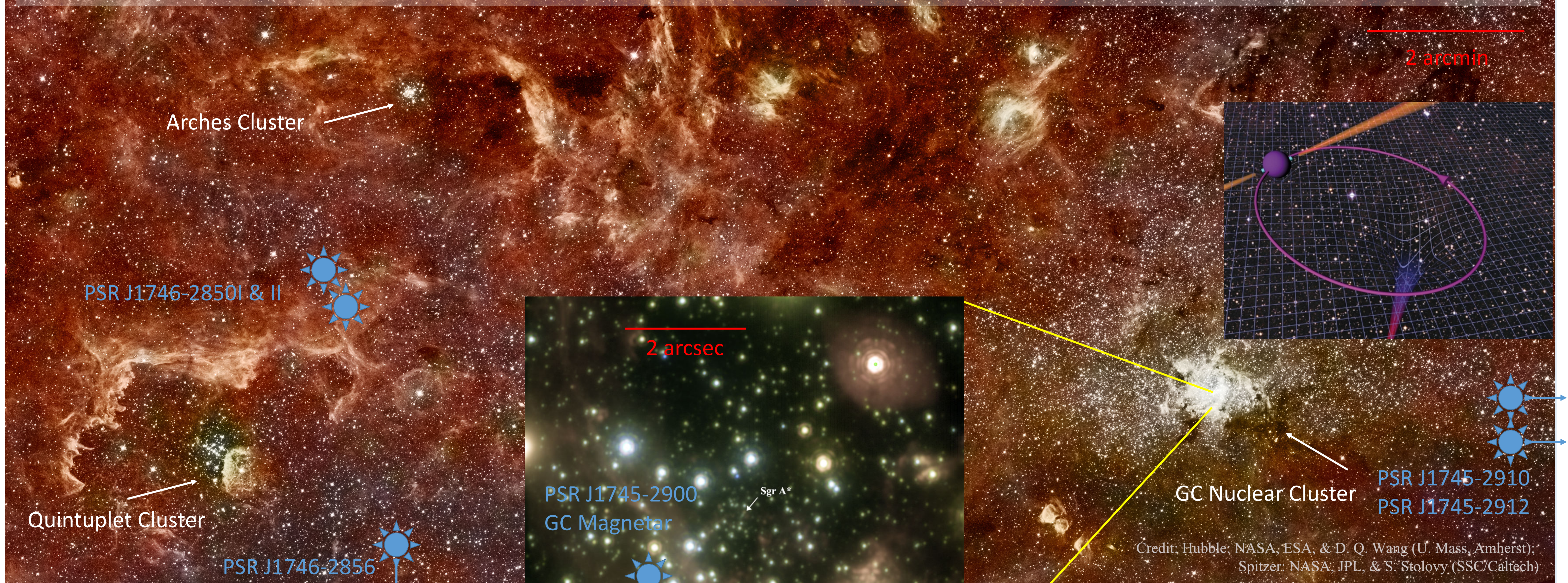


ngVLA Key Science Goal 4: Using Pulsars in the Galactic Center as Fundamental Tests of Gravity

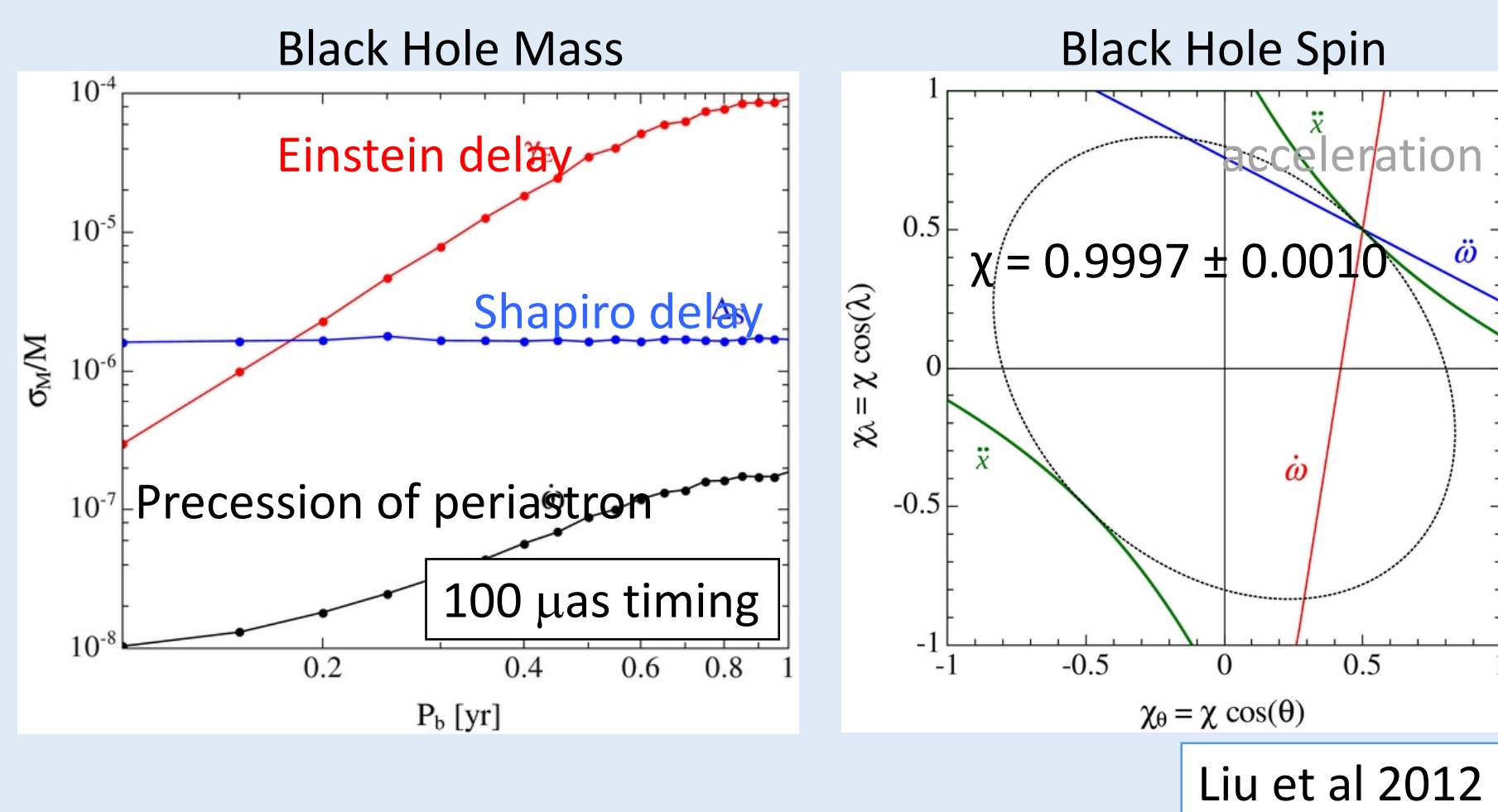
G.C. Bower¹, P. Demorest², S. Chatterjee³, J. Cordes³, J. Deneva⁴, J. Dexter⁵, M. Kramer⁶, J. Lazio⁷, S. Ransom², R. Wharton⁶
¹ASIAA, ²NRAO, ³Cornell, ⁴NRL, ⁵MPE, ⁶MPIfR, ⁷JPL

- General Relativity and Black Hole Physics with Sgr A*-bound Pulsar
- Star-formation, Stellar Death, Dynamical Evolution, Dark Matter within the Central Molecular Zone
- Interstellar Medium, Turbulence, Magnetic Fields within the Central Molecular Zone



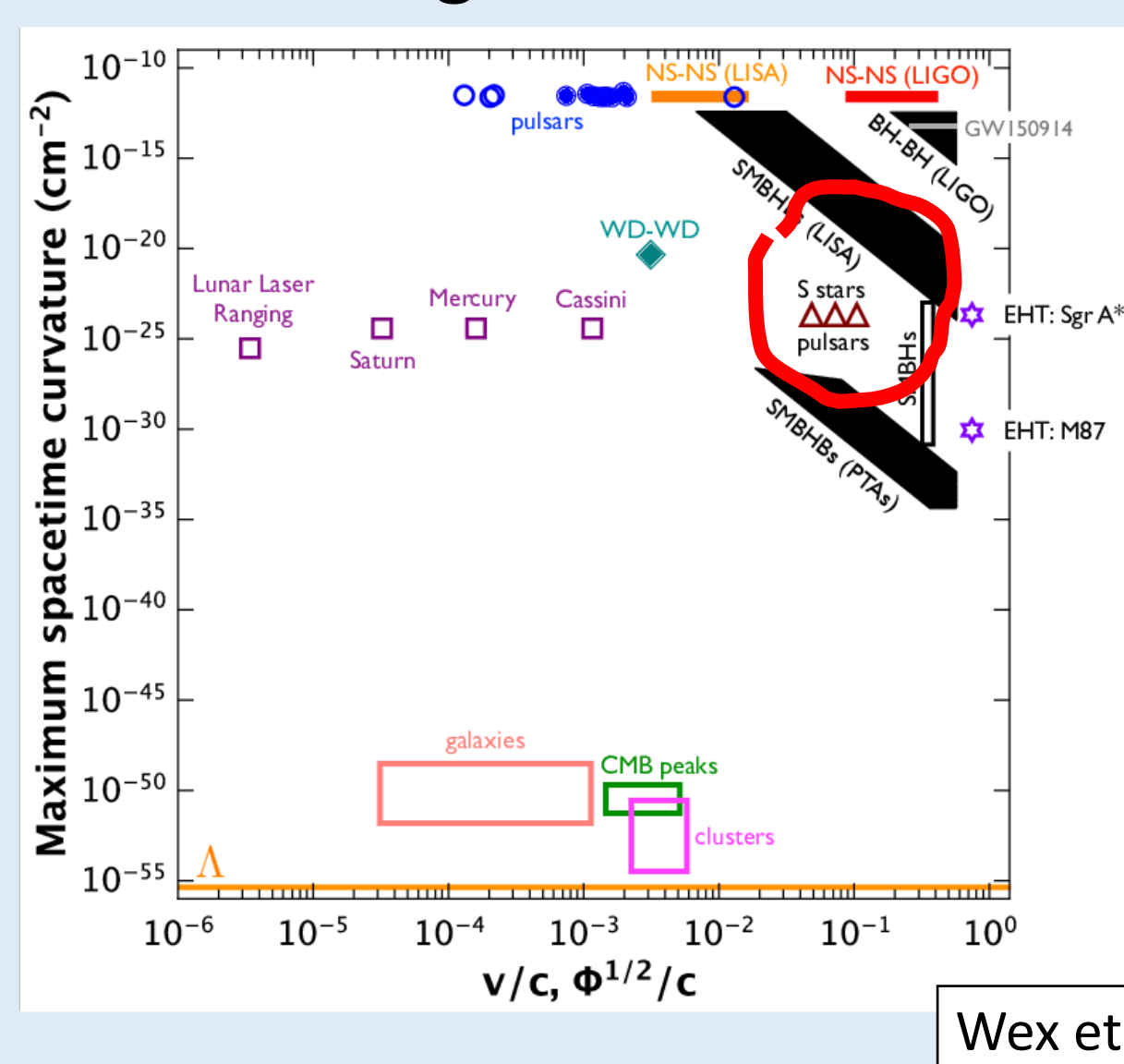
Credit: Hubble; NASA, ESA, & D. Q. Wang (U. Mass, Amherst); Spitzer; NASA, JPL, & S. Stolovy (SSC/Caltech)

A Pulsar Orbiting Sgr A* is a Powerful Probe of GR



Liu et al 2012

And Probes Unique Parameter Space with High Precision



Wex et al

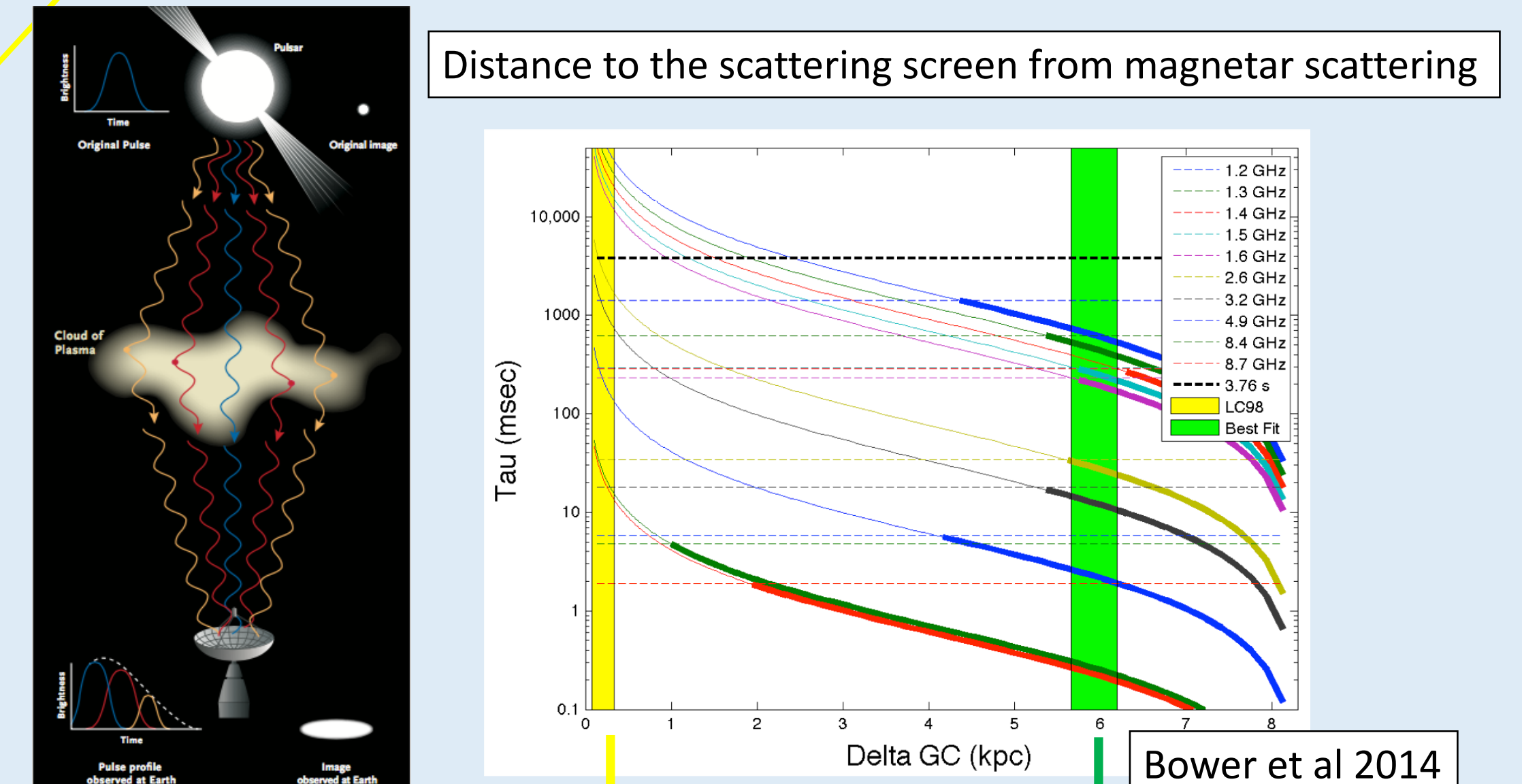
Discovery of the GC Magnetar

- Serendipitous X-ray discovery in 2013 (Degenaar et al 2013)
- Radio pulsations $P=3.7s$ (Eatough et al 2013)
- $2.4'' = 0.1$ pc in projection from Sgr A*
- Orbital period > 700 yr (Bower et al 2015)
- Not suitable for GR but proof of concept for bound pulsar detection

Unique ngVLA Capabilities for GC Pulsars

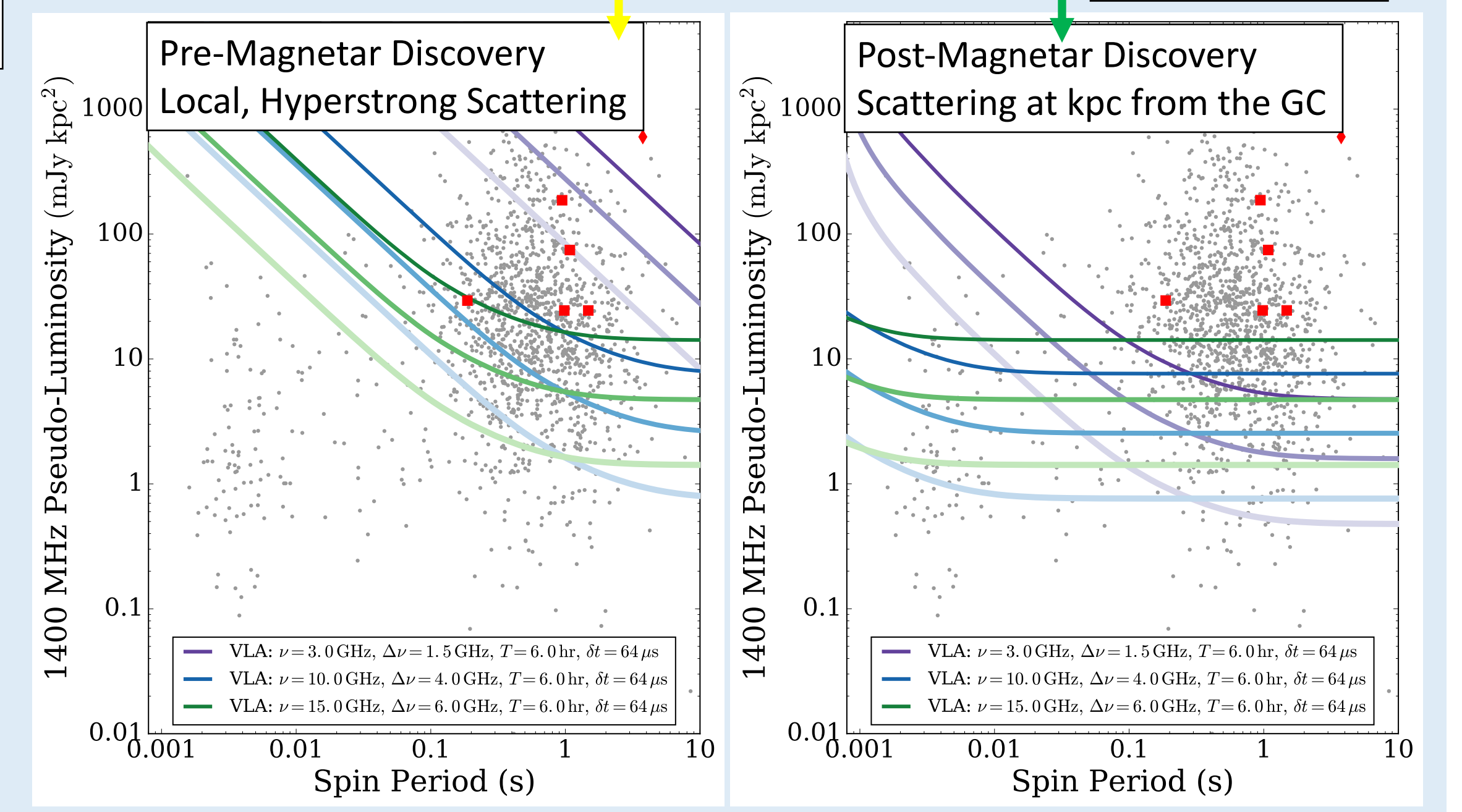
- High Sensitivity at Frequencies $\sim 3 - 30$ GHz
- Flexible wide-band DSP
 - Maximum BW per Rx (~ 8 GHz)
 - Sub-millisecond imaging
 - Beam-forming capability
- Central core suitable for phasing
- VLBI for astrometry

Scattering Limits Low Frequency Pulsar Detection



Distance to the scattering screen from magnetar scattering

Bower et al 2014



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