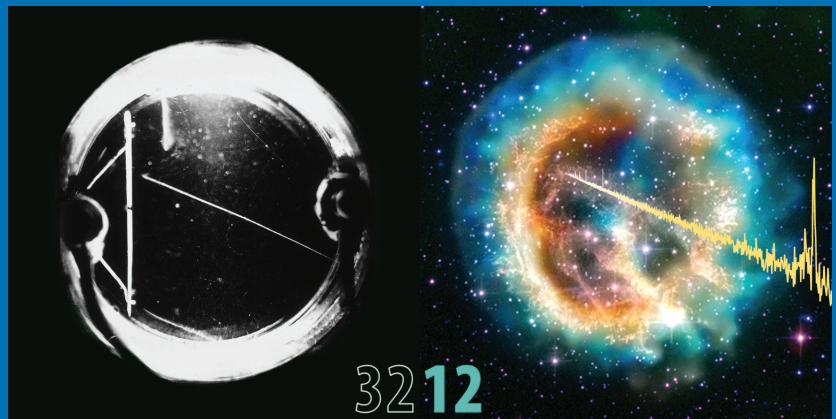
Neutron Stars and Pulsars: Challenges and Opportunities after 80 years

Edited by

Joeri van Leeuwen

ISSN 1743-9213

International Astronomical Union



CAMBRIDGE
UNIVERSITY PRESS

NEUTRON STARS AND PULSARS:
CHALLENGES AND OPPORTUNITIES AFTER 80 YEARS

IAU SYMPOSIUM No. 291

COVER ILLUSTRATION:

1932 – 2012:

DISCOVERY OF THE NEUTRON – A NEUTRON STAR IN A SUPERNOVA

This diptych combines the 1932 detection of the neutron with the state of modern neutron-star and pulsar research, in 2012.

In the left-hand side photograph, neutrons have collided with the atoms in a layer of paraffin wax, ejecting a proton. The proton path is visible in the ionization chamber.

The right-hand panel shows an optical (HST) and X-ray (Chandra) false-color image of supernova remnant 1E 0102-7219. Overlaid for illustration is radio (WSRT) data of the Crab pulsar.

Left image courtesy of I. Joliot-Curie & F. Joliot/NMSI. Right image of SNR E0102 courtesy of NASA/CXC/STScI/MIT/SOA/D.Dewey/J.DePasquale; overlay of Crab pulsar radio data courtesy of J. van Leeuwen/ASTRON.

IAU SYMPOSIUM PROCEEDINGS SERIES

Chief Editor

THIERRY MONTMERLE, IAU General Secretary
*Institut d'Astrophysique de Paris,
98bis, Bd Arago, 75014 Paris, France
montmerle@iap.fr*

Editor

PIERO BENVENUTI, IAU Assistant General Secretary
*University of Padua, Dept of Physics and Astronomy,
Vicolo dell'Osservatorio, 3, 35122 Padova, Italy
piero.benvenuti@unipd.it*

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

International Astronomical Union



**NEUTRON STARS AND
PULSARS:
CHALLENGES AND
OPPORTUNITIES
AFTER 80 YEARS**

**PROCEEDINGS OF THE 291st SYMPOSIUM OF
THE INTERNATIONAL ASTRONOMICAL UNION
HELD IN BEIJING, CHINA
20–24 AUGUST 2012**

Edited by

JOERI VAN LEEUWEN

*ASTRON, the Netherlands Institute for Radio Astronomy,
Postbus 2, 7990 AA, Dwingeloo, The Netherlands*



**CAMBRIDGE
UNIVERSITY PRESS**

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, United Kingdom
32 Avenue of the Americas, New York, NY 10013 2473, USA
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

© International Astronomical Union 2013

This book is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of the International Astronomical Union.

First published 2013

Printed in the UK by MPG Books Ltd

Typeset in System L^AT_EX 2 ϵ

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication data

This journal issue has been printed on FSC-certified paper and cover board. FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. Please see www.fsc.org for information.

ISBN 9781107033801 hardback
ISSN 1743-9213

Table of Contents

Preface	xvi
Scientific Organizing Committee.....	xvii
Welcome	xviii

Plenary Presentations

Pulsars are cool. Seriously.	3
<i>S. M. Ransom</i>	
Magnetars: neutron stars with huge magnetic storms.....	11
<i>N. Rea</i>	
Probing gravitation with pulsars	19
<i>M. Kramer</i>	

Session 1: Pulsar Discovery I

The High Time Resolution Universe surveys for pulsars and fast transients	29
<i>M. J. Keith on behalf of the HTRU collaboration</i>	
The PALFA Survey: Going to great depths to find radio pulsars	35
<i>P. Lazarus on behalf of the PALFA Collaboration</i>	
The hunt for new pulsars with the Green Bank Telescope.....	41
<i>R. S. Lynch, on behalf of the GBT 350 MHz Drift-scan survey and Green Bank North Celestial Cap survey collaborations</i>	
New results from LOFAR	47
<i>V. Kondratiev, on behalf of Ben Stappers and the LOFAR Pulsar Working Group</i>	
Conducting the deepest all-sky pulsar survey ever: the all-sky High Time Resolution Universe survey.....	53
<i>C. Ng and the HTRU Collaboration</i>	
A search for pulsars in the central parsecs of the Galactic center	57
<i>A. Siemion, M. Bailes, G. Bower, J. Chennamangalam, J. Cordes, P. Demorest, J. Deneva, G. Desvignes, J. Ford, D. Frail, G. Jones, M. Kramer, J. Lazio, D. Lorimer, M. McLaughlin, S. Ransom, A. Roshi, M. Wagner, D. Werthimer, & R. Wharton</i>	

Session 2: Pulsar Genesis – Neutron-star formation and birth properties

Structure of Quark Stars	61
<i>F. Weber, M. Orsaria, H. Rodrigues, & S.-H. Yang</i>	
Numerical modeling of core-collapse supernovae and compact objects	67
<i>K. Sumiyoshi</i>	

How “free” are free neutrons in neutron-star crusts and what does it imply for pulsar glitches?	73
<i>N. Chamel</i>	
Neutron star structure: what we learn from their masses and radii.	77
<i>F. Özel</i>	
Session 3: Pulsar Discovery II	
Fermi-LAT searches for γ -ray pulsars.	81
<i>P. M. Saz Parkinson for the Fermi LAT Collaboration</i>	
Radio counterparts of gamma-ray pulsars	87
<i>L. Guillemot, on behalf of the Fermi LAT Collaboration, the Fermi Pulsar Search Consortium and the Fermi Pulsar Timing Consortium</i>	
Session 4: Pulsar Diversity	
Rotating Radio Transients and their place among pulsars	95
<i>S. Burke-Spolaor</i>	
Central compact objects and their magnetic fields	101
<i>W. C. G. Ho</i>	
Discoveries of Rotating Radio Transients in the 350 MHz Green Bank Telescope Drift-scan Survey	107
<i>C. Karako-Argaman and the GBT Drift-scan Collaboration</i>	
Pulsar searches in nearby dwarf spheroidal galaxies	111
<i>E. Rubio-Herrera & T. Maccarone</i>	
The decaying magnetic field of magnetars: evidence and inference	115
<i>S. Dall’Osso</i>	
The first radio-quiet millisecond pulsar?	116
<i>A. Belfiore</i>	
X-ray properties of rotation-powered pulsars.	117
<i>G. Pavlov & O. Kargaltsev</i>	
Session 5: Binary Pulsars	
Binary pulsar evolution: unveiled links and new species.	121
<i>A. Possenti</i>	
Surrounded by spiders! New black widows and redbacks in the Galactic field . . .	127
<i>M. S. E. Roberts</i>	
Formation of the planet orbiting the millisecond pulsar J1719–1438.	133
<i>L. M. van Haften, G. Nelemans, R. Voss & P. G. Jonker</i>	
Recycling Pulsars: spins, masses and ages	137
<i>T. M. Tauris, M. Kramer & N. Langer</i>	
A peculiar thermonuclear X-ray burst from the transiently accreting neutron star SAX J1810.8–260	141
<i>N. Degenaar & R. Wijnands</i>	

Constraining neutron star EoS from cooling stages of X-ray bursts	145
<i>J. Poutanen & V. Suleimanov</i>	
Neutron star masses.	146
<i>D. Nice</i>	
Session 6: Neutron star vibration and emission	
Merging neutron star binaries: equation of state and electrodynamics	149
<i>D. Lai</i>	
Quasi-Periodic Oscillations in magnetars: linking variability and emission.	155
<i>C. D'Angelo</i>	
Neutron star seismology	159
<i>N. Andersson</i>	
Magnetar X-ray emission mechanisms	160
<i>S. Zane</i>	
Long timescale radio emission variability and spin-down changes in PSR J0738-4042	161
<i>A. Karastergiou, P. Brook, S. Roberts, S. Buchner & S. Johnston</i>	
Session 7: Pulsar timing and testing gravitational theories	
Pulsar Timing Arrays: Status & Techniques	165
<i>G. Hobbs</i>	
Prospects for probing strong gravity with a pulsar-black hole system.	171
<i>N. Wex, K. Liu, R. P. Eatough, M. Kramer, J. M. Cordes & T. J. W. Lazio</i>	
Constraining the nanohertz gravitational wave background with the Parkes Pulsar Timing Array	177
<i>R. Shannon</i>	
Stochastic and continuous gravitational wave analysis pipelines for pulsar timing array data	178
<i>J. Ellis, F. Jenet, X. Siemens & M. McLaughlin</i>	
19 Years of high precision timing of the millisecond pulsar J1713+0747.	179
<i>W. Zhu</i>	
Update on the European Pulsar Timing Array	180
<i>K. Liu</i>	
Session 8: Pulsar Timing	
Timing noise and the long-term stability of pulsar profiles	183
<i>A. Lyne</i>	

Testing gravity theories in the radiative regime using pulsar timing arrays	189
<i>K. J. Lee</i>	
The spin evolution of young pulsars	195
<i>C. M. Espinoza</i>	
PSR J1906+0746: From relativistic spin-precession to beam modeling.	199
<i>G. Desvignes, M. Kramer, I. Cognard, L. Kasian, J. van Leeuwen, I. Stairs & G. Theureau</i>	
The superslow pulsation X-ray pulsars in high mass X-ray binaries	203
<i>W. Wang</i>	
Vela Glitch Monitoring from HartRAO	207
<i>S. Buchner</i>	
On the peculiarities in the spin-down of isolated radio pulsars	208
<i>A. Chukwude</i>	
Session 9: Pulsars and the interstellar medium	
Galactic structure and turbulence, pulsar distances, and the intergalactic medium	211
<i>J. M. Cordes</i>	
Interstellar scattering — New diagnostics of pulsars and the ISM.	217
<i>J.-P. Macquart</i>	
Pulsars as excellent probes for the magnetic structure in our Milky Way.	223
<i>J. Han</i>	
Pilot pulsar surveys with LOFAR.	229
<i>T. Coenen, on behalf of the LOFAR Pulsar Working Group</i>	
FRATs: Searching for fast radio transient in real-time with LOFAR	233
<i>H. Falcke and the ILT LOFAR Consortium</i>	
Session 10: Galactic distribution and evolution of neutron stars	
The Galactic Millisecond Pulsar Population	237
<i>D. R. Lorimer</i>	
The pulsar population in Globular Clusters and in the Galaxy.	243
<i>P. C. C. Freire</i>	
Pulsar Wind Nebulae: On their growing diversity and association with highly magnetized neutron stars	251
<i>S. Safi-Harb</i>	
Constraining the luminosity function parameters and population size of radio pulsars in globular clusters	257
<i>J. Chennamangalam, D. R. Lorimer, I. Mandel & M. Bagchi</i>	
The extended X-ray emission around RRAT J1819–1458	261
<i>A. Camero-Arranz, N. Rea, M. A. McLaughlin, N. Bucciantini, P. Slane, B. Gaensler, D. Torres, L. Stella, E. de Oña, G. Israel, F. Camilo & A. Possenti</i>	

Diffusion and advection model for particle transport in young pulsar wind nebulae <i>X. Tang & R. A. Chevalier</i>	265
Science with radio pulsar astrometry <i>S. Chatterjee</i>	269
Session 11: Pulsar magnetosphere and emission mechanisms	
The complex charm of the pulsar magnetosphere <i>A. N. Timokhin</i>	273
The structure of the pulsar magnetosphere via particle simulation with GRAPE <i>S. Shibata</i>	279
Pulsar electrodynamics revisited. <i>D. B. Melrose & R. Yuen</i>	283
Resistivity and dissipation in pulsar magnetospheres <i>J. Li, A. Spitkovsky, & A. Tchekhovskoy</i>	287
Modeling of pulsar magnetospheres <i>A. Spitkovsky</i>	291
Session 12: Emission mechanisms	
Radio pulsar variability <i>E. F. Keane</i>	295
Elementary radiation patterns in pulsar profiles <i>J. Dyks & B. Rudak</i>	301
Pulsars in gamma rays: What <i>Fermi</i> is teaching us <i>M. Kerr and the Fermi-LAT Collaboration</i>	307
Binary pulsar B1259-63 spectrum evolution: detailed study. <i>M. Dembska, J. Kijak & W. Lewandowski</i>	313
Pulsar emission at the bottom end of the electromagnetic spectrum <i>V. Kondratiev and the LOFAR Pulsar Working Group</i>	317
“An X-Raydio Switcheroo” – The detection of correlated mode changes in radio and X-ray <i>J. van Leeuwen, W. Hermsen, J. Hessels, L. Kuiper, D. Mitra, J. Rankin, B. Stappers & G. Wright</i>	321
A multi-wavelength campaign to study giant pulses from the Crab Pulsar <i>W. Majid</i>	322
Session 13: Future facilities	
The Five-hundred-meter Aperture Spherical radio Telescope project and its early science opportunities <i>D. Li, R. Nan & Z. Pan</i>	325

NuSTAR observations of rotation-powered pulsars and magnetars	331
<i>V. M. Kaspi, H. An, M. Bachetti, E. Bellm, A. M. Beloborodov, S. Boggs, D. Chakrabarty, F. Christensen, B. Craig, F. Dufour, F. Harrison, E. V. Gotthelf, T. Kitaguchi, C. Kouveliotou, K. Mori, M. Pivovarovff, D. Stern, J. K. Vogel, W. Zhang, & The NuSTAR Team</i>	
The Square Kilometre Array	337
<i>A. R. Taylor</i>	
Summary	
Closing remarks	345
<i>J. Bell Burnell</i>	
Posters	
High magnetic field pulsars with magnetar-like activity	351
<i>Y. Aoki</i>	
R-Process nucleosynthesis in high entropy environment in explosion of supernova type II and neutron star formation	352
<i>R. Baruah, K. Duorah, & H. L. Duorah</i>	
A new low-B magnetar: Swift J1822.3–1606	353
<i>A. Camero-Arranz, N. Rea, G. L. Israel, P. Esposito, J. A. Pons, R. P. Mignani, R. Turolla, S. Zane, M. Burgay, A. Possenti, S. Campana, T. Enoto, N. Gehrels, E. Göğüş, D. Götz, C. Kouveliotou, K. Makishima, S. Mereghetti, & S. R. Oates</i>	
Does a hadron-quark phase transition in dense matter preclude the existence of massive neutron stars ?	356
<i>N. Chamel, A. F. Fantina, J. M. Pearson, & S. Goriely</i>	
Unified description of dense matter in neutron stars and magnetars	359
<i>N. Chamel, R. L. Pavlov, L. M. Mihailov, Ch. J. Velchev, Zh. K. Stoyanov, Y. D. Mutafchieva, M. D. Ivanovich, A. F. Fantina, J. M. Pearson, & S. Goriely</i>	
Relativistic strange stars with anisotropy and B-parameter in pseudo spheroidal space time	362
<i>P. K. Chattopadhyay & B. C. Paul</i>	
Pulsar time scale and its future application	365
<i>D. Chen, G. Hobbs, W. Coles, & R. Manchester</i>	
New timing solutions for RRATs	366
<i>B. Cui, J. Boyles, M. McLaughlin, & N. Palliyaguru</i>	
Microensing pulsars	369
<i>S. Dai & R. Xu</i>	
Constraints on Yukawa parameters by double pulsars	372
<i>X.-M. Deng, Y. Xie, & T.-Y. Huang</i>	

SPAN512: A new mid-latitude pulsar survey with the Nançay Radio Telescope	375
<i>G. Desvignes, I. Cognard, D. Champion, P. Lazarus, P. Lespagnol, D. A. Smith, & G. Theureau</i>	
Annular gap model for multi-wavelength pulsed emission from young and millisecond pulsars	378
<i>Y. J. Du & G. J. Qiao</i>	
Characterizing glitches and timing irregularities in pulsars and magnetars	381
<i>C. Espinoza, D. Antonopoulou, A. Patruno, B. Stappers, & A. Watts</i>	
Can we see pulsars around Sgr A*? The latest searches with the Effelsberg telescope.	382
<i>R. P. Eatough, M. Kramer, B. Klein, R. Karuppusamy, D. J. Champion, P. C. C. Freire, N. Wex, & K. Liu.</i>	
A survey of nulling pulsars using the Giant Meterwave Radio Telescope	385
<i>V. Gajjar, B. C. Joshi, & M. Kramer</i>	
The surface and inner temperatures of magnetars	386
<i>Z. F. Gao, N. Wang, & Q. H. Peng</i>	
<i>Chandra</i> observations of black widow pulsars	389
<i>P. Gentile, M. McLaughlin, M. Roberts, F. Camilo, J. Hessels, M. Kerr, S. Ransom, P. Ray, & I. Stairs</i>	
Spin rotation, Chandler wobble and free core nutation of isolated multi-layer pulsars	392
<i>A. Gusev & I. Kitiashvili</i>	
Constraints of the compactness of the isolated neutron stars via X-ray phase-resolved spectroscopy.	393
<i>V. Hambaryan, V. Suleimanov, R. Neuhäuser, & K. Werner</i>	
Magnetars are super hot and super cool	396
<i>W. C. G. Ho, K. Glampedakis, & N. Andersson</i>	
Birth accelerations of neutron stars	399
<i>R. Heras</i>	
An XMM-Newton study of the supernova remnant G296.7–0.9.	402
<i>R. H. H. Huang, C. Y. Hui, L. Trepl, & A. K. H. Kong</i>	
X-ray studies of the black widow pulsar PSR B1957+20	405
<i>R. H. H. Huang, A. K. H. Kong, J. Takata, C. Y. Hui, L. C. C. Lin, & K. S. Cheng</i>	
Neutron stars: history of the magnetic field decay	408
<i>A. P. Igoshev & A. F. Kholtygin</i>	
Population synthesis of young neutron stars	411
<i>A. P. Igoshev & A. F. Kholtygin</i>	
Testing the relationship between nulling, drifting and mode-changing	414
<i>B. C. Joshi</i>	

Distribution of ionized gas density measured by differential VLBI Observations of pulsars.	417
<i>O. Kameya</i>	
Gamma-ray emission from pulsar binaries	418
<i>J. Kirk & I. Mochol</i>	
TeV cosmic-ray electrons from millisecond pulsars	419
<i>S. Kisaka & N. Kawanaka</i>	
Infrared AKARI observations of magnetars 4U 0142+61 and 1E 2259+586.	422
<i>T. Kohmura, K. Kaneko, S. Ikeda, M. Morii, K. Asano, M. Shirahara, & N. Shibazaki</i>	
Magnetic field evolution in magnetars	425
<i>Y. Kojima</i>	
Recoil velocity of pulsar/magnetar induced by magnetic dipole and quadrupole radiation	428
<i>Y. Kojima</i>	
A pulsar census of the Local Group	431
<i>V. Kondratiev, D. Lorimer, M. McLaughlin, & S. Ransom</i>	
Tracking dispersion measure variations of timing array pulsars with the GMRT.	432
<i>U. Kumar, Y. Gupta, W. van Straten, S. Ostrowski, J. Roy, N. D. R. Bhat, M. Bailes, & M. J. Keith</i>	
<i>H</i> -cluster stars	435
<i>X. Y. Lai & R. X. Xu</i>	
A data analysis library for gravitational wave detection.	438
<i>A. Lassus, R. van Haasteren, C. M. F. Mingarelli, K. J. Lee, & A. Vecchio</i>	
Modelling X-ray Pulse Profiles of Millisecond Pulsars	441
<i>D. A. Leahy, S. Morsink, & W. Tian</i>	
Broadband spectral investigations of SGR J1550–5418 bursts.	444
<i>L. Lin & E. Göğüş</i>	
Profile stability and timing precision limit of millisecond pulsars	447
<i>K. Liu</i>	
The missing compact star of SN1987A: a solid quark star?	448
<i>X. W. Liu, J. D. Liang, R. X. Xu, J. L. Han, & G. J. Qiao</i>	
Relativistic Cowling approximation for fluid oscillation modes of color superconducting self-bound stars.	451
<i>G. Lugones & C. V. Flores</i>	
New observations of the Geminga pulsar at low radio frequencies.	452
<i>V. M. Malofeev, O. I. Malov, S. V. Logvinenko, & D. A. Tepliykh</i>	
Do magnetars really exist?	455
<i>I. F. Malov</i>	
Revisiting quark stars under the influence of strong magnetic fields.	458
<i>D. Menezes</i>	

The slow X-ray pulsar SXP 1062 and associated supernova remnant in the Wing of the Small Magellanic Cloud	459
<i>L. M. Oskinova, M. A. Guerrero, V. Hénault-Brunet, W. Sun, Y.-H. Chu, C. Evans, J. S. Gallagher, III, R. A. Gruendl, & J. Reyes-Iturbide</i>	
Seven pulsars in binary systems above the spin-up line	462
<i>Y. Y. Pan & N. Wang</i>	
Magnetic Color-flavor-locked Stars	465
<i>L. Paulucci, E. J. Ferrer, V. de la Incera, & J. E. Horvath</i>	
Ultra-compact X-ray binaries with high luminosity: a key for a new scenario . . .	468
<i>K. Pavlovskii & N. Ivanova</i>	
Global structure of the pulsar force-free magnetosphere revisited	471
<i>S. Petrova</i>	
AXPs & SGRs: Magnetar or Quarctar?	474
<i>G. Qiao, X. Liu, R. Xu, Y. Du, J. Han, H. Tong, & H. Wang</i>	
Searches for continuous gravitational waves with the LIGO and Virgo detector .	477
<i>K. Riles, for the LIGO Scientific Collaboration and Virgo Collaboration</i>	
On the environments and progenitors of supernova remnants associated with highly magnetized neutron stars	480
<i>S. Safi-Harb & H. S. Kumar</i>	
A high-energy catalogue of Galactic supernova remnants and pulsar wind nebulae	483
<i>S. Safi-Harb, G. Ferrand, & H. Matheson</i>	
The new magnetar Swift J1822.3–1606	486
<i>P. Scholz, C.-Y. Ng, M. A. Livingstone, V. M. Kaspi, A. Cumming, & R. Archibald</i>	
X-ray properties of G308.3-1.4 and its central compact object	489
<i>K. A. Seo, C. Y. Hui, R. H. H. Huang, L. Trepl, T.-N. Lu, A. K. H. Kong, & F. M. Walter</i>	
Observations of transients and pulsars with LOFAR international stations and the ARTEMIS backend	492
<i>M. Serylak, A. Karastergiou, C. Williams, W. Armour, M. Giles, & the LOFAR Pulsar Working Group</i>	
Evidence for nonlinear and chaotic behaviour in pulsar spin-down rates	495
<i>A. Seymour & D. Lorimer</i>	
New Constraints on Preferred Frame Effects from Binary Pulsars	496
<i>L. Shao, N. Wex, & M. Kramer</i>	
Formation of Binary and Millisecond Pulsars: Puzzles and Possible Solutions . . .	499
<i>Y. Shao & X.-D. Li</i>	
Detection of Giant pulses from pulsar PSR B0950+08	502
<i>T. V. Smirnova</i>	
Electric current diagnostics in the magnetosphere of neutron stars	505
<i>A. V. Stepanov & V. V. Zaitsev</i>	

Discovery of an intermittent pulsar: PSR J1839+15	508
<i>M. P. Surnis, B. C. Joshi, M. A. McLaughlin, & V. Gajjar</i>	
Model of radio emission from spherically symmetric pulsar wind nebulae	511
<i>S. J. Tanaka</i>	
Near IR Astrometry of Magnetars	514
<i>S. P. Tendulkar</i>	
The spectral energy distributions of isolated neutron stars in the resonant cyclotron scattering model	517
<i>H. Tong & R. Xu</i>	
Is magnetar a fact or fiction to us?	518
<i>H. Tong & R. X. Xu</i>	
What can Fermi tell us about magnetars?	521
<i>H. Tong & R. X. Xu</i>	
Restrictions to neutron star models based on twin-peak quasi-periodic oscillations	524
<i>G. Török, M. Urbanec, K. Goluchová, P. Bakala, E. Šrámková, & Z. Stuchlík</i>	
Origin of the pulsar pulse fine structure.	527
<i>O. M. Ulyanov, A. A. Seredkina, & A. I. Shevtsova</i>	
Polarization sounding of the pulsar magnetosphere	530
<i>O. M. Ulyanov, A. I. Shevtsova, & A. A. Seredkina</i>	
On the glitch evolution of pulsars.	533
<i>J. O. Urama, B. C. Joshi, & A. E. Chukwude</i>	
Quadrupole moments of rotating compact stars	536
<i>M. Urbanec, J. Miller, & Z. Stuchlík</i>	
Particle simulation for an axisymmetric pulsar magnetosphere	537
<i>T. Wada</i>	
Wave propagation in pulsar magnetospheres	540
<i>C. Wang, D. Lai, & J. Han</i>	
Search for the gravitational wave memory effect with the Parkes Pulsar Timing Array	543
<i>J. Wang, G. Hobbs, & N. Wang</i>	
The distance indicators in gamma-ray pulsars.	546
<i>W. Wang</i>	
On the mode switching timescales of pulsar PSR B0329+54	549
<i>H.-G. Wang, J.-L. Chen, Z.-G. Wen, & F.-P. Pi</i>	
Curvature radiation in rotating pulsar magnetosphere	552
<i>P. F. Wang, C. Wang, & J. L. Han</i>	
Pulsed γ -ray emission from magnetar 1E 2259+586	555
<i>J. H. K. Wu, C. Y. Hui, R. H. H. Huang, A. K. H. Kong, K. S. Cheng, J. Takata, P. H. T. Tam, E. M. H. Wu, & C.-Y. Liu</i>	

Constraints on the standard model extension with binary pulsars	558
<i>Y. Xie</i>	
Modeling pulsar time noise with long term decay modulated by short term oscillations of the magnetic fields of neutron stars	561
<i>Y. Xie & S. Zhang</i>	
VLBI astrometry of two millisecond pulsars	562
<i>Z. Yan, Z.-Q. Shen, J.-P. Yuan, N. Wang, H. Rottmann, & W. Alef</i>	
On the origin of the low-frequency QPO in GRS 1915+105 ρ state	565
<i>S.-P. Yan, N. Wang, & G.-Q. Ding</i>	
Rotation Measure variations for millisecond pulsars	568
<i>W. Yan, R. N. Manchester, & N. Wang</i>	
Glitches detected in southern radio pulsars	571
<i>M. Yu</i>	
Pulsar timing with the DFB at Nanshan	574
<i>J. P. Yuan, N. Wang, Z. Y. Liu, & J. B. Wang</i>	
FAST low frequency pulsar survey	577
<i>Y. Yue, D. Li, & R. Nan</i>	
Changes in Polarization Position Angle across the Eclipse in the Double Pulsar System.	580
<i>R. Yuen, R. N. Manchester, M. Burgay, F. Camilo, M. Kramer, D. B. Melrose, & I. H. Stairs</i>	
Questions on accreting mass and minimum magnetic field of millisecond pulsars	583
<i>C. M. Zhang</i>	
Mutual influence of magnetic field decay and thermal evolution of rotational neutron stars	586
<i>X. Zhou, M. Kang, & N. Wang</i>	
Author index	589

Preface

The neutron hit the paraffin wax. It had been cast out when the alpha particle and beryllium nucleus had merged. In the wax, the neutron smashed out a proton. It traveled through the round bubble chamber, its mark captured on photographic plate. It's 1932, and the neutron is discovered.

A massive star exploded, and left a round supernova remnant. The neutron star was smashed out from the center of the crash. It spins and sends a beam of radio emission racing through the galaxy, to the telescope, arriving in 2012.

These two images, so visually similar as the front cover makes clear, mark the begin and current state of 80 years of neutron star research. That status, those newest results in neutron-star and pulsar studies, were presented at the IAUS291, Beijing, August 2012.

Several of the outstanding presentations in this volume are clearly linked to previous highlights in the lifetime of this octogenarian field. Chamel uses the sudden spin changes seen in some radio pulsars to constrain how the neutrons inside the star behave – 80 years after the initial idea by Landau that such stars might exist. And while Baade and Zwicky proposed in 1934 that neutron stars form in supernovae, Sumiyoshi now presents our, partial, understanding of the mechanism driving these explosions. The new LOFAR discoveries presented by Kondratiev, and by Coenen, were made using a telescope operating at the same frequencies, and build as a similar array of dipoles, as the original Cambridge array with which Hewish and Bell found the first radio pulsar in 1967. Backer, much missed, found the first, isolated millisecond pulsar in 1982 – a discovery that echoed in Roberts' review on the now numerous detections of black-widow millisecond pulsars.

Other results, however, are exceedingly novel. Saz Parkinson presented tens of gamma-ray pulsars that were blindly detected with Fermi-LAT, uncovering a new population that is nearby and energetic, and often radio-quiet. An entire session, headed off by Hobbs, showcased the potential for gravity-wave pulsar astronomy. In several talks the intriguing new-found relations between spin-down and profile evolution were discussed. Burke-Spolaor, and Karako, explained how some radio pulsars only emit sporadically.

On August 24, 2012, 17:12 Beijing time, this IAU Symposium 291 came to a close. Yet, the talks and posters remain, in several complementary forms: as both slides and video online†, and as proceedings in the volume before you.

Joeri van Leeuwen
21 November, 2012

† <http://www.pulsarastronomy.net/IAUS291>

SCIENTIFIC ORGANISING COMMITTEE**Co-chairs:**

Dick Manchester (Australia) Renxin Xu (China)

Members:

Sarah Buchner	(South Africa)	Yashwant Gupta	(India)
Jinlin Han	(China)	Rick Jenet	(USA)
Vicky Kaspi	(Canada)	Michael Kramer	(Germany)
Maura McLaughlin	(USA)	Andreas Reisenegger	(Chile)
Roger Romani	(USA)	Shinpei Shibata	(Japan)
Marten van Kerkwijk	(Canada)	Joeri van Leeuwen	(The Netherlands)
Nina Wang	(China)	Silvia Zane	(UK)

Welcome

The title of IAU Symposium 291 “Neutron Stars and Pulsars: Challenges and Opportunities after 80 Years” encapsulates the spirit of this Symposium: the 80 years since the idea of neutron stars was born and, in particular, the 45 years since pulsars were discovered have provided us with a rich harvest of scientific discovery, but many exciting avenues for future research remain. The Symposium, held in the huge Chinese National Convention Center adjacent to Beijing’s Olympic Park as part of the 28th General Assembly of the International Astronomical Union, was very successful with more than 160 talks and posters presented over the five days and 14 sessions of the meeting. We are pleased that most of these presentations are represented in these Proceedings.

The sessions covered current searches for pulsars, both radio and gamma-ray, neutron-star formation and properties, binary pulsars, pulsar timing and tests of gravitational theories, magnetars, radio transients, radio, X-ray and gamma-ray pulse properties and emission mechanisms, and future facilities. This range of topics illustrates the diverse nature and wide application of pulsar research. Exciting new results were presented in all sessions and it is impossible to list them all. However, I would like to mention the three plenary talks, presented by Scott Ransom, Nanda Ray and Michael Kramer, which were outstanding and given to a standing-room-only audience despite the early hour. As the corresponding articles in this Proceedings show, they managed to successfully communicate the excitement of current pulsar research. I had many comments afterward, mostly from “non-pulsar” people, about how fascinating these talks were. I would also like to give special mention to Jocelyn Bell-Burnell’s highly original closing remarks. We are grateful to her for allowing us to include them in this Proceedings.

Finally, I would like to give my thanks to the IAU and the GA Local Organising Committee for a well-run and successful meeting, to the Scientific Organising Committee for Symposium 291 for their assistance with putting together an excellent scientific programme, to all the presenters for realising the potential of the programme and to the Editor of the Proceedings, Joeri van Leeuwen, for all the hard work required to bring this volume to fruition. I hope and expect that it will be a valuable reference work for both current and future students and researchers in astronomy and astrophysics.

R. N. (Dick) Manchester

16 November, 2012