*Aust. J. Phys.*, 1994, **47**, 535–9

# John Bolton—Some Early Memories*

*K. C. Westfold*

Trinity College, University of Melbourne,
Parkville, Vic. 3052, Australia.

*Abstract*

A review is given of a long collaborative association with J. G. Bolton and his colleagues, first in 1948 at the Dover Heights station of the CSIRO Division of Radiophysics, followed by joint visits to European astronomical institutions, and later in 1958 at the California Institute of Technology, to which Bolton had been appointed to institute a radio-astronomy program in the Department of Astrophysics.

My close association with John Bolton began in late 1948, after Steve Smerd and I had finished writing up our work on thermal radiation from the quiet Sun (Smerd and Westfold 1949). Because this work represented a substantial challenge to the theory contained in David Martyn's already published paper (Martyn 1948), which enjoyed the imprimatur of Joe Pawsey, John Jaeger (then a valued consultant to the Radiophysics Laboratory) thought there might be some advantage in having me in a more insulated position. John Bolton told me later that it had taken some persuasion to secure Pawsey's agreement to what appeared to me to be simply an invitation from John to work with him, Gordon Stanley, and Bruce Slee at Dover Heights.

So began our joint work in surveying the southern sky at 100 MHz with the Dover Heights Yagi array (Fig. 1). It was an eye-opening experience to me, a mere theorist, to see contours taking shape around the Galactic centre, delineating the Galactic plane in equatorial coordinates. John's knowledge of astronomy was impressive. He explained that, for background, he had read through the last 20 years or so of the *Astrophysical Journal* and *Monthly Notices of the Royal Astronomical Society*. He also had a good understanding of receiver techniques and could turn his hand easily to mechanical matters affecting the equipment. John, Gordon, and Bruce together constituted a self-contained, very effective team.

My chief contribution was to work out a numerical method of allowing for the smoothing effect of the 17° antenna beamwidth. We used a crude means to solve the integral equation relating the measured antenna temperature to the brightness temperature. This used a perspex grid, representing average beam weightings, and a printing calculator. It was a tedious business, which took months of observing and data reduction before we had a map of brightness temperature in Galactic coordinates over the region of the sky accessible to our latitude (see Fig. 2).

* Refereed paper based on a contribution to the John G. Bolton Memorial Symposium held at the Parkes Observatory, 9–10 December 1993.

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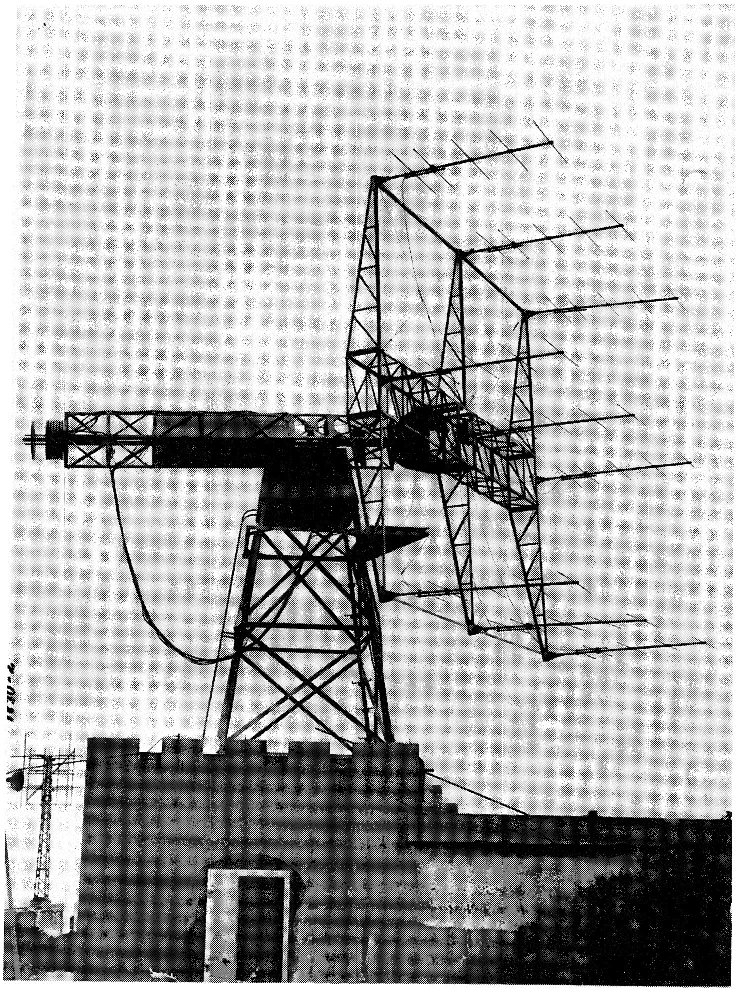

**Fig. 1.** The Dover Heights 100-MHz array.

Then began the process of interpreting our results. We concluded that the Sun lay in or near a leading spiral arm of our Galaxy, which was rotating in the sense of the spiral unwinding (Bolton and Westfold 1950*b*). In terms of Galactic structure, we assumed that the radiation originated in a distribution of radio stars (Bolton and Westfold 1951). At the same time, the group had produced a paper (Stanley and Slee 1950) on the discrete sources (later termed radio stars) observed at Dover Heights by sea-interferometric methods.

The paper on the distribution of radio stars was completed at Oxford, where John joined me, first to attend the URSI meeting at Zürich and then to visit observatories on the continent to discuss our work. On the Zürich trip we visited the Institut d'Astrophysique in Paris, and the Observatories of Leiden and Utrecht. On a second trip, accompanied by our wives, we visited the Institut für Astrophysik in Kiel, the Stockholm Observatory, the Institute for Theoretical

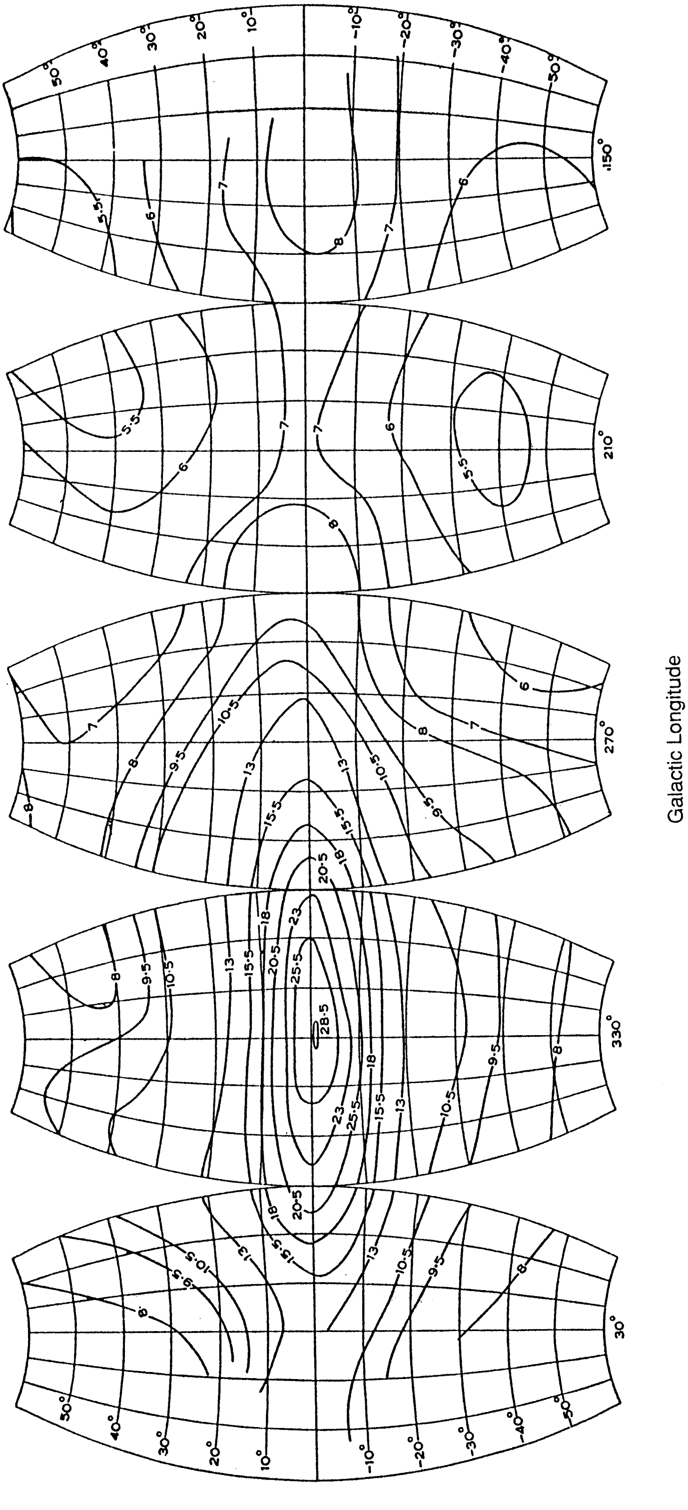


**Fig. 2.** The 100-MHz map of the blackbody temperature of the sky, obtained using the Dover Heights array (from Bolton and Westfold 1950*a*).

Astrophysics at Oslo, and the Chalmers Institute of Technology in Gothenburg. We chose those places because much of our understanding of astronomical matters had come from the writings of people in these institutions. We were gratified by the intense interest that was shown in our work, and the work of the Radiophysics Laboratory in general which, in many areas, seemed to be in advance of theirs. Indeed, we got the impression that the optical astronomers on the continent were taking radio astronomy rather more seriously than their counterparts in England and Australia.

After my return to Australia in 1951 I joined the University of Sydney, but retained my connection with John's group. I spent one day a week at Dover Heights working with the group, which now included Dick McGee. One of our activities involved surveying the ground and digging out sand to construct a paraboloidal dish of 80-ft (24-m) diameter. The objective was to carry out a survey of the region of the Galactic centre at 400 MHz but, since the project had not gained a high enough ranking in competition with projects from the other groups, John felt that he had to proceed independently. After laying pegs we stretched out strips of steel packing strip and erected a central tiltable mast to carry the dipole. Gordon and Bruce had already constructed a receiver, so it was not long before we had a map of the Galactic centre for John to wave in front of E. G. (Taffy) Bowen, chief of the Radiophysics Laboratory. The next thing I knew was that the paraboloid was being constructed in concrete (Fig. 3), incorporating a reflecting mesh, so that a clean map, which showed a strong

**Fig. 3.** The in-ground 80-ft paraboloidal dish at Dover Heights. The lone figure is Dick McGee.

source in the Galactic nucleus, could be made (McGee and Bolton 1954; McGee *et al.* 1955).

In 1955, on Bowen's recommendation, John was appointed a professor of physics and astronomy at the California Institute of Technology, with the task of inaugurating a program of radio astronomy in the Department of Astrophysics. He set up the Owens Valley Radio Observatory at Big Pine, near Bishop in Northern California; Gordon Stanley was appointed assistant director of the observatory. The first project, after gathering staff, was to build two 90-ft dishes with equatorial mounts, on rail lines, to use as a two-element interferometer.

I took study leave from the University of Sydney in 1958 and joined John at Caltech. As well as working in the group, I gave a course on radio astronomy to graduate students in the department, some of whom were also involved in developing equipment and working at the Owens Valley site. I found these students remarkable for their knowledge and intellectual capacity. One, Bob Wilson, subsequently won a Nobel Prize for his discovery of the 3 K background radiation. I repeated the course before returning to Sydney, having made copies of the lecture notes, which were then widely circulated in the astronomical community (Westfold 1958).

I was appointed to Monash University, Melbourne, in 1961. Not long afterwards, John returned to Australia to become the first director of the Parkes Radio Observatory, and went on to make contributions to optical astronomy as significant as those he had made to radio astronomy.

I remember John as a great, innovative and far-seeing scientist, with a unique capacity for overcoming obstacles. He could get more out of equipment than any designer envisaged; or else he would design his own. He has been an inspiration to many.

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Manuscript received 1 February, accepted 1 July 1994