Science with Parkes
the John Bolton era to the ATNF

Science with Parkes at 50
Parkes, 31 Oct 2011
Ron Ekers
CSIRO, Australia
CSIRO Parkes (1961-1979)

- Commissioned Parkes 210’ Telescope (1961)
- 3C273 occultation (1963)
  - First quasar redshift
  - Paradigm shift in astronomy
- Parkes catalog (1964-)
- Parkes interferometer (1967)
- Apollo 11, 13 (1969)
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>Tom Mathews identifies 3C48 with a stellar object. Spectrum has a possible $z=0.36$ but not accepted (variability, line fit). Misinterpreted as a peculiar galactic star.</td>
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<tr>
<td>1962</td>
<td>Cyril Hazard observes multiple lunar occultations of 3C273 at Parkes. Core jet structure and position determined.</td>
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<tr>
<td>Jan 1963</td>
<td>13mag star identified with 3C273 using position and structure. Bolton, Hazard and Mathews all involved in the now obvious identification.</td>
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<td>Mar 1963</td>
<td>Schmidt observes spectrum and identifies lines with $z=0.158$.</td>
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<tr>
<td>Mar 1963</td>
<td>Greenstein and Mathews now reinterpreted 3C48 as a $z=0.36$ Quasar. Sandage has already measured variability.</td>
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<tr>
<td>1963</td>
<td>Variability implies small volume and luminosity implies gravitational energy.</td>
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<tr>
<td>Dec 1963</td>
<td>First Texas Symposium on Relativistic Astrophysics, Named Quasars but name not in general use for many years.</td>
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3C273 Occultation
Parkes, Aug 5 1962, 410MHz
3C273

Parkes Occultation

- Striking difference in radio spectra
- Component A
  \[ S = \nu^{-0.9} \]
- Component B
  \[ S = \nu^{0.0} \]
3C273
VLA 5GHz
Tracking the lunar limb
Parkes circa 1964
John Bolton’s Astronomy Style

- Understand your Instrument
  - Building it is the best way
  - Not a National Facility fan!
- Don’t ask anyone to do anything
- Always gave credit to others
- Shun Authority
  - Management
  - Scientific establishment
- Clear vision pursued with passion and vigor
John Bolton and his PhD students

- Initiation
  - Barry Clark – oxy torch
  - Ken Kellermann - pulling cables
  - Bob Wilson – circuit design
  - Ron Ekers – used tractor to grade the N-S interferometer track
  - Marc Price – built a sky horn

- Need to earn your PhD
  - We were not allowed to use Parkes for PhD projects
    » Anyone could get a PhD that way
Some Students

- Barry Clark: VLBI, VLA, VLBA
- Bob Wilson: Nobel prize CMB
- Ken Kellermann: Source Spectra, VLBI
- Radhakrishnan
- Al Moffet
- Dan Harris
- George Sielstad
- Jim Roberts
- Jasper Wall
- Ron Ekers
- Marc Price
- Bev Harris
Great debate started in the 1950’s and still continues

Bolton argued for the flexibility of a big dish and the resolution of an interferometer made of big dishes

Bowen wanted the grandeur of a big dish

Chris thought the age of the “Wind Jammers” had passed

Pawsey wanted to do astronomy

Mills argued that the arrays were more cost effective and that the interesting Universe was at low frequencies
Variable Baseline Interferometer

- Built to measure positions – but never did
- Flexibility of the variable baseline
Parkes Catalogues and Source Identifications

- Parkes catalog (1964-
- Identifications
  - Single dish positions
  - AAO redshifts
- Team
  - Jay Ekers
  - Jet Merkelijn
  - Ann Savage
  - Alan Wright
Radhakrishnan arrives
1967
Apollo 11
1969
Australia Synthesis Telescope

1975

Steering Committee

John Bolton
Chris Christiansen
George Ellis
Bernie Mills
Brian Robinson
Paul Wild

$10M
- Parkes in decline
- AST proposal transformed into the Australia Telescope
  - Parkes
  - Narrabri
  - Mopra
  - Tid.....
- NASA & ESA funding
- Pks-Tid radio link
- Industry links
- Software crisis
- Prototype receivers for ATCA
- Digital backend based on ATCA correlator
- Parkes becomes a National Facility
Parkes and the Space Missions

- 1963: NASA base DSN design on Parkes
- 1965: Mariner IV tracked at Parkes
- 1969: Moon Landing with Apollo 11
- 1969-72: Apollo Missions 12 through 17
- 1986: ESA Giotto mission to Halley’s comet
- 1986: Voyager II at Uranus
- 1989: Voyager II at Neptune
- 1990: TDRSS First Space VLBI Demonstration
- 1996-97: Galileo
- 2000: The Dish
The 1980 upgrades
Ables – Jacka era

- Upgrade and prepare for NASA & ESA missions
- New computer room on first floor
- New control room on second floor
- Replace metadynes
- Replace vacuum tube-based control system with solid state electronic controllers
- Network of PDP11 microcomputers
Parkes Control Desk before
National facility Impact
International linkages

No of O/S organizations using AT

Year

0 20 40 60 80 100 120

89 90 91 92 93 94 95 96 97 98 99 00 01
The Parkes Multibeam Receiver

- NRAO 5GHz multibeam receiver on Parks (PMN)
  - Ice breaker for the engineers
- HI survey case
  - Mike Disney’s Icebergs
  - Lister Staveley Smith large scale structure
- Trevor Bird and the design of a feed array
- NRAO declines a collaboration request
- NASA Galileo funds the Parkes focus cabin upgrade
- Collaboration with U. Melbourne
- Warwick Wilson builds a digital correlator
  - 9 $\Rightarrow$ 13 beams
- The Pulsar gang join in
- The rest is history – perhaps the most cited receiver in all time?
Installing the Parkes 21cm Multibeam Receiver
External contracts

- Must align with our mission

- NASA-Galileo $3.6M
  - Upgraded Parkes
  - Built receiver
  - Tracked Galileo spacecraft
    » Apr 96-Nov 97
    » 97.3% up time
22 August 2001: Sen. Minchin awards $23.5m to the MNRF astronomy proposal