



TEXAS TECH UNIVERSITY™



Galactic Plane Radio Surveys

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Eli Pattie (Texas Tech grad student) (VLA survey of Galactic Bulge)

Amaris McCarver (Texas Tech undergrad/NRL NREIP intern) (VLITE globular cluster pulsar search w/NRL group)

Overview



- Galactic radio source science
- Some results from VLA survey work
- Some thoughts toward SWARM and ngVLA surveys



Stars

Pulsars

X-ray binaries

Cataclysmic variables

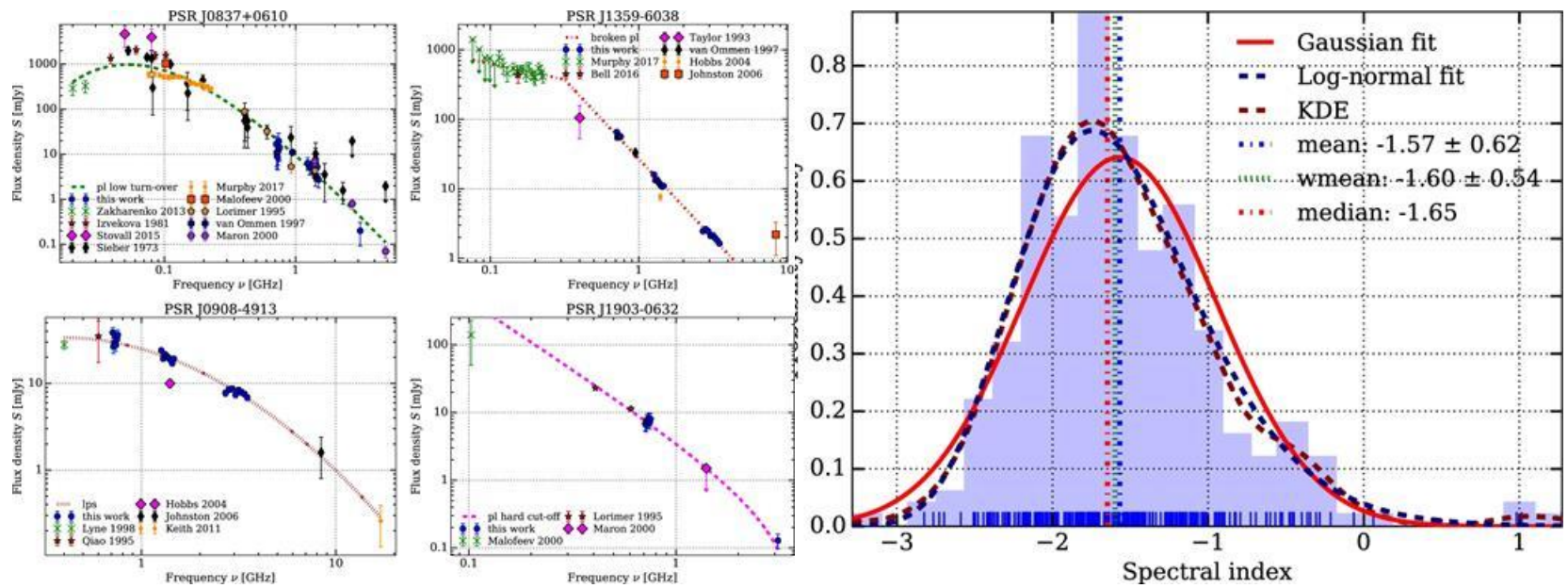
Supernova remnants

Planetary nebulae

I'll focus on pulsars and X-ray binaries

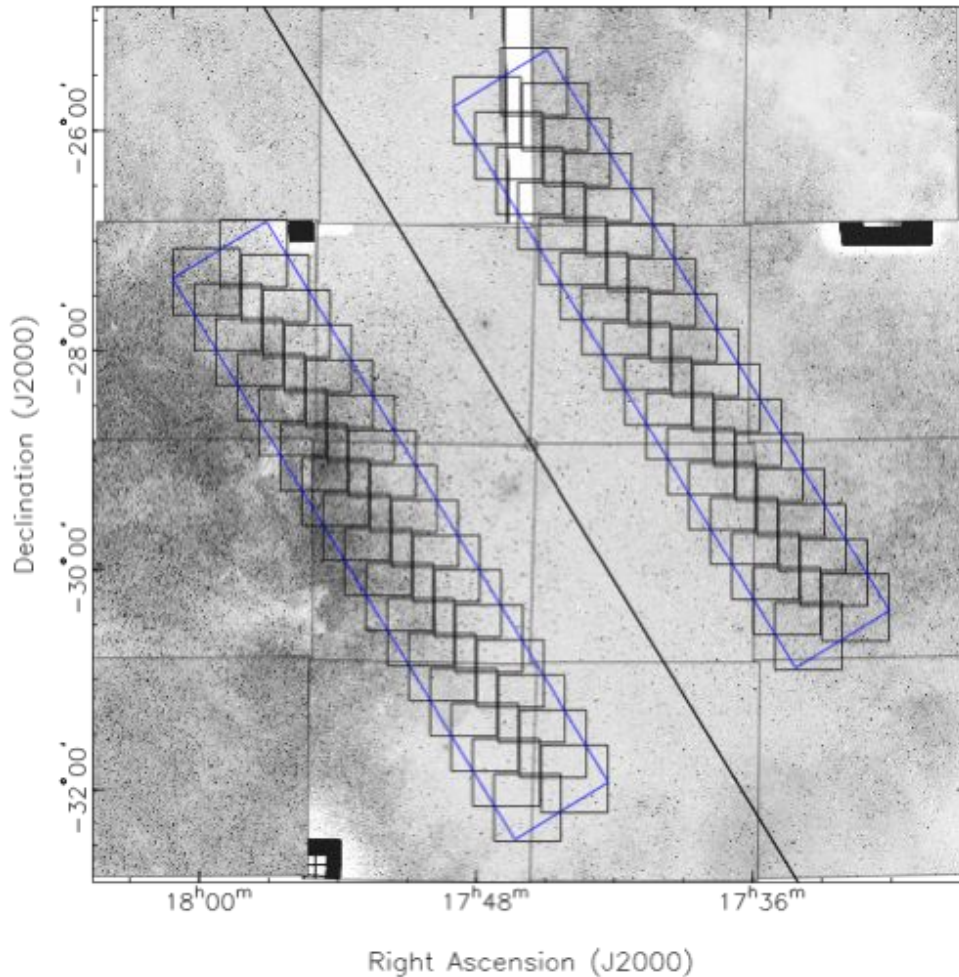


Pulsars have very steep spectra!





- Pulsars can be hard to detect if they are:
 - faint
 - highly dispersed/scattered (intrinsically or by ISM)
 - in very tight binaries with large accelerations and jerks
- Imaging surveys are not affected by the latter two problems
- The tight binaries are potentially most interesting!

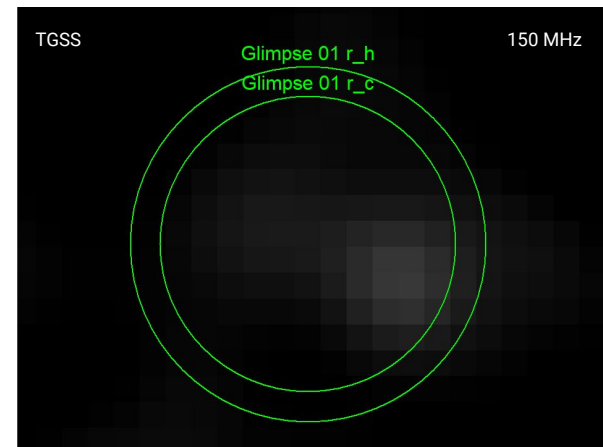
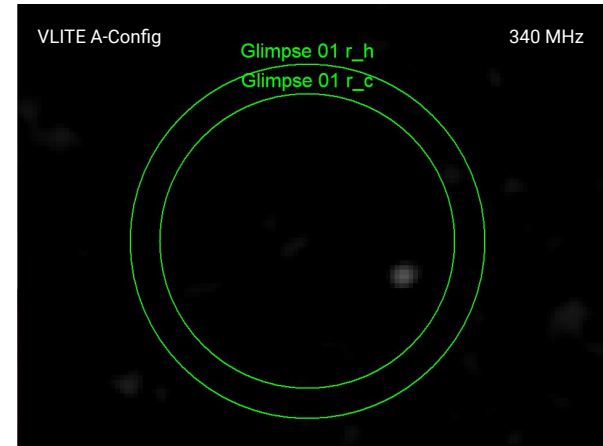


- Pilot project by Eli Pattie: L-band, 1.5 hr depth, 2 square degrees with VLA, 100 objects per steeper than -1.5 , only 2 previously known pulsars
- A few of these have X-ray counterparts as well, as expected

VLITE globular cluster survey (led by Amaris McCarver through NREIP program)

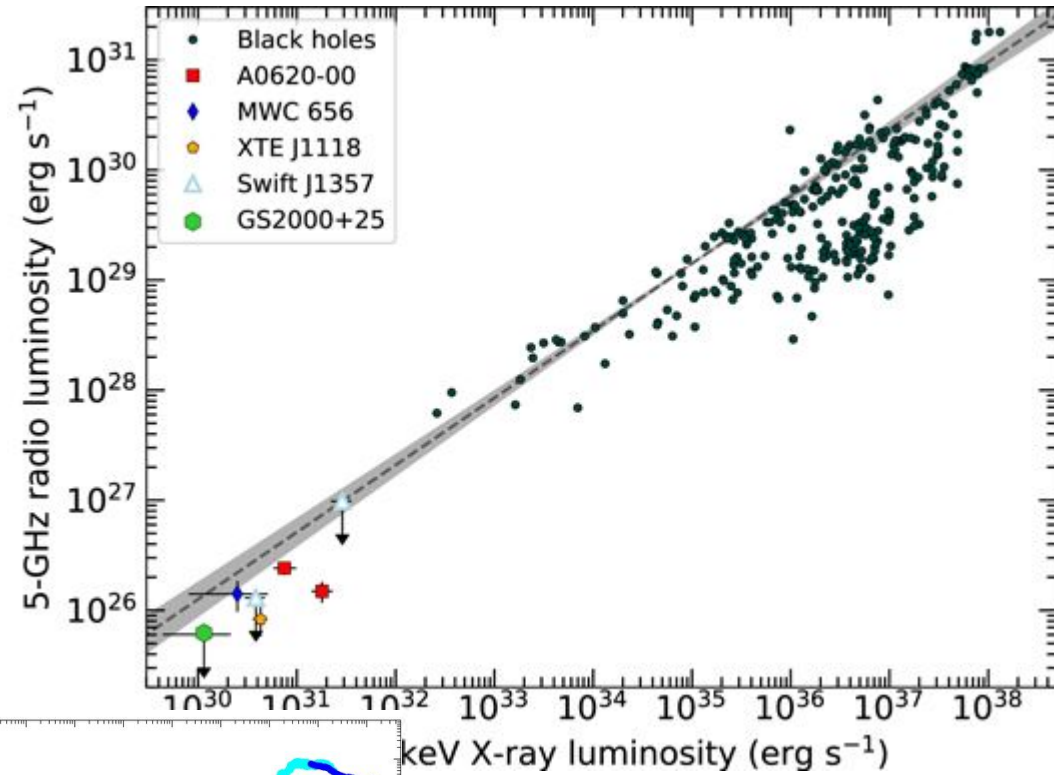
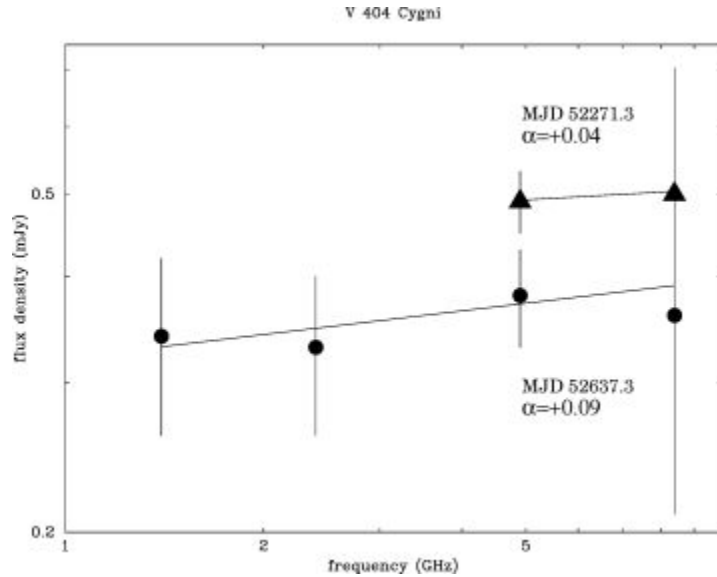
Glimpse 01

- The globular cluster Glimpse 01 is located within a chaotic region of the sky.
- In VLITE and TGSS images, there is a promising source within the half-light radius of the cluster.
- Preliminary calculations indicate that the spectral index is approximately -2.7 within the expected range for pulsars.

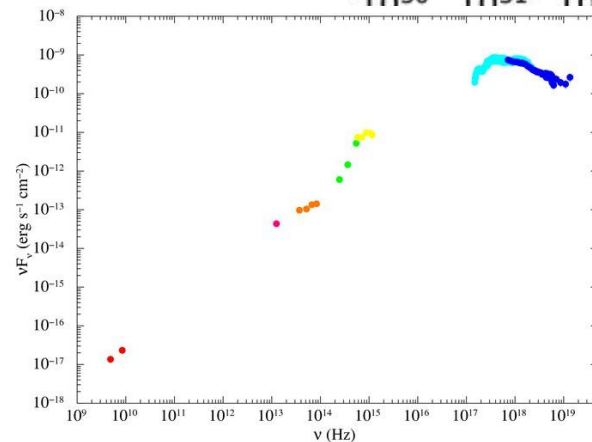
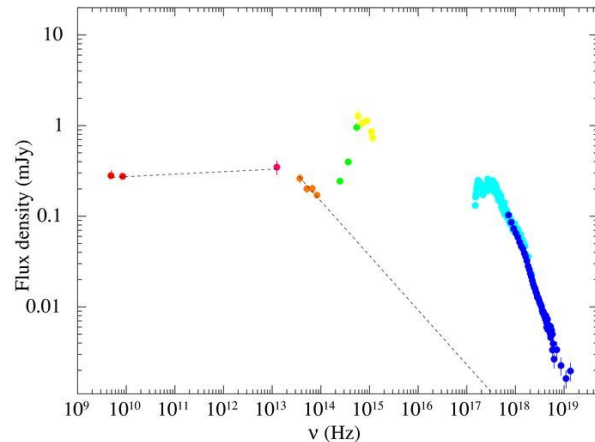




X-ray binaries



Gallo et al. 2006



Above: Rodriguez et 2020; Left:
Migliari et al 2010



Amaris McCarver -- during academic year, cross match of NVSS, FIRST, VLASS for flat spectrum sources

No good BH candidates, but some interesting active stars

Eli Pattie - One good candidate from 2 square degree VLA survey

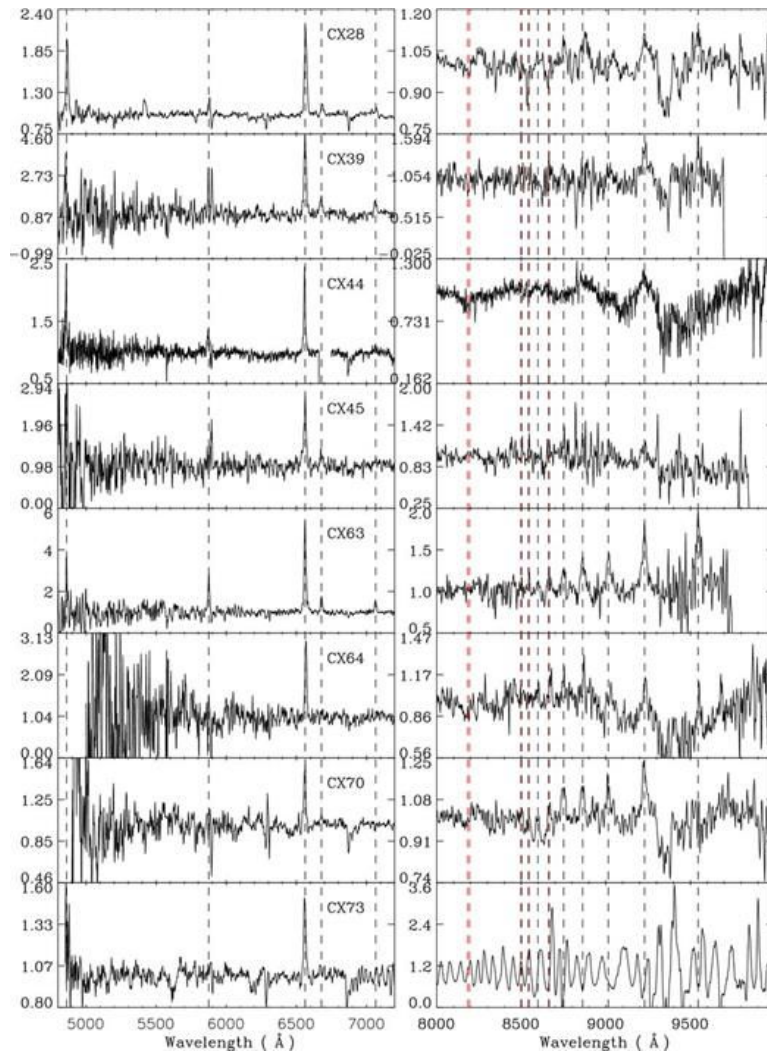


Black hole candidate

Source 63

Was classified as a likely cataclysmic variable by Torres et al. 2014

Optical spectra and X-ray fluxes are very similar for CVs and BHXBs -- radio important in LSST era!





MWA - lacks long baselines, is at higher frequencies

LOFAR - too far north, cannot see much of the Galactic Plane, extremely relevant for rare objects



For pulsars: ~1000 hours would beat VLASS by order of magnitude in sensitivity for pulsars in Galactic Plane -- would be ideal combination

30 pointings

1 mJy noise

-1.9 spectral index

Without SWARM, confusion limited.



ngVLA would help A LOT for the stellar mass
black holes

Radio IDs of a large sample of eROSITA+LSST
matches, similar to “source 63”, our new BH
candidate

Proper motions will help, too.



We are starting to get significant numbers of radio-imaging-selected compact objects

Some is from cm work, but low frequencies quite valuable especially for pulsars

LWA-SWARM or something like it needed to beat the confusion limit