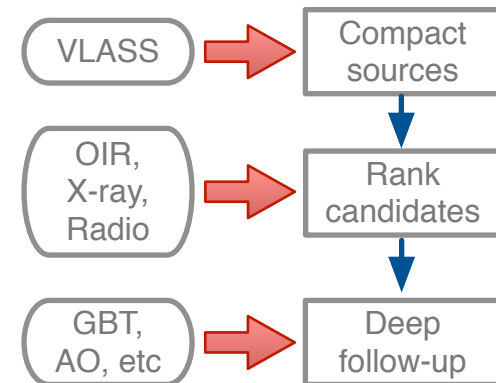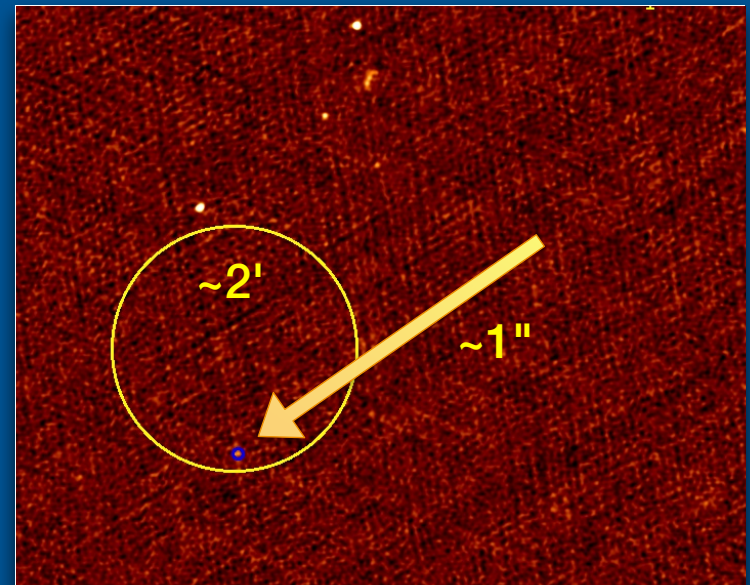# Finding Exotic Pulsars & Transients with VLASS + Time-domain Surveys

What's the science?

* Binary systems: test theories of gravity, GR.
    Seek pulsar-black hole binary.
* NS-NS, NS-BH systems: LIGO event rates.
* Stable recycled MSPs in pulsar timing arrays:
    Detect gravity waves.
* Unique objects:
    Probe equation of state for ultra-dense matter.
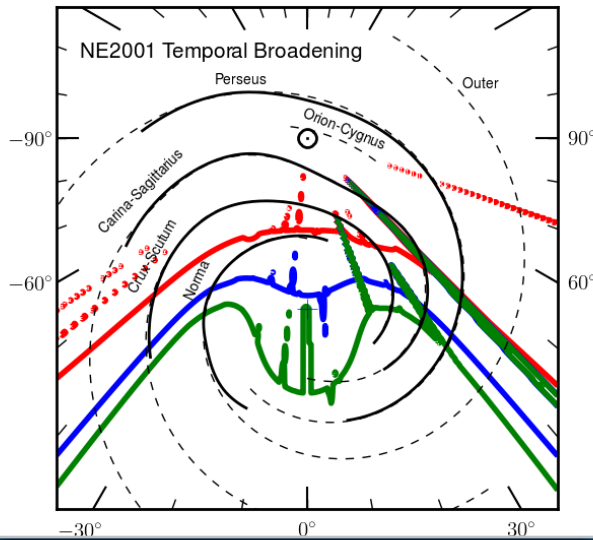* Intermittency, transients: the time-variable sky.

Parameter	Desirable	Acceptable
Obs Frequency	1-2 GHz	2-4 GHz
Array Config	A (~1")	B
Sky Coverage	All sky	Gal plane ++
Cadence	Multi-pass	2 passes
Pt Src Sensitivity	≲100 µJy at 5σ	

~2'

~1"

VLASS ➡ Compact sources

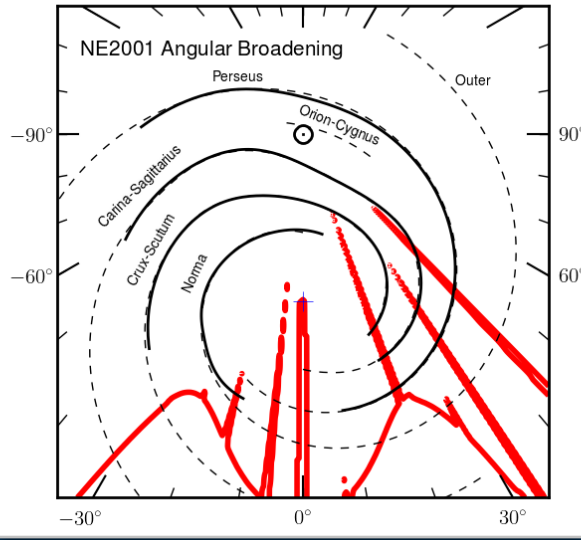OIR, X-ray, Radio ➡ Rank candidates

GBT, AO, etc ➡ Deep follow-up

Source counts per sq deg, >100 µJy:
~1000 extragalactic sources;
~8 pulsars in Gal plane.

Why do we need a finder survey with the VLA?

Time domain: scattering is a severe problem (1, 10, 20 ms).

NE2001 Temporal Broadening

Imaging: angular broadening is not significant (<0.1").

NE2001 Angular Broadening

RFI is killing time domain search!

2 Pulses of Best Profile

RFI   Pulsar

Time domain: tight binary systems are hard to detect.

NS-NS Binary Detection-Analysis Regimes

Standard Period-DM Search OK

Acceleration Search

Full-orbit or Imaging Search

Intermittency, transient behavior on all time scales.

PSR B1931+24 cycles On/Off.