

THE IAU HISTORIC RADIO ASTRONOMY WORKING GROUP. 3: PROGRESS REPORT (2006-2009)

This Progress Report follows the publication of two earlier Progress Reports (Orchiston, et al., 2004; 2005) and a Triennial Report of the Working Group for 2003-2006 (Orchiston, et al., 2006), all of which appeared in the *Journal of Astronomical History and Heritage*.

1 Role of the Working Group

This WG was formed at the 2003 General Assembly of the IAU as a joint initiative of Commissions 40 (Radio Astronomy) and 41 (History of Astronomy), in order to:

- assemble a master list of surviving historically-significant radio telescopes and associated instrumentation found worldwide;
- document the technical specifications and scientific achievements of these instruments;
- maintain an on-going bibliography of publications on the history of radio astronomy; and
- monitor other developments relating to the history of radio astronomy (including the deaths of pioneering radio astronomers).

The membership list of the WG contains the names of about one hundred astronomers who are active in the history of radio astronomy field or sympathetic to it.

2 National Masterlists of Surviving Historically-Significant Radio Telescopes

WG members actively worked on national master lists for Australia, France, Germany, India, the Netherlands, the United Kingdom and the USA, and a number of research papers were prepared documenting individual instruments or instruments and research associated with specific radio astronomy field stations.

3 The Destruction of Historically-Significant Radio Telescopes

Despite intensive lobbying by members of the WG and others, Stanford University proceeded to demolish the five 60-ft antennas at their field station off Highway 280 (California). However, the concrete pillars were spared that contain the engraved names of well-known optical astronomers and radio astronomers.

4 The WG Project on Early French Radio Astronomy

Immediately following the 2006 Prague IAU General Assembly the Chairman of the WG went to Paris to launch a collaborative project aimed at documenting, in English, the main developments in French radio astronomy that occurred up to and including 1961. Since this initial visit, four further research visits have been made to Paris Observatory, and the following colleagues have participated in the collaboration: Jacques Arsac, Émile-Jacques Blum, André Boisshot, Suzanne Débarbat, Jean Delannoy, Mukul Kundu, James Lequeux, Monique Pick and Jean-Louis Steinberg. To date, four research papers have been published (Debarbat et al, 2007; Orchiston and Steinberg, 2007; Orchiston et al., 2007; and Orchiston

et al., 2009—see details, the listing in Section 6, below). Two further papers, completing this series, will be published in March 2010.

5 Research on the History of Radio Astronomy

Colleagues who actively researched aspects of radio astronomical history during 2005-2009 included: *the late Émile-Jacques Blum* (France), *André Boisshot* (France), *the late Ron Bracewell* (USA), *Wim Brouw* (The Netherlands), *Geoffrey Burbidge* (USA), *Bernard Burke* (USA), *Ron Burman* (Australia), *Jessica Chapman* (Australia), *Marshall Cohen* (USA), *Nan Dieter Conklin* (USA), *R.D. Dagkesamanskii* (Russia), *Rod Davies* (United Kingdom), *Suzanne Débarbat* (France), *Jean Delannoy* (France), *John Dickel* (USA), *Martin George* (Australia), *Miller Goss* (USA), *Dave Green* (United Kingdom), *Alastair Gunn* (United Kingdom), *Dave Jauncey* (Australia), *Ken Kellermann* (USA), *A.A. Konovalenko* (Ukraine), *Mukul Kundu* (USA), *the late Arcady Kuzmin* (Russia), *James Lequeux* (France), *Bruce McAdam* (Australia), *Dick McGee* (Australia), *Don Mathewson* (Australia), *Leon Matveenko* (Russia), *A.V. Megn* (Ukraine), *Doug Milne* (Australia), *Wayne Orchiston* (Australia), *Yuri Parijskij* (Russia), *Monique Pick* (France), *V. Radhakrishnan* (India), *Peter Robertson* (Australia), *Bruce Slee* (Australia), *F. Graham Smith* (UK), *Peter Stark* (USA), *Jean-Louis Steinberg* (France), *Ronald Stewart* (Australia), *Richard Strom* (The Netherlands), *Woody Sullivan III* (USA), *Govind Swarup* (India), *Dick Thompson* (USA), *I.B. Vavilova* (Ukraine), *the late Edward Waluska* (USA), *Wang Shouguan* (China), *Harry Wendt* (Australia), *John Whiteoak* (Australia), *Richard Wielebinski* (Germany) and *Hugo Van Woerden* (The Netherlands).

6 Further Publications on the History of Radio Astronomy

Since the last list was published (Orchiston et al., 2005) we have noted the following books and papers about the history of radio astronomy or that contain a significant historical component:

- Bignall, H.E., de Bruyn, A.G., and Jauncey, D.L., 2005. The variable extragalactic radio universe. In Gurvits, et al., 157-176.
- Booth, R.S., 2005. Galactic masers. In Gurvits, et al., 297-316.
- Bracewell, R., 2005. Radio astronomy at Stanford. *Journal of Astronomical History and Heritage*, 8, 75-86.
- Burbidge, G., 2007. Attempts by a theorist to work with Martin Ryle in the Cavendish, 1953-1955. *Astronomische Nachrichten*, 328, 432-433.
- Burke, B.F., 2005. Early years of radio astronomy in the U.S. In Gurvits, et al., 27-56.
- Conklin, N.D., 2006. *Two Paths to Heaven's Gate*. Green Bank, National Radio Astronomy Observatory.
- Cohen, M.H., 2007. A history of OVRO: Part II. *California Institute of Technology Engineering and Science*, LXX(3), 33-43.
- Cohen, M.H., 2009. Genesis of the 1000-foot Arecibo Dish. *Journal of Astronomical History and Heritage*, 12(2), 141-152.
- Dagkesamanskii, R.D., 2007. The Pushchino Radio Observatory: origin and first decade's history. *Astronomische*

- Nachrichten*, 328, 395-404.
- Davies, R.D., 2005. A history of the Potts Hill radio astronomy field station. *Journal of Astronomical History and Heritage*, 8, 87-96.
- Davies, R.D., 2007. The search for the elusive Zeeman effect in HI. *Astronomische Nachrichten*, 328, 436-442.
- Davies, R.D., 2009. Recollections of two and a half years with 'Chris' Christiansen. *Journal of Astronomical History and Heritage*, 12, 4-10.
- Débarbat, S., Lequeux, J., and Orchiston, W., 2007. Highlighting the history of French radio astronomy. 1: Nordmann's attempt to observe solar radio emission in 1901. *Journal of Astronomical History and Heritage*, 10, 3-10.
- Dickel, J.R., 2006a. What are supernovae and supernova remnants? In Chen, K.-Y., Orchiston, W., Soonthornthum, B., and Strom, R. (eds.). *Proceedings of the Fifth International Conference on Oriental Astronomy*. Chiang Mai, Chiang Mai University. Pp. 37-42.
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- Gayland, M.J., and Nicolson, G.D., 2007. Forty years of radio astronomy at Hartebeesthoek. *African Skies*, 11, 49-52.
- Goss, M., and McGee, R.F., 2009. *Under the Radar – The First Woman in Radio Astronomy: Ruby Payne-Scott*. Springer.
- Graham-Smith, F., 2005. The early history of radio astronomy in Europe. In Gurvits, et al., 1-13.
- Gunn, A.G., 2005. Jodrell Bank and the pursuit of cosmic rays. In Gurvits, et al., 15-26.
- Gurvits, L.I., Frey, S., and Rawlings, S., 2005. *JENAM 2003. Radio Astronomy from Karl Jansky to Microjansky*. PA deCourtaboeuf, EDP Sciences.
- Hirabayashi, H., 2005. Next generation space VLBI. In Gurvits, et al., 465-478.
- Kassim, N.E., Perez, M.R., Junor, W., and Henning, P.A., 2005. *From Clark Lake to the Long Wavelength Array: Bill Erickson's Radio Science*. San Francisco, Astronomical Society of the Pacific (ASP Conference Series, Volume 345).
- Konovalenko, A.A., and Stepkin, S.V., 2005. Radio recombination lines. In Gurvits, et al., 271-295.
- Kuzmin, A.D., 2007. Detection of the polarized radio emission from the Crab Nebula. *Astronomische Nachrichten*, 328, 434-435.
- Lockman, F.J., Ghigo, F.D., and Balsler, D.S., 2007. *But it was Fun. The First Forty Years of Radio Astronomy at Green Bank*. Green Bank, National Radio Astronomy Observatory.
- McAdam, B., 2008. Molonglo Observatory: building the Cross and MOST. *Journal of Astronomical History and Heritage*, 11, 63-70.
- Matveenko, L.I., 2007. Early VLBI in the USSR. *Astronomische Nachrichten*, 328, 411-419.
- Milne, D.K., and Whiteoak, J.B., 2005. The impact of F.F. Gardner on our early research with the Parkes Radio Telescope. *Journal of Astronomical History and Heritage*, 8, 33-38.
- Orchiston, W., 2005. Sixty years in radio astronomy: a tribute to Bruce Slee. *Journal of Astronomical History and Heritage*, 8, 3-10.
- Orchiston, W., and Mathewson, D.S., 2009. Chris Christiansen and the Chris Cross. *Journal of Astronomical History and Heritage*, 12, 11-32.
- Orchiston, W., and Slee, B., 2006. Early Australian observations of historic supernova remnants at radio wavelengths. In Chen, K.-Y., Orchiston, W., Soonthornthum, B., and Strom, R. (eds.). *Proceedings of the Fifth International Conference on Oriental Astronomy*. Chiang Mai, Chiang Mai University. Pp. 43-56.
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- Orchiston, W., Steinberg, J.-L., Kundu, M., Arsac, J., Blum, É.-J., and Boischot, A., 2009. Highlighting the history of French radio astronomy. 4: Early solar research at the École Normale Supérieure, Marcoussis and Nançay. *Journal of Astronomical History and Heritage*, 12, 175-188.
- Orchiston, W., Bracewell, R., Davies, R., Denisse, J.-F., Goss, M., Gunn, A., Kellermann, K., McGee, D., Morimoto, M., Slee, B., Slysh, S., Strom, R., Sullivan, W., Swarup, G., Van Woerden, H., Wall, J., and Wielebinski, R., 2005. The IAU Historic Radio Astronomy Working Group. 2: Progress Report. *Journal of Astronomical History and Heritage*, 8, 65-69.
- Parijskij, Y.N., 2007. The big Pulkovo Radio Telescope and Pulkovo radio astronomy. *Astronomische Nachrichten*, 328, 405-410.
- Radhakrishnan, V., 2006. Olof Rydbeck and early Swedish radio astronomy: a personal perspective. *Journal of Astronomical History and Heritage*, 9, 139-144.
- Roos, M., and de Kroon, P.-R., 2009. A 45 minute film titled "Spiral Galaxy – De Melkweg Ontrafeld" available on DVD (see: <http://www.spiralgalaxy.nl/>)
- Slee, B., 2005. Early Australian measurements of angular structure in discrete radio sources. *Journal of Astronomical History and Heritage*, 8, 97-106.
- Smith, F.G., 2007. Early Cambridge radio astronomy. *Astronomische Nachrichten*, 328, 426-431.
- Steinberg, J.-L., 2001. The scientific career of a team leader. *Planetary and Space Science*, 49, 511-522.
- Steinberg, J.-L., 2004a. Radioastronomie & interférométrie. *L'Astronomie*, 118, 622-625.
- Steinberg, J.-L., 2004b. La création de la Station de Nançay. *L'Astronomie*, 118, 626-631.
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- Waluska, E., 2007. Quasars and the Caltech-Carnegie connection. *Journal of Astronomical History and Heritage*, 10, 79-91.
- Wang Shouguan, 2009. Personal recollections of W.N. Christiansen and the early days of Chinese radio astronomy. *Journal of Astronomical History and Heritage*, 12, 33-38.
- Wendt, H., 2009. Radio astronomy at Murrumbidgee. *Journal of the Hornsby Shire Historical Society*, 7(8), 27-29.
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7 The Prague IAU General Assembly

At the August 2006 General Assembly of the IAU the WG Committee held a Business Meeting, a one-day Science Meeting devoted to “The History of European Radio Astronomy” and a half-day Science Meeting on “Radio Astronomy Fifty Years Ago: From Field Stations to ‘Big Science’”.

7.1 “The History of European Radio Astronomy”

This meeting was held on Thursday 17 August, during Sessions 1, 2 and 3, and included the presentation of the 2006 Grote Reber Medal to Bernie Mills. The following papers were presented:

- The Dwingeloo 25-meter Dish Celebrates its Golden Jubilee (Hugo van Woerden)
- Fifty Years of the Pushino Radio Astronomy Observatory (R.D. Dagkesamanskiy)
- Attempts by Theorists to Work with Martin Ryle in the Cavendish, 1954-1956 (G. Burbidge)
- Early VLBI in the USSR (Leonid Matveyenko)
- The Pulkovo (BRP 1956) Giant Radio Telescope (Yuri Parijskij)
- A.H. de Voogt, Radio Amateur, Engineer and Astronomy Pioneer (Richard Strom)

- Fifty Years of the Stockert 25-m Radio Telescope and What Came Afterwards (Richard Wielebinski)
- The Search for the Elusive Zeeman Effect (Rod Davies)

These papers were subsequently published in a special issue of *Astronomische Nachrichten*, edited by Richard Wielebinski, Ken Kellermann and Wayne Orchiston.

7.2 “Radio Astronomy Fifty Years Ago: From Field Stations to ‘Big Science’”

This meeting was held on Wednesday 23 August, during Sessions 3 and 4, and the following papers were presented:

- The Beginnings of the U.S. National Radio Astronomy Observatory (Ken Kellermann and E.N. Bouton)
- The 218-ft Jodrell Bank Transit Telescope and its Contribution to Radio Astronomy (Andrew Quinn, Alastair Gunn and Wayne Orchiston)
- A True Radio Astronomy Pioneer: Cornell H. Mayer (1921-2005) (V. Radhakrishnan)
- Solar Radio Astronomy at Fort Davis, Stanford and Kalyan, 1956-1966: Personal Reminiscences (Govind Swarup)
- The Contribution of the Ex-Georges Heights Experimental Radar Antenna to Australian Radio Astronomy” (Wayne Orchiston and Harry Wendt)
- The Development of Low Frequency Radio Astronomy in Tasmania (Martin George and Wayne Orchiston)

There were also two poster papers:

- The Contribution of the Potts Hill Field Station to International Radio Astronomy (Harry Wendt and Wayne Orchiston)
- Owens Valley Radio Observatory, QSOs and Palomar (Edward Waluska and Marshall Cohen)

8 ICOA-6 Conference

In 2008 the Sixth International Conference on Oriental Astronomy was held at James Cook University in Townsville, Australia, and the program included four sessions on the history of radio astronomy, where the following papers were presented:

- Quasi-Stellar Objects, The Owens Valley Radio Observatory, and the Changing Nature of the Caltech-Carnegie Nexus (Edward Waluska)
- The World’s First Radiospectrograph—Penrith 1949 (Ron Stewart, Harry Wendt, Wayne Orchiston and Bruce Slee)
- Cygnus A in Historical Perspective: Unravelling the Enigma of the first ‘Radio Star’ (Edward Waluska, Wayne Orchiston, Bruce Slee and Harry Wendt)
- The Contribution of the Division of Radiophysics Potts Hill and Murraybank Field Stations to International Radio Astronomy (Harry Wendt)
- A Retrospective View of Australian Solar Radio Astronomy—Part 1 (1945-1960) (Ron Stewart, Harry Wendt, Wayne Orchiston and Bruce Slee)
- From String and Sealing Wax to Serious Science: The First Ten Years of Australian H-line Research (1951-1961) (Harry Wendt, Wayne Orchiston and Bruce Slee)
- The Sun Sets on a Brilliant Mind: John Paul Wild (1923-2008), Solar Radio Astronomer Extraordin-

aire (Ron Stewart, Wayne Orchiston and Bruce Slee)

- The Contribution of W.N. Christiansen to Radio Astronomy: 1948-1960 (Harry Wendt, Wayne Orchiston and Bruce Slee)

Most of these papers will appear in the Proceedings, which will be published by Springer in 2010.

9 The Rio IAU General Assembly

At the August 2009 General Assembly of the IAU the WG Committee held a Business Meeting, a half-day Science Meeting devoted to “The Development of Aperture Synthesis Imaging in Radio Astronomy” and a quarter-day Science Meeting on “Recent Research”.

9.1 Business Meeting

At this meeting the new Committee listed at the end of this report was appointed. We particularly welcome new members, James Lequeux, Norio Kaifu and Yuri Ilyasov representing France, Japan and Russia respectively.

The Report of the WG included in the Division’s Triennial Report was summarised, and the program of work for the WG during the next triennium (2009-2012) was outlined and discussed. Apart from a continuation of the existing program, key new initiatives included the following studies:

- Christiansen & Dutch radio astronomy (Brouw & Casse)
- Arthur Covington & Goth Hill (Brotten & Wall)
- Culgoora Circular Array—non-solar work (Slee)
- Fleurs Synthesis Telescope (Goss)
- Ft. Davis Radio Astronomy field station (Thompson, Hughes, Maxwell & Swarup)
- Key developments in Japanese radio astronomy
- ‘Le Grand Radiotelescope’ at Nançay (Lequeux, Steinberg & Orchiston)
- Mills & the Mills Cross (Slee, Orchiston & Wendt)
- Radio astronomy at the University of Maryland (Kundu et al.)

9.2 “The Development of Aperture Synthesis Imaging in Radio Astronomy”

This meeting was held on Wednesday 5 August during Sessions 3 and 4, and included the presentation of the 2009 Grote Reber Medal to Barry Clark. The following papers were presented during this meeting:

- Aperture Synthesis 1946; a Proposal by Pawsey and Payne-Scott (Miller Goss)
- Why Synthesis Imaging Works in Radio Astronomy (V. Radhakrishnan)
- Early Developments in Australia (Bob Frater)
- Cambridge and Australia, Similarities and Differences (Ron Ekers)
- Synthesis Imaging from the Clark Clean Algorithm Onward (Tim Cornwall)
- The Impact of Computing to Synthesis Imaging (Barry Clark)

9.3 “Recent Research”

This meeting was also held on Wednesday 5 August, but during Session 2. The following papers were presented:

- The History of Radio Astronomical Studies of

Supernova Remnants (John Dickel)

- Highlighting the History of Australian Radio Astronomy: The CSIRO Division of Radiophysics Potts Hill Field Station, 1948-1962 (Harry Wendt, Wayne Orchiston and Bruce Slee)
- Science with the Molonglo Cross: Publications 1960-1984 (Bruce McAdam)
- Highlighting the History of Australian Radio Astronomy: The CSIRO Division of Radiophysics Dapto Field Station, 1952-1965 (Ron Stewart, Wayne Orchiston and Bruce Slee)

The following poster papers were also displayed during this meeting:

- Early Australian Optical and Radio Observations of Centaurus A (Peter Robertson, Bruce Slee and Wayne Orchiston)
- Highlighting the History of Australian Radio Astronomy: Grote Reber’s Low Frequency Research at Kempton, Tasmania, in 1956-1957 (Martin George, Wayne Orchiston and Bruce Slee)
- Highlighting the History of Australian Radio Astronomy: The CSIRO Division of Radiophysics Murraybank Field Station, 1956-1961 (Harry Wendt, Wayne Orchiston and Bruce Slee)
- Highlighting the History of Australian Radio Astronomy: The CSIRO Division of Radiophysics Penrith Field Station, 1948-1951 (Ron Stewart, Wayne Orchiston and Bruce Slee)

10 The End of an Era

With sadness WG members noted the passing of the following pioneering radio astronomers since the 2006 IAU General Assembly: Émile-Jacques Blum, Ron Bracewell, W.N. (‘Chris’) Christiansen, Fred Hadcock, Arcady Kuzmin, Slava Slysh, and J. Paul Wild.

11 Graduate Studies in the History of Radio Astronomy

A notable recent development has been the introduction of an off-campus part-time Ph.D. program in history of astronomy at James Cook University (JCU), Townsville, Australia. Since its inception in 2005, the following six students have researched aspects of early Australian and U.S. radio astronomy:

- Martin George (Australia) “The History of Low Frequency Radio Astronomy in Tasmania”
- Peter Robertson (Australia) “John Bolton and the Enigma of the ‘Radio Stars’”
- Peter Stark (USA) “Early Pulsar Research and the Roles of the Molonglo Radio Telescope, Parkes Radio Telescope and Culgoora Circular Array”
- Ron Stewart (Australia) “Contribution of the Division of Radiophysics Penrith and Dapto Field Stations to International Solar Radio Astronomy”
- Edward Waluska (USA) “Quasi-Stellar Objects, the Owens Valley Radio Telescope, and the Changing Nature of the Caltech-Carnegie Nexus”
- Harry Wendt (Australia) “Contribution of the Division of Radiophysics Potts Hill and Murraybank Field Stations to International Radio Astronomy”

Wayne Orchiston, Bruce Slee, Richard Strom and Richard Wielebinski are supervising these research projects; for this purpose, Slee, Strom and Wielebinski have all been appointed Adjunct Professors by James Cook University.

We are pleased to report that in 2008 Harry Wendt became the first of these students to complete his thesis, and in March 2009 was awarded a Ph.D. Edward Waluska also completed the first draft of his thesis in 2008 but sadly he died after a long battle with cancer before completing the necessary revisions. Wayne Orchiston and Richard Strom are looking at the possibility of making these revisions and submitting the thesis so that a posthumous Ph.D. can be awarded. In August 2009 Ron Stewart completed his thesis, and it is currently with the examiners.

In addition to the foregoing doctoral program, Alastair Gunn (Jodrell Bank) and Wayne Orchiston supervised the following Masters research project:

- Andrew Quinn (UK) “The 218-ft Jodrell Bank Transit Telescope and its Contribution to Radio Astronomy”

12 References

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Yuri Ilyasov (Russia)
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