

Passing the Baton

Notes on Ron's PhD Supervisor John Bolton

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Innovation & Discovery in Radio Astronomy

A Celebration of the Career of Ron Ekers

Queenstown, New Zealand, 13 – 16 September 2016

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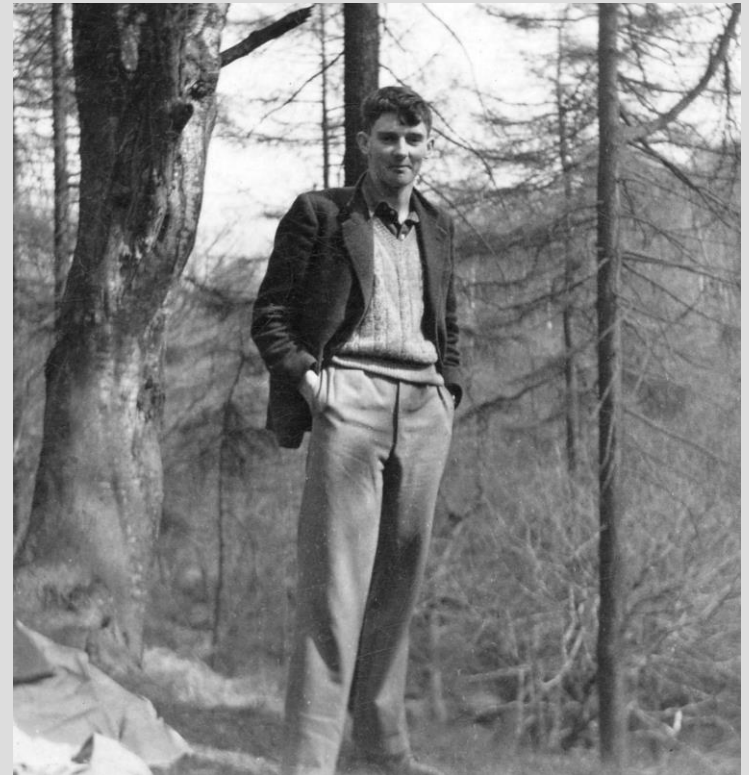
The Dishmaster 1961 – 81

Acknowledgments

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Special thanks to Ron for his support throughout this project

Thanks also the Astrophysics Group, School of Physics, University of Melbourne for its support

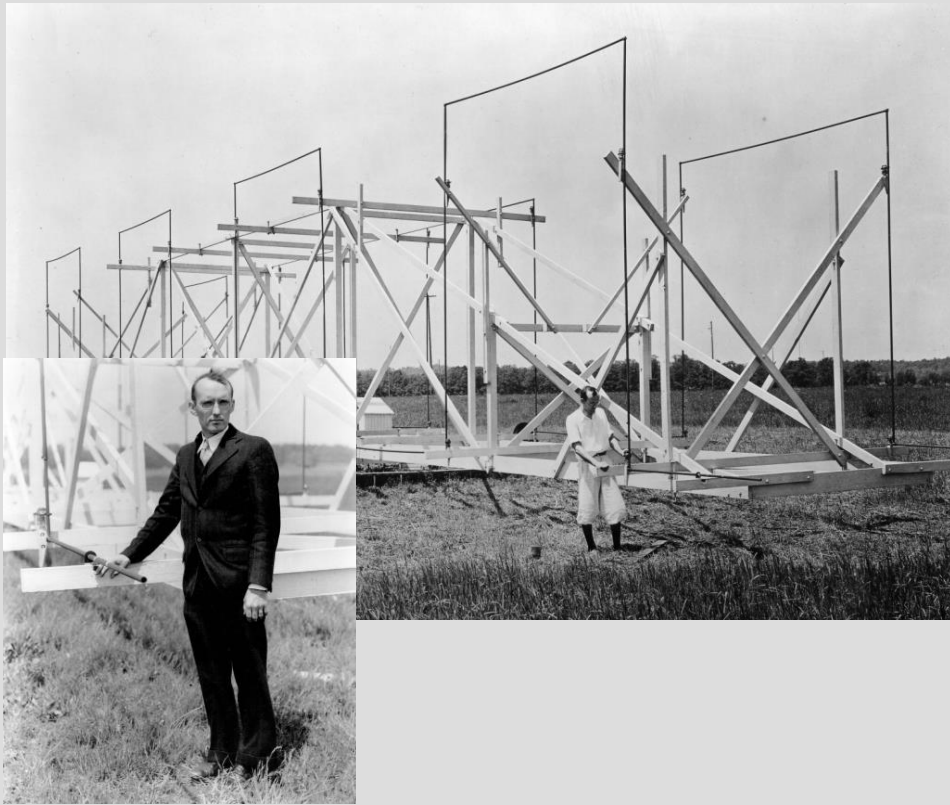
Most photos are courtesy of the Bolton family and the CSIRO Radio Astronomy Image Archive



- Born in 1922 in Sheffield. Both parents were teachers
- Educated at King Edward VI School in Sheffield and at Trinity College, Cambridge
- Bachelors degree (1940-42) compressed into two years because of wartime conditions



- Radar research and development in England and Scotland (1942–43)
- Radio officer on board the aircraft carrier HMS 'Unicorn' in the Pacific (1944–46)
- Joined the Radiophysics Lab in September 1946



Karl Jansky and the 'merry-go-round' aerial used to study sources of interference to trans-Atlantic radio communications

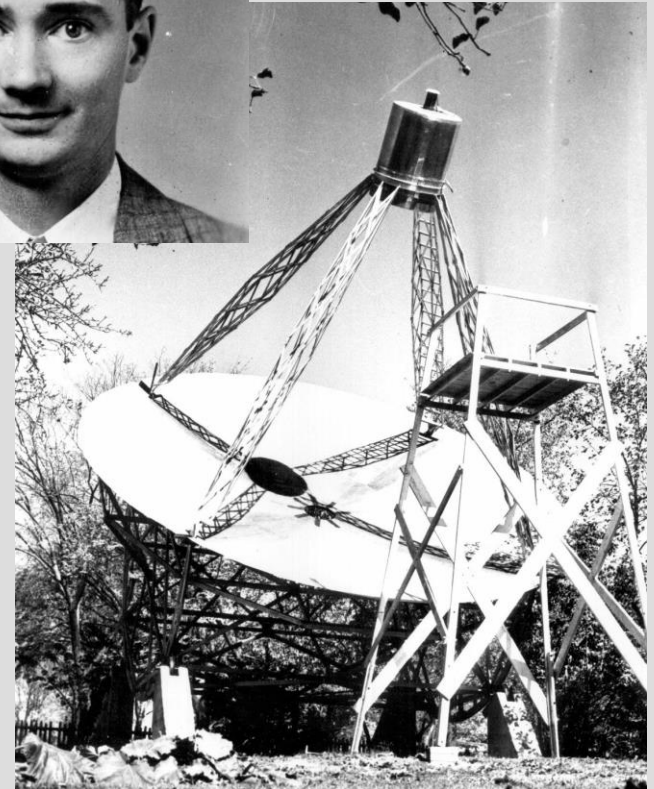
Discovery of radio waves from space at the Bell Telephone Labs, New Jersey, in 1932



Grote Reber follows up Jansky's discovery and builds his own radio telescope at his home in Wheaton, Illinois

Produces the first detailed sky maps of radio emission intensity in early 1940s

Radio emission thought to come from collisions between charged particles in interstellar space



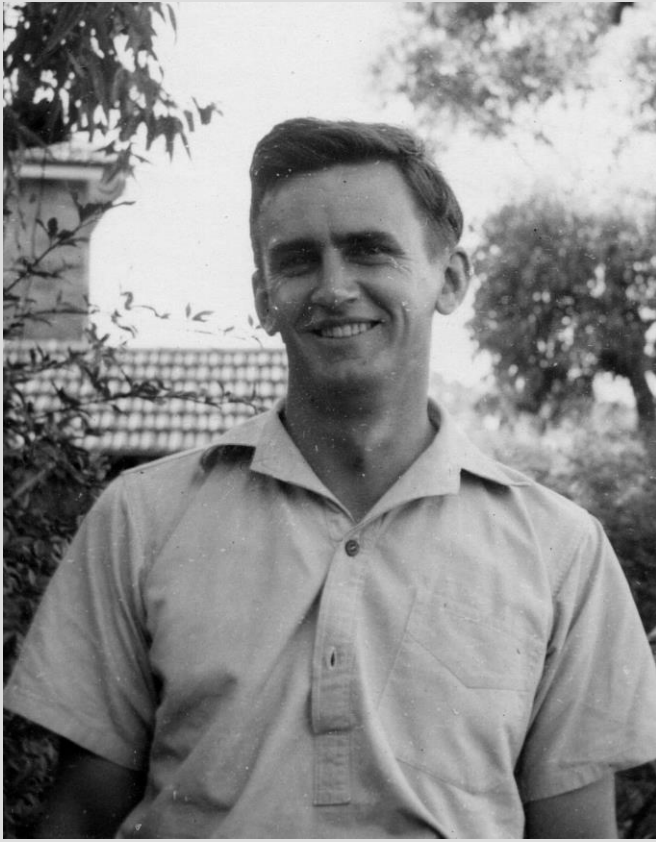
The Cliffs at Dover Heights 1946 – 54



Radio astronomy began in Australia at the Dover Heights field station, south of the entrance to Sydney Harbour

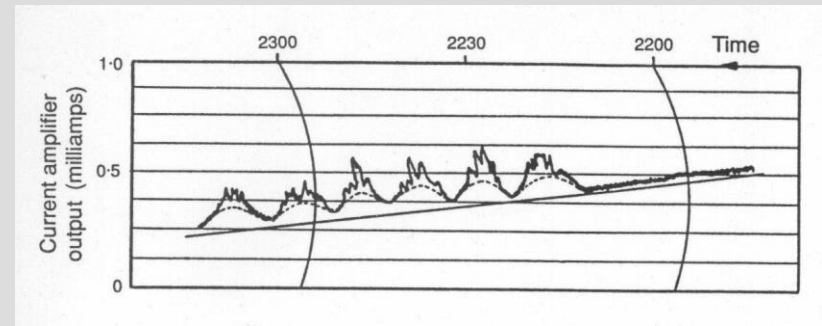
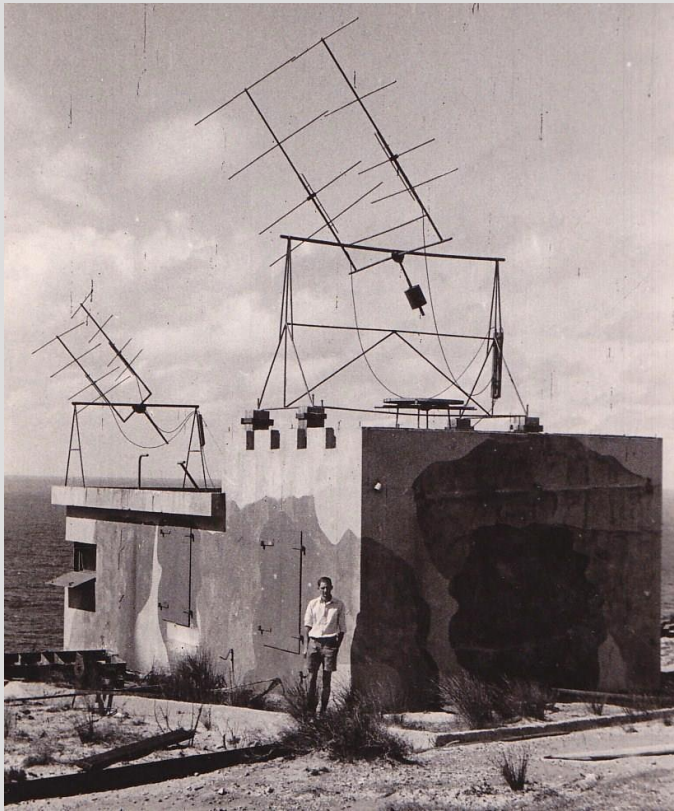
Field station operated by the Radiophysics Laboratory, part of the Council for Scientific and Industrial Research (later CSIRO)

First observations in 1945 were of radio emission from the Sun



Gordon Stanley was born in Cambridge, New Zealand. Joined the Radiophysics Laboratory in 1944. Specialised in radar receivers and electronics

Bruce Slee was born and raised in Adelaide. Wartime service as a radar operator near Darwin. Independently discovered radio emission from the Sun



Commonwealth of Australia
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
(Reprinted from NATURE, Vol. 161, page 312, February 28, 1948.)

Variable Source of Radio Frequency Radiation in the Constellation of Cygnus

Cosmic or galactic noise was discovered by Jansky¹ in 1931; but its exact origin has remained uncertain. It is generally supposed to originate from collisions in interstellar matter²; but there are divergencies between existing theory and experimental results, particularly at lower radio frequencies³. Hey, Parsons and Phillips⁴ discovered variations in the intensity of galactic noise from the direction of the constellation of Cygnus, with a period of about one minute—suggesting that this particular radiation has its origin in a discrete source.

During the past three months, we have made a

- In August 1946 Hey's group reported an intense source of radio emission in the Cygnus constellation. Rapid fluctuations suggest a compact source of emission
- Successful detection of Cygnus source at Dover Heights on 19 June 1947
- Source smaller than 8 minutes of arc, but no identifiable optical counterpart
- Five new sources discovered by end of 1947 and named after the constellation in which they were found

Piha on west coast



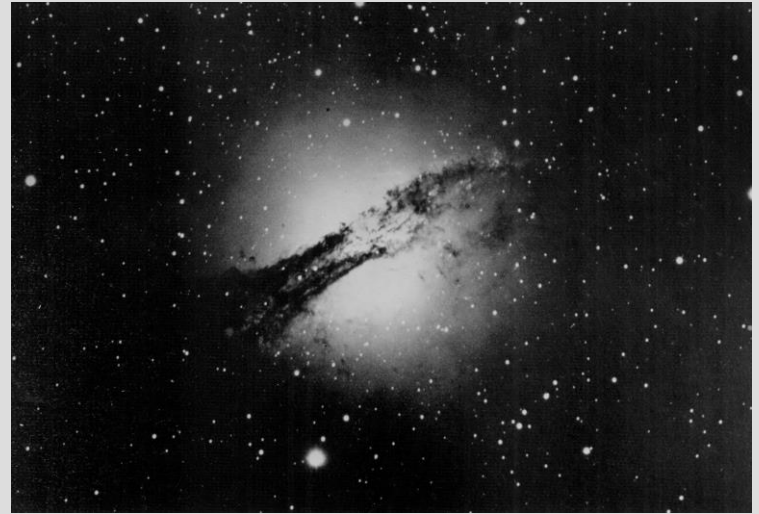
Pakiri Hill on east coast

- Mobile sea interferometer was constructed and shipped to Pakiri Hill, north of Auckland, in June 1948
- Observations made on the four strongest sources: Cygnus, Taurus, Centaurus, Virgo
- In August the sea interferometer towed to a former wartime radar station at Piha

Nature paper in July 1949 by Bolton,
Stanley and Slee:

“It is found that all three sources
correspond within limits of experimental
error to positions of certain nebulous
objects.”

The Eureka paper!



Centaurus A (NGC 5128)



Taurus A (the Crab Nebula)



Virgo A (M87)

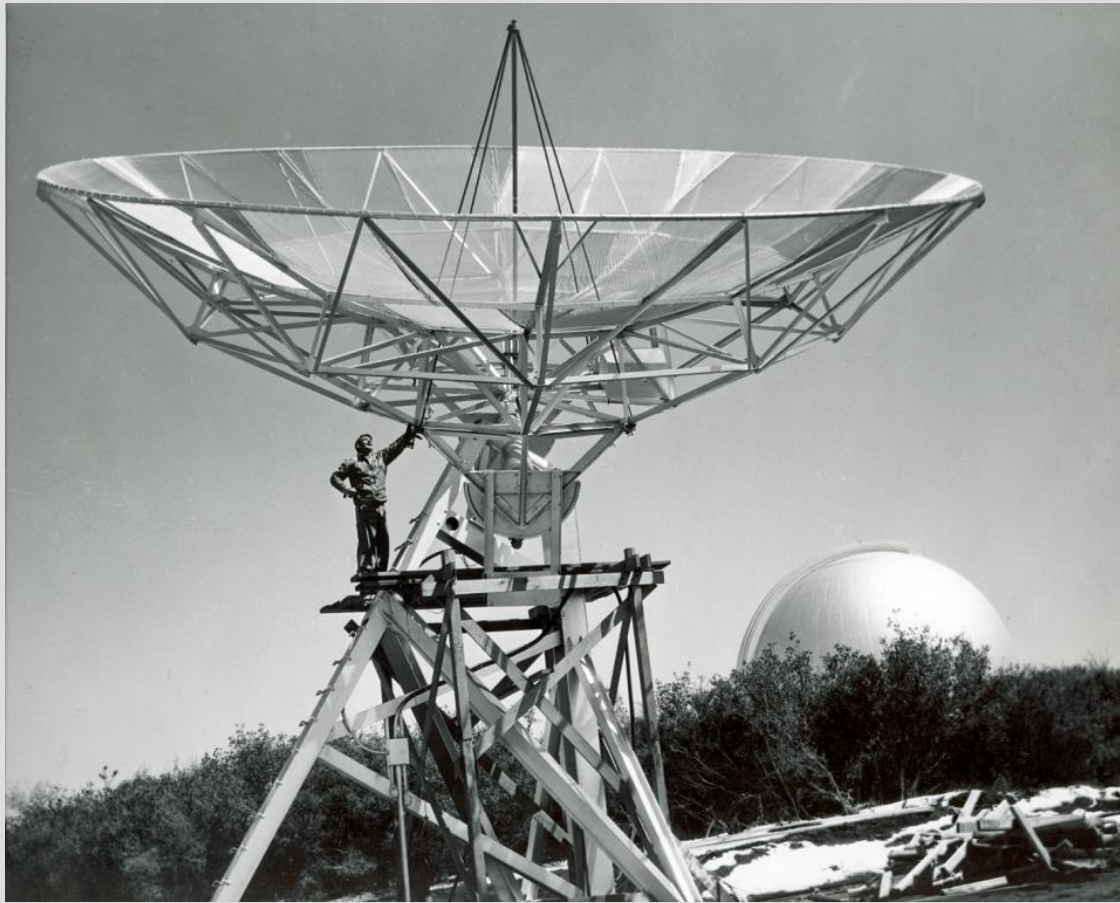


- Successful optical identifications led to larger and more sensitive aerials
- During 1950–54 over 100 new radio sources discovered at Dover Heights
- Sea interferometer overtaken by other techniques and field station closes in late 1954

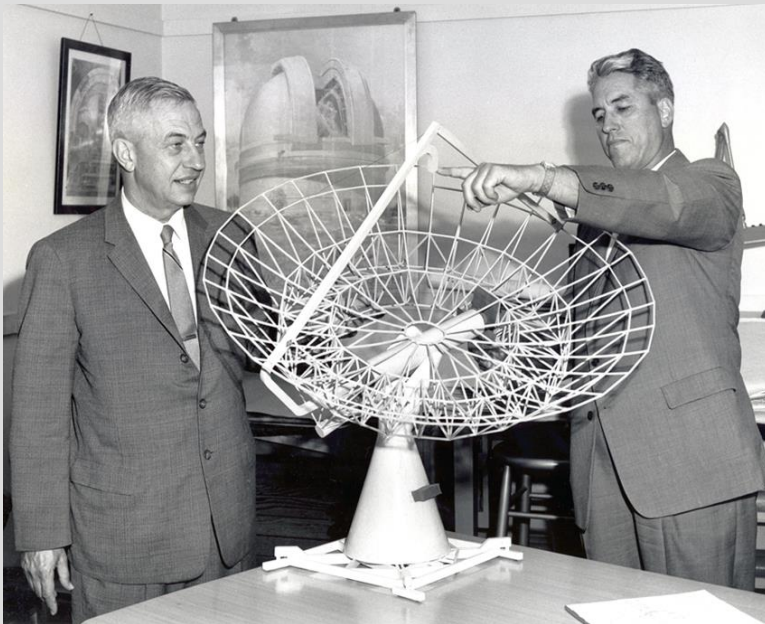
Caltech and Owens Valley 1955 – 60



John & Letty Bolton, Mieke Oort, Joe Pawsey at Mammoth Lakes April 1958



- Bolton and Stanley construct 32 ft dish on Palomar Mountain
- Primarily a test instrument but used for a sky survey at 21 cm
- Bolton-Stanley-Harris, *PASP* (1958) first radio astronomy paper produced from Caltech



- Gordon Stanley finds the Owens Valley site, 400 km north of Pasadena
- Exceptionally radio quiet
- Design of the twin-dish interferometer by Bruce Rule

Caltech president Lee DuBridge (left) with Bruce Rule



Bruce Rule (left), Bolton and Grote Reber

- Earthworks began on site in July 1956
- Contract awarded to engineering firm in Phoenix, Arizona
- On-site assembly of components began in July 1958
- Interferometer funded by the US Office of Naval Research



Jim Roberts



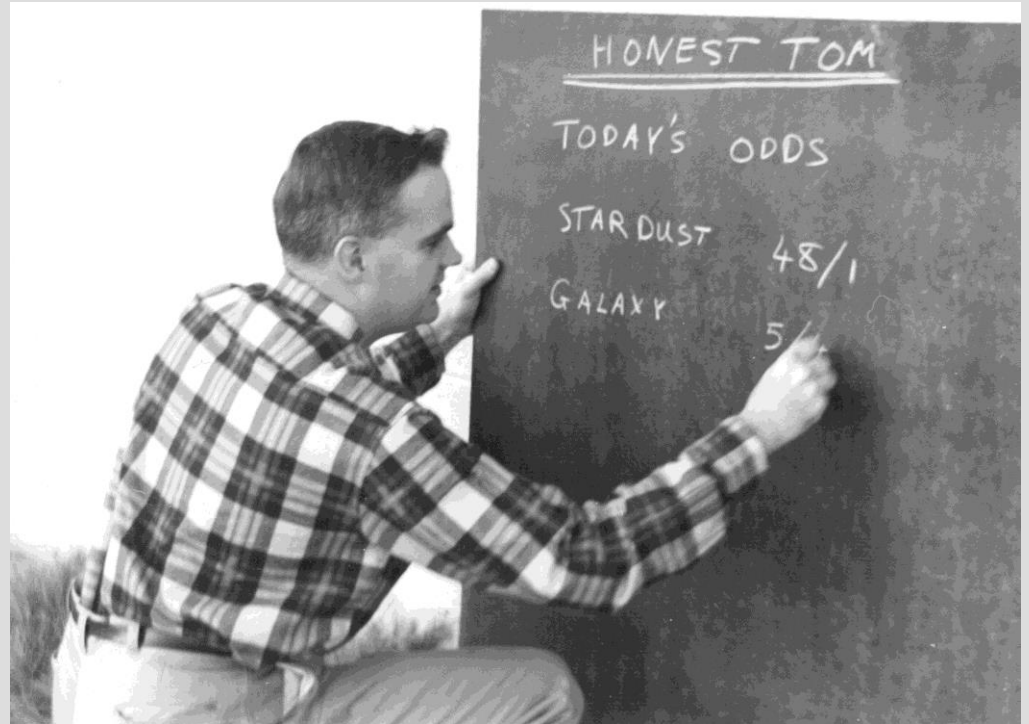
- Inauguration of Owens Valley Radio Observatory in December 1958
- Interferometer not fully operational until mid-1960



Rudolph Minkowski



Tom Matthews



Two breakthroughs at Owens Valley in 1960:

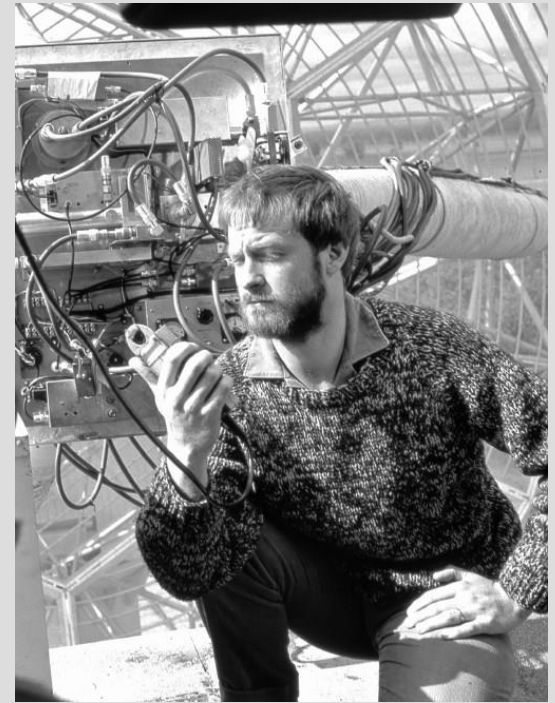
- Accurate position for 3C295 enables Minkowski to measure record redshift of 0.46. Previous record of 0.20 by Milt Humason had stood for ten years
- Caltech postdoc Tom Matthews measures accurate position for the compact source 3C48. Unusual spectrum and redshift unknown. Later, 3C273 and 3C48 shown to be first quasars

The Dishmaster 1961 – 81



‘After the Sydney Harbour Bridge and Opera House, the Parkes Telescope is probably the best publicised structure in Australia’

Chris Christiansen



Ron begins PhD thesis 'The Structure of Southern Radio Sources' using the Parkes interferometer. Supervisors Bart Bok (ANU) and John Bolton

Jay coauthors six papers with John (1966 – 67) on the optical identification of extragalactic sources in the Parkes Catalogue





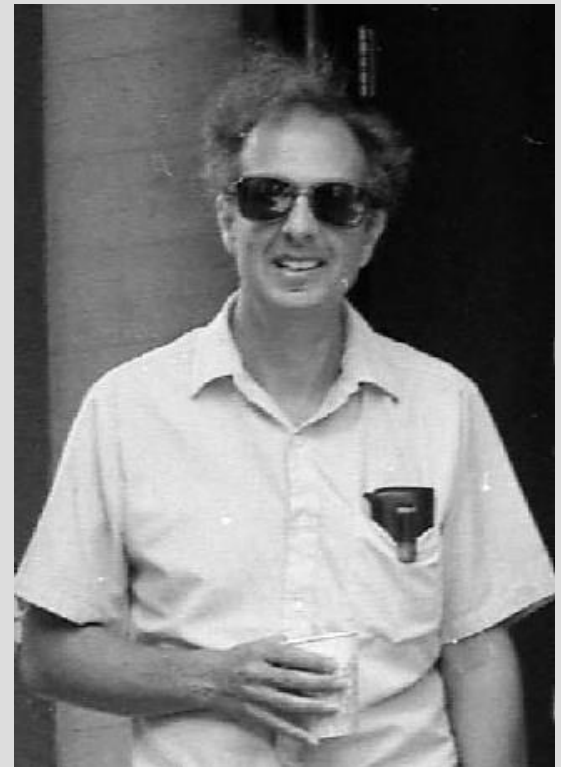
Bob Wilson

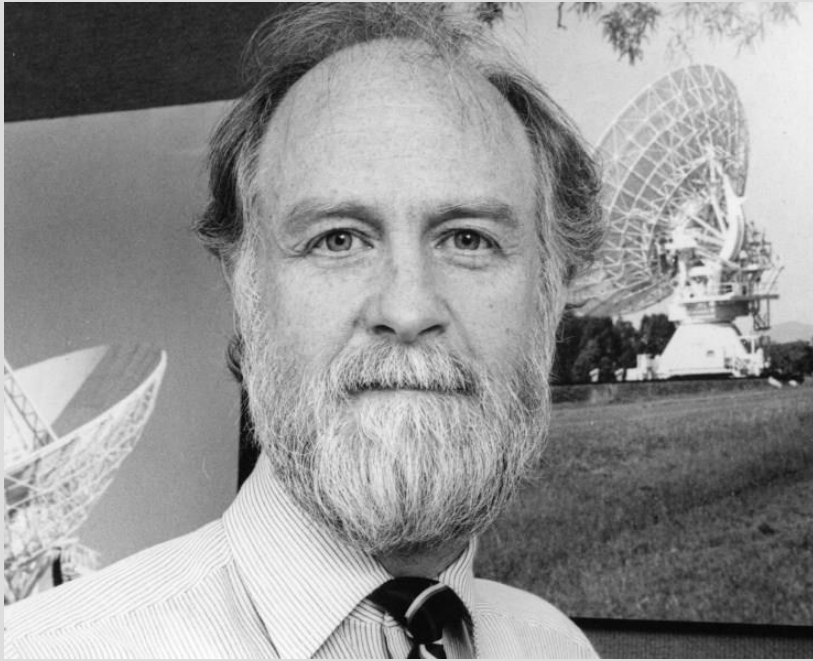
“Since the arrival of the news from Sweden yesterday, I’ve thought of you several times. I want to give you a long-overdue thanks for giving me such a good start on an astronomical career. I have always admired your fluency of ideas and tried to copy your care and honesty in making measurements and your willingness to work on all of the jobs from ditch digging on up.”

Wilson to Bolton, 18 October 1978

Ken Kellermann

“John was a scientific leader in the true sense of the word: he *led* rather than *directed*. He expected total commitment from his colleagues and even more from his students; but never more than he was prepared to contribute himself. Whether it was building equipment, painting antennas, welding steel, pouring concrete, or digging holes, Bolton was there first. It was hard to keep up with him, but the effort was worth it, especially for the students who literally had to learn radio astronomy from the ground up.”



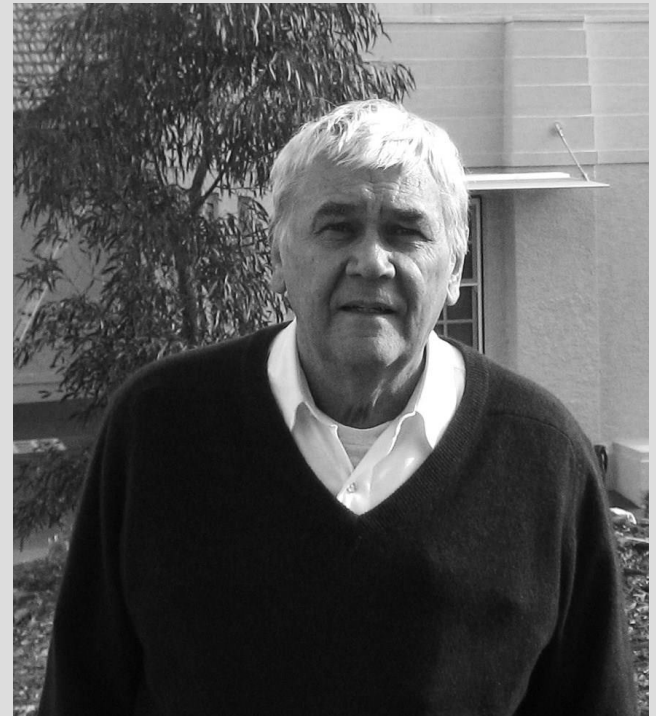


Ron

“John had a view that you had to be able to do it yourself before you could ask others to do it. If he asked us to do something he would know that it could be done, either because he had done it or knew he could do it if we got it wrong. It was the same with the workmen, whether it was digging a ditch or pouring concrete. It was very much leading by example. I try to do that with my students, but I don’t think I do it as well as John, possibly because things are different now.”

Dave Jauncey

“Jasper Wall and I were intent on making the Parkes 2.7 GHz survey complete, whereas John’s attitude was completely different. Although the survey was important in its own right, that’s not what really interested John. He wanted to find the unusual, the unknown and interesting sources. He had a bloody good idea of what was important. John was driven by his curiosity – it was not just a career. Discovering new things is a very potent drug, and that’s what drove John.”



IAU Symposium on Extragalactic Radio Sources Albuquerque, 1981



Bolton students and colleagues (standing from left): Ron Ekers, Alan Moffet, Ken Kellermann, Jasper Wall, Dan Harris, George Seilstad, Jim Roberts, Barry Clark and Radhakrishnan (kneeling) Marc Price and Beverly Wills