The Murchison Radio Observatory

- Murchison shire in Western Australia: extremely radio-quiet site.
  - Area 16,000 sq miles, radio-quiet population ~110.
  - Operations in FM, TV bands: radio-quiet is crucial.
  - Proposed site for Square Kilometer Array: infrastructure improving, power & fiber coming.

The Australian Square Kilometer Array Pathfinder (ASKAP)

- ASKAP = 36 antennas, 12-m each, Tsys = 50K, baselines up to 6 km.
- 2-km site, sensitive radio surveys.
- Large sky coverage, good localization.
- Suited for radio followup or discovery.

VAST Survey Design

Continuous commercial observations: piggyback with all other surveys at ASKAP.

- Dedicated surveys being designed at present.
  - VAST Wide: 10,000 sq deg observed daily (400 pointsing × 40 sec each; 0.5 mJy/beam).
  - VAST Deep: 10,000 sq deg observed twice (400 pointings × 1 hr, 50 mJy/beam, many ΔT).
  - VLAST Galactic plane: 750 sq deg; ΔT ~ 2.7 days (33 pointings × 16 min each; 0.1 mJy/beam).

Survey the Milky Way and Magellanic Clouds.

VAST Data Flow & Processing

Continuous real-time operation on ASKAP images.

- VOEvent alert mechanism for follow-up obs.

Target Source Classes

Based on underlying mechanism:

- Explosions: Radio SNe, prompt GRB emission, orphan afterglows.
- Propagation: scintillation, IDVs, extreme scattering events.
- Accretion and Magnetars: AON, flare stars, CVs, XRBs, microquasars, magnetars, pulsars.

More important: unexplained, undiscovered sources.

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Get Involved with VAST!

- Open collaboration: we welcome new members.
- Current membership is 70+ participants from 32 institutions on 4 continents.
- Design Study currently has 7 working groups:
  - WG 1: Simulations & imaging (Randall Wayth)
  - WG 2: Source finding (Tara Murphy - PI)
  - WG 3: Survey strategy (Shami Chatterjee - PI)
  - WG 4: Commissioning (Simon Johnston)
  - WG 5: Data format & access (Hayley Bignall)
  - WG 6: Transient detection (David Kaplan)
  - WG 7: Transient source classes (Duncan Gallaway)

Science with ASKAP, Johnston et al. '07, PASA, 24, 174

Faint transients in deep archival VLA data. (Bowyer et al. 2007, ApJ, 666, 346; 3 GHz: t ~ days to years; no O/IR counterparts for most RSNs?; Old halo NS? Or...?)

Light curves of the total intensity (Stokes I) and circularly polarized (Stokes V) radio emission from the late-type M dwarf TVLM 513-46546 (Hallinan et al. 2007, ApJ, 663, L25). The periodicity of 1.96h is readily apparent and is in agreement with the rotational period of this source. Bursts occur with 100% polarization of both right- and left-handedness (labeled as “RCP” and “LCP”, respectively).

The Murchison Widefield Array (MWA)

- Low-frequency (80-300 MHz) array under construction at MRO.
- 32 site in place, 512 sites to end of 2011.
- Baseline up to 500m, outlers out to 2km.
- No moving parts.
- Secured electronically with beamformers, can repoint in 8s.
- 1000 th site: 30% instantaneous FOV, 5 resolution.
- Transient & pulsar surveys along with other science (solar, EoR).

David Kaplan (UWM), S. Chatterjee (Cornell), T. Murphy (U Sydney) on behalf of the VAST & MWA Transients collaborations