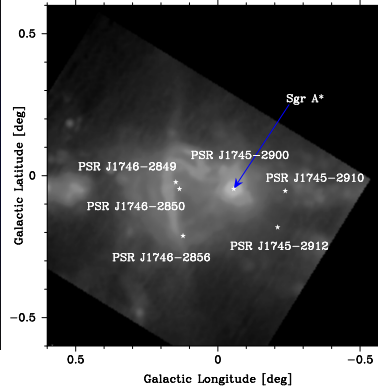
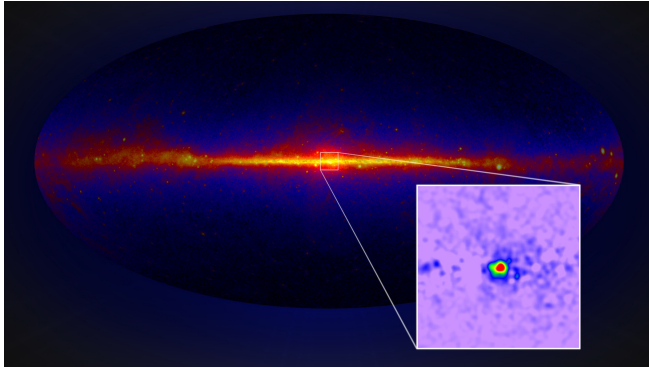




# Neutron Stars in the Dense Stellar Cluster at the Center of the Galaxy

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**Collaborators:** Jonathon Kocz (Caltech), Shinji Horiuchi (CSIRO)  
**Program:** Strategic Initiative R&TD



## PROJECT OBJECTIVE

- Survey of the inner region of the galaxy for pulsars with new DSN capability at K-band
- Develop search methodologies and efficient pipelines to detect isolated and binary pulsars in the GC, including Crab-like pulsars with bright single pulse emitters
- Tune up pipelines with observations of radio magnetars, e.g., the GC magnetar PSR J1745-2900

## BACKGROUND

- NASA's Fermi LAT instrument has identified excess gamma-ray emission toward the inner part of the GC
- Leading explanations include the possibilities of direct annihilation of DM or a large population of MSPs
- Detection of MSPs in dense nuclear star clusters pose a special challenge for surveys, requiring high frequency, large antennas, wide bandwidths, long integration times

## BENEFITS TO NASA & JPL

- Major contribution to Fermi science in tackling an outstanding mystery in high energy astrophysics
- Making use of the new K-band receiving system at the DSN 70-m antenna, which is both a unique JPL asset and the most sensitive centimeter-wavelength antenna in the Southern Hemisphere

## RELEVANT PUBLICATIONS

- *Majid, W., Pearlman, A., Prince, T., et al., "Post-outburst Radio Observations of the High Magnetic Field Pulsar PSR J1119-6127", ApJL, 834, L2 (2017).*
- *Pearlman, A., Majid, W., Prince, T., et al., "Pulse Morphology of the Galactic Center Magnetar PSR J1745-2900", ApJ, 866, 160 (2018).*
- *Pearlman, A., Majid W., & Prince "Observations of Radio Magnetars with the Deep Space Network", Advances in Astronomy, vol 2019, 6325183 (2019).*

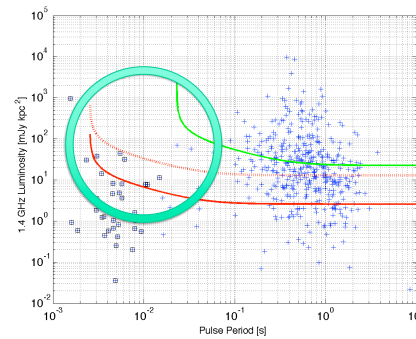
National Aeronautics and Space Administration

Jet Propulsion Laboratory  
 California Institute of Technology  
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[www.nasa.gov](http://www.nasa.gov)

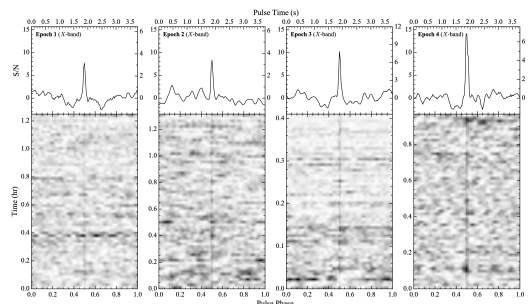
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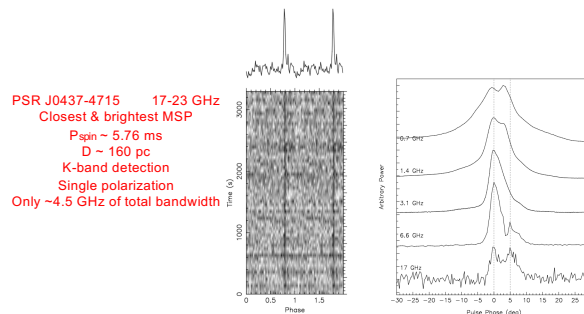
## Detectability of pulsars in the GC region



## Average pulse profiles of the GC Magnetar J1745-2900



## Highest frequency detection of MSP PSR J0437-4715



PSR J0437-4715 17-23 GHz  
 Closest & brightest MSP  
 $P_{\text{spin}} \sim 5.76$  ms  
 $D \sim 160$  pc  
 K-band detection  
 Single polarization  
 Only  $\sim 4.5$  GHz of total bandwidth

Previous highest frequency detection  
 Keith+2011, MNRAS