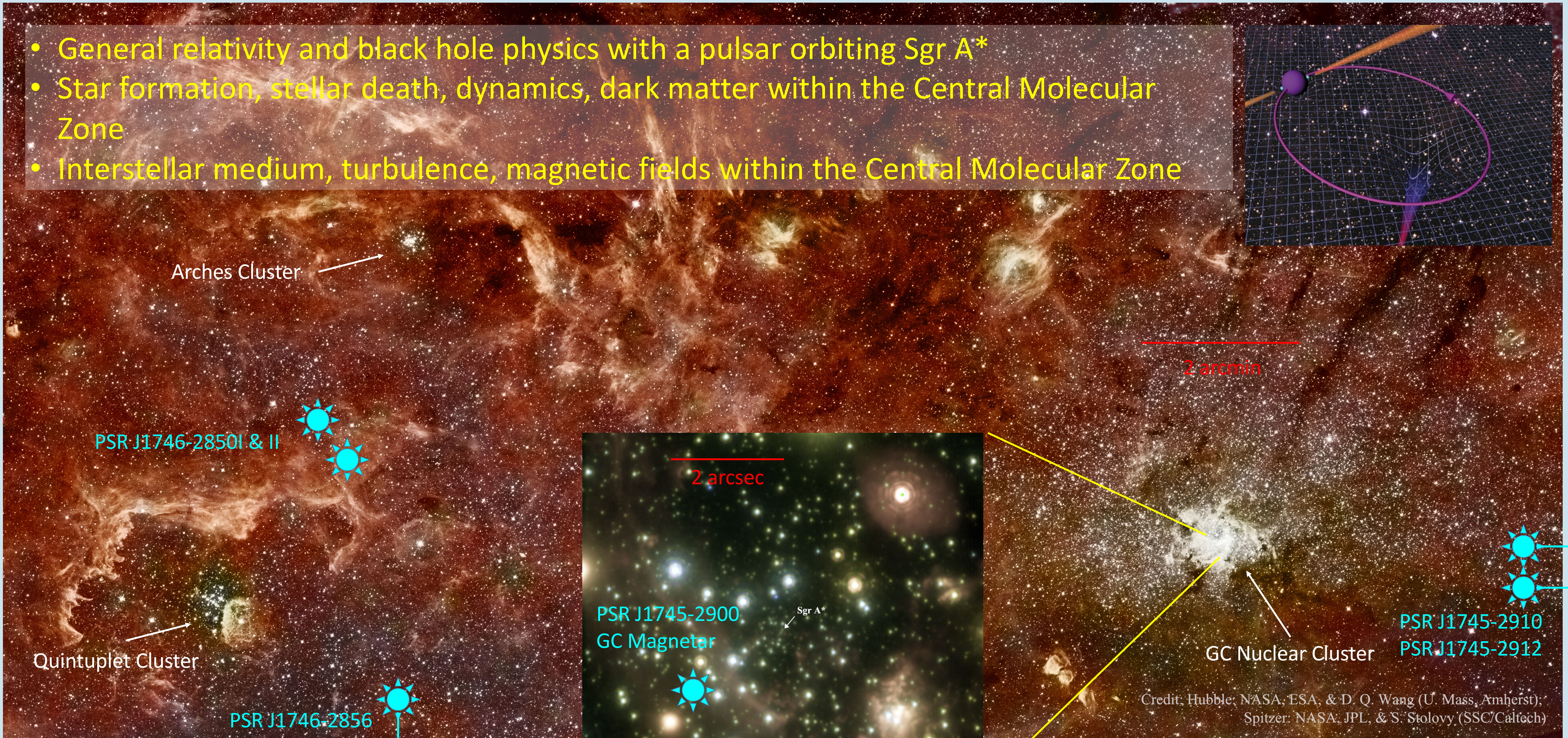


# ngVLA Key Science Goal 4: Fundamental Physics with Galactic Center Pulsars

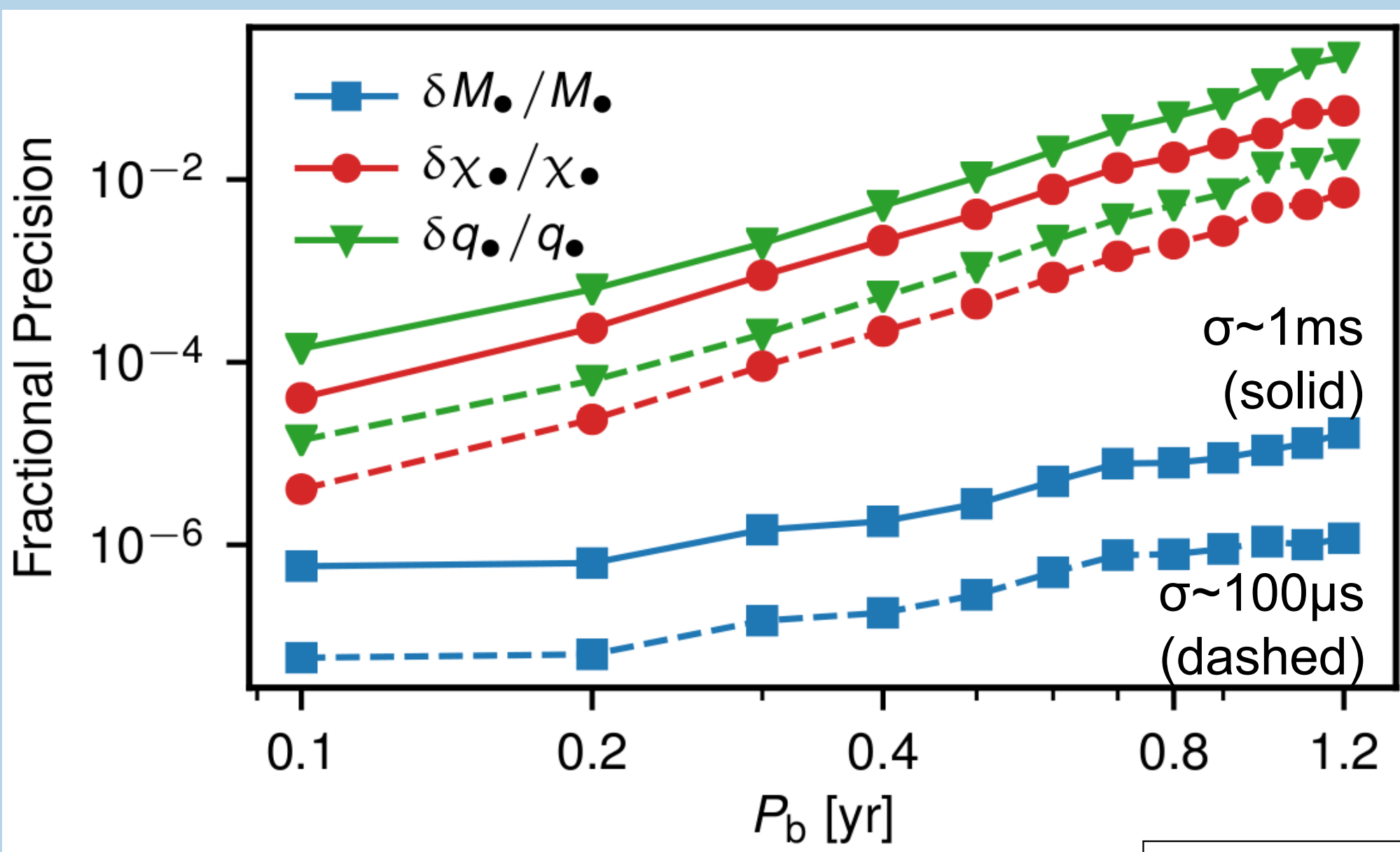
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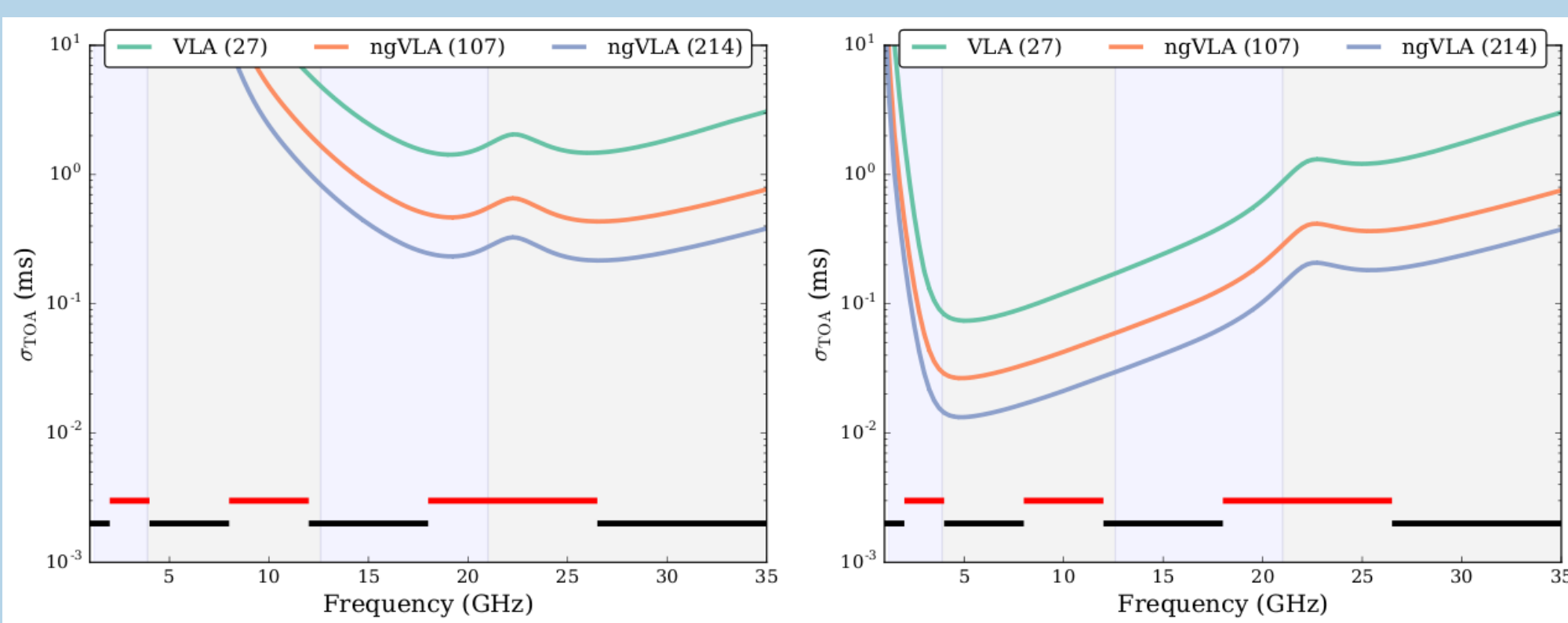
- General relativity and black hole physics with a pulsar orbiting Sgr A\*
- Star formation, stellar death, dynamics, dark matter within the Central Molecular Zone
- Interstellar medium, turbulence, magnetic fields within the Central Molecular Zone



A pulsar orbiting Sgr A\* would measure BH properties (mass, spin, quadrupole) at unparalleled precision:



Measurement precision is optimized at frequencies between 5 GHz and 30 GHz, frequencies at which the ngVLA is being optimized:



### Discovery of the GC Magnetar

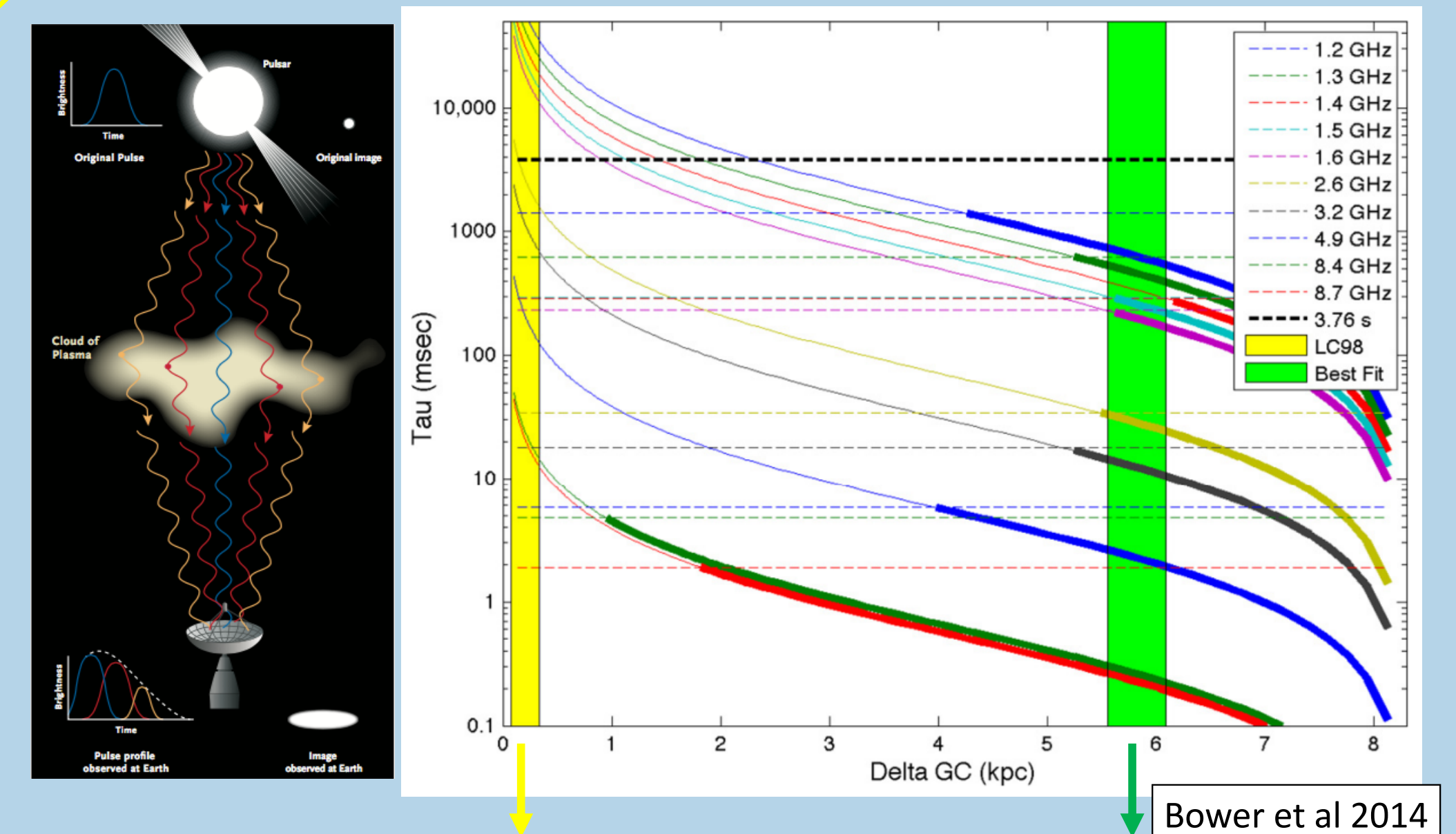
- Serendipitous X-ray discovery in 2013 (Degenaar et al 2013)
- Radio pulsations P=3.7s (Eatough et al 2013)
- 2.4" = 0.1 pc in projection from Sgr A\*
- Orbital period > 700 yr (Bower et al 2015)
- Not suitable for GR but proof of concept for bound pulsar detection

### Unique ngVLA Capabilities for GC Pulsars

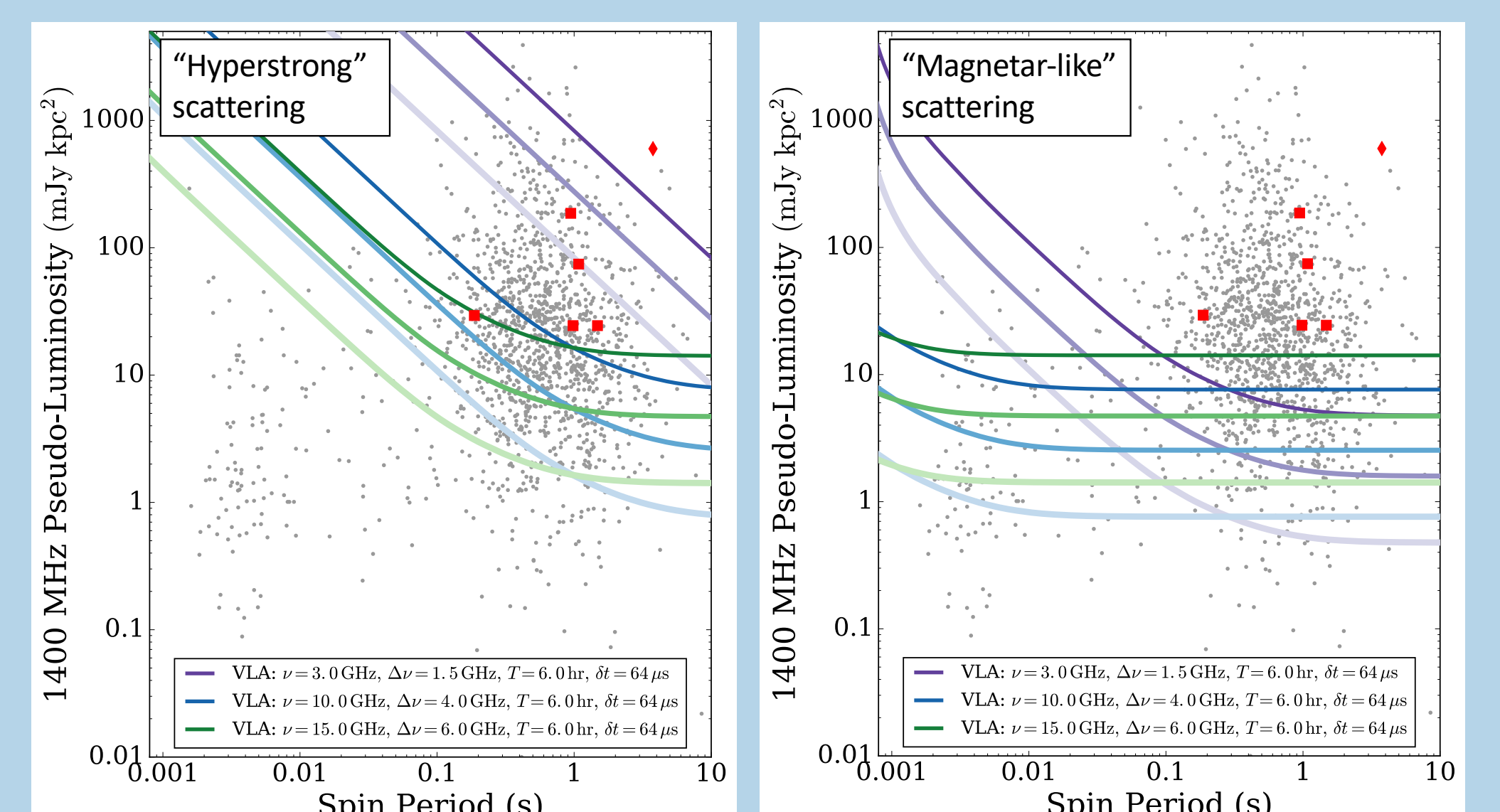
- High sensitivity at frequencies ~ 3 – 30 GHz
- Flexible wide-band DSP
  - Maximum BW per Rx (~8 GHz)
  - Sub-millisecond imaging
  - Beam-forming capability
- Central core suitable for phasing
- VLBI for astrometry

See Bower et al. (2018), "Galactic Center Pulsars with the ngVLA" in the *Science with a Next-Generation VLA* book for more details.

### Scattering limits low frequency pulsar detection:



### Detectability of the known pulsar population:







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