

# Learning how to do large-N radio interferometry

The VLA in the early eighties



# Prior art

- (Cambridge 5km)
- WSRT
- Stanford interferometer
- Clark Lake
- Green Bank Interferometer
- Merlin
- VLBI
- etc...

# The Very Large Array

- 27 antennas of 25m diameter
- Antennas moveable along railroad tracks
- Y - shaped configuration
- Reconfigurable over 4 scales
- Multiple frequency bands
- Circular polarisation



# Working environment

- All work at the VLA Site
- Computing: DEC 10, PDP 11/70s, VAX 780s
- No email, web, etc.
- Lots of visitors
- Eagle Guest Ranch for dinner

# VLA Bus

- 1 hour bus ride morning and afternoon
- Mixing pool
- Opportunities to talk to most people
- Best time to talk to Ron



# My time at the VLA

- Joined as a technical post-doc in Oct 1980
- Immense culture shock on coming from Jodrell Bank
- Many smart, knowledgeable, and accessible people
- Nearly everyone more experienced
- But an open environment





# Things we had to learn

- What the sky looked like!
- Limits of the telescope
- Debugging the telescope
- Simple things: Two point vs Boxcar phase interpolation
- Computing: Dec 10 package and AIPS
- CLEAN, MEM, Selfcal, wide field
- Pointing limits
- Spectral line imaging / The Pipeline
- Mosaicing



# Ron as Director

- Ron was the VLA site director
- Bona-fide intellectual leader
- Combination of wide science interests, deep technical insight, broad experience, and high energy
- Popular decisions
  - Mandated free coffee
  - Mexican food 3 days a week at the canteen



# Problems at the VLA

- Declining Research Equipment fund
- Rail roads ties had to be replaced much earlier than expected: continual drain on budget
- Real struggle to get spectral line imaging to work
- VLA support spread over VLA site, CV, and GB

# The Pipeline

- Designed for spectral line imaging
- Sorter, Transpose memory, Gridder
- Barry Clark and Wim Brouw
- Unreliable networking!
- Eventually Wim and Bob Payne made it work
- Miller and Jacqueline did heroic amounts of testing
- The Pipeline had a few years useful lifetime prior to Convex

# How we progressed

- Endless discussions about science and techniques
- Monthly Test meetings and Calibration meetings
- Constant flow of scientists visiting to use the telescope and reduce the data
- Slowly increasing computing capabilities
- Summer schools to consolidate and spread knowledge

# Ron part 2

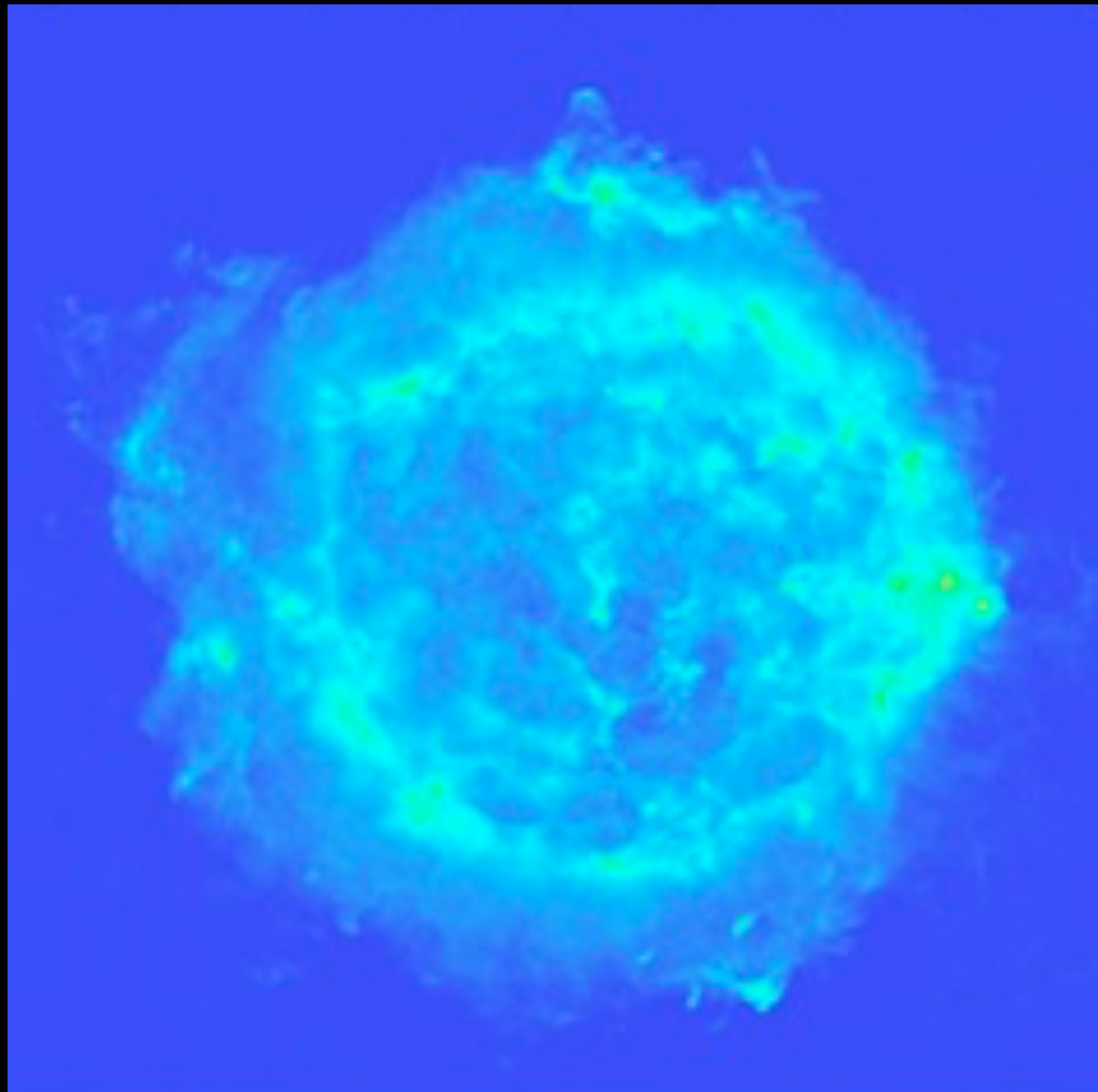
- Amazing level of energy
- Energised by ideas!
- Led from the front-line
- Involved in many side projects
- Ron likes to understand a topic deeply before hand
- Exploratory discussions tend to go on a bit

# Notable advances by mid eighties

- Telescope working well (apart from “It”)
- Working self-calibration to 40 - 50 dB
- Clark CLEAN for VAX 11/780 + Array Processor
- MX CLEAN for sparsely filled fields
- MEM algorithm for large filled fields
- Working spectral line PIPELINE/GRIDDER

# 1986 state of the art

- VLA A,B,C,D image
- MEM image calculated on CRAY-YMP at Digital Productions, Los Angeles
- 4K by 4K
- Brief flirtation with supercomputing



# Epilog

- Ron went to ATNF in late eighties
- Big loss to NRAO
- ATNF inevitably became very productive
- Ron and I worked at the same place again: ATNF in the mid-2000's.
- ASKAP was on the horizon and led to similarly lively discussions as at the VLA



# Things I learned from Ron

- Have a healthy skepticism of received wisdom
- Things that you don't understand can be nearly always be reduced to something you already do understand
- If you cannot explain it in a few minutes you don't understand it
- If you cannot explain it without math you don't understand it
- Engage across both scientific and technical boundaries

# Summary

- The VLA benefited immensely from Ron's time as Director during the critical early years
- I was and still am personally very lucky to have him as a mentor and colleague
- Many people in radio astronomy benefited from Ron's influence, insights, and enthusiasm

“His like will not be seen again”

# Thanks, Ron!

