Our new President

In the first of a series in which new RAS Councillors introduce themselves, the new President Nigel Weiss sums up his career.

I grew up in South Africa but have spent most of my life at Cambridge. After reading physics as an undergraduate I began research in the origin of the Earth’s magnetic field, under Teddy Bullard, but I soon decided that solar magnetism was more interesting. I spent a year at MIT and was a postdoc at Calham, developing computational magnetohydrodynamics. Then I returned to Cambridge to stay, apart from sabbaticals at CfA, Sacramento Peak, Munich and in Japan. In due course I became a Reader and Professor of Mathematical Astrophysics; for five years I was lucky enough to hold a SERC Senior Fellowship – but I paid the penalty by spending the next six years as Chairman of the School of Physical Sciences, sitting on far too many university committees. After that, being President of the RAS is not just an honour, but a pleasure.

The aim of my research is to explain the structure and origin of magnetic fields in the Sun and stars. Features ranging in size from sunspots to tiny flux concentrations owe their origin to the nonlinear interaction between magnetic fields and convection. Magnetohconvection is fascinating in its own right and has led me into other aspects of convection, nonlinear dynamics, bifurcation theory and chaos. These problems are intrinsically nonlinear and involve large-scale computation. Powerful computers have made it possible to relate numerical results to the latest high-resolution observations. I am also engaged in modelling stellar dynamos and explaining the origin of episodes of reduced activity such as the Maunder Minimum, as well as in exploring the relationship between solar activity and climatic change.

Radio astronomers at the World Radio Conference WRC-2000 in Istanbul in May succeeded in winning crucial protection for the mm-wave spectrum. As a result, radio astronomy is now officially allocated most of the usable frequencies between 71 and 275 GHz. WRCs are held every two or three years. They are where governments of the world agree on how the radio spectrum should be shared out. Of the 2500 delegates to the month-long meeting, only 16 were radio astronomers (7 from Europe).

Pressure on the radio spectrum is intense at some frequencies, such as those suitable for broadcasting, mobile phones and satellite communications. The main business of WRC-2000 was to re-plan satellite TV broadcasting, and find space for the new-generation mobile phone system IMT-2000 (International Mobile Telecommunications). Radio astronomy made its gains in the mm-wave region of the spectrum, where commercial exploitation has scarcely begun.

Radio astronomers have pioneered the mm-wave bands. The mm-wave spectrum is incredibly rich in molecular lines, so that the idea of protecting narrow frequency-bands centred on each important line is ridiculous: there are just too many important lines. Radio astronomers adopted the bold strategy of asking for large blocks of continuous spectrum. Crucial to the bargaining were the relatively small number of mm-wave observatories, and the fact that mm-wave propagation is more or less line-of-sight. Thus it is feasible to protect a few sensitive sites over a wide range of frequencies, while allowing other use of the frequencies elsewhere.

The radio astronomy strategy for WRC-2000 was coordinated internationally through IUCAF (a scientific committee of UNESCO, with members drawn from IAU, URSI and COSPAR), and in Europe through the European Science Foundation’s Committee on Radio Astronomy Frequencies (CRAF). CRAF’s planning began in Grenoble in 1995, when Dennis Downes of IRAM (Institute de Radio Astronomie Millimetrique) outlined the need to protect the entire mm-wave spectrum. Although this seemed impossible at the time, CRAF took the idea on board. We produced a report for IUCAF on protecting mm-wave astronomy which eventually led to coordinated radio astronomy inputs to the WRC-2000 from Europe, North America, and the Asian-Pacific countries. That plan was accepted virtually intact by WRC-2000.

Under the new allocations, radio astronomy now has primary allocations to most of the spectrum in the three atmospheric windows between 71 and 275 GHz. In return, radio astronomy gave up some of its hands in which no transmissions are allowed. If we simply count up the bandwidth, radio astronomy has lost 3.45 GHz of purely passive spectrum, but has gained 8.74 GHz of shared primary allocations, in which radio astronomy will be protected.

Radio astronomy has now also staked its claim to the sub-mm region. Our use of frequency bands up to 1000 GHz is now acknowledged in the Radio Regulations via footnote S5.365. Frequency allocations above 275 GHz are on the agenda for WRC-06.

In the immediate future, there is WRC-03, with over 40 agenda items, of which at least 7 concern radio astronomy at lower frequencies. The mills grind slowly in this business. From past experience, radio astronomers need to start working towards WRC-03 and WRC-06 right now.

Success for radio astronomy

Jim Cohen of Jodrell Bank Observatory, University of Manchester, brings good news from Istanbul for mm-wave radio astronomers.

Public understanding of science, naval style

The enthusiastic American “Sidewalk astronomers” who brave muggers, police and public incomprehension to present the wonders of the universe to passers-by have, perhaps, a longer pedigree than they realize, though exponents of earlier generations may have thought more of turning an honest penny than altruistic educational ends.

In this cartoon from Punch, of 5 September 1874, an old sailor, with the confident assurance of his kind, exhibits the bright Moon on some pier head to an interested audience. He blandly assures his listeners that the distance to our satellite is 24 million miles. A country excursionist, who is not actually called Hodge, but probably should be, asks how this vast distance is known and the sailor assures him it has been measured to “a hinch”.

Note on the right an Armstrong’s Patent capstan (everything worked by manual labour at sea is known as Armstrong’s Patent), probably for warping vessels into harbour, with holes for the capstan bars at the top and strips of wood on the decking to give purchase for the feet of those who tramped round it. The cartoon is from RAS ADD MS 90 (Jackson-Gwilt) page 71. P D Hingley, Librarian of the RAS.