

NANOGrav

progress toward detecting a SMBHB
stochastic background



slide from Stephen Taylor (Vanderbilt)



ipta4gw.org

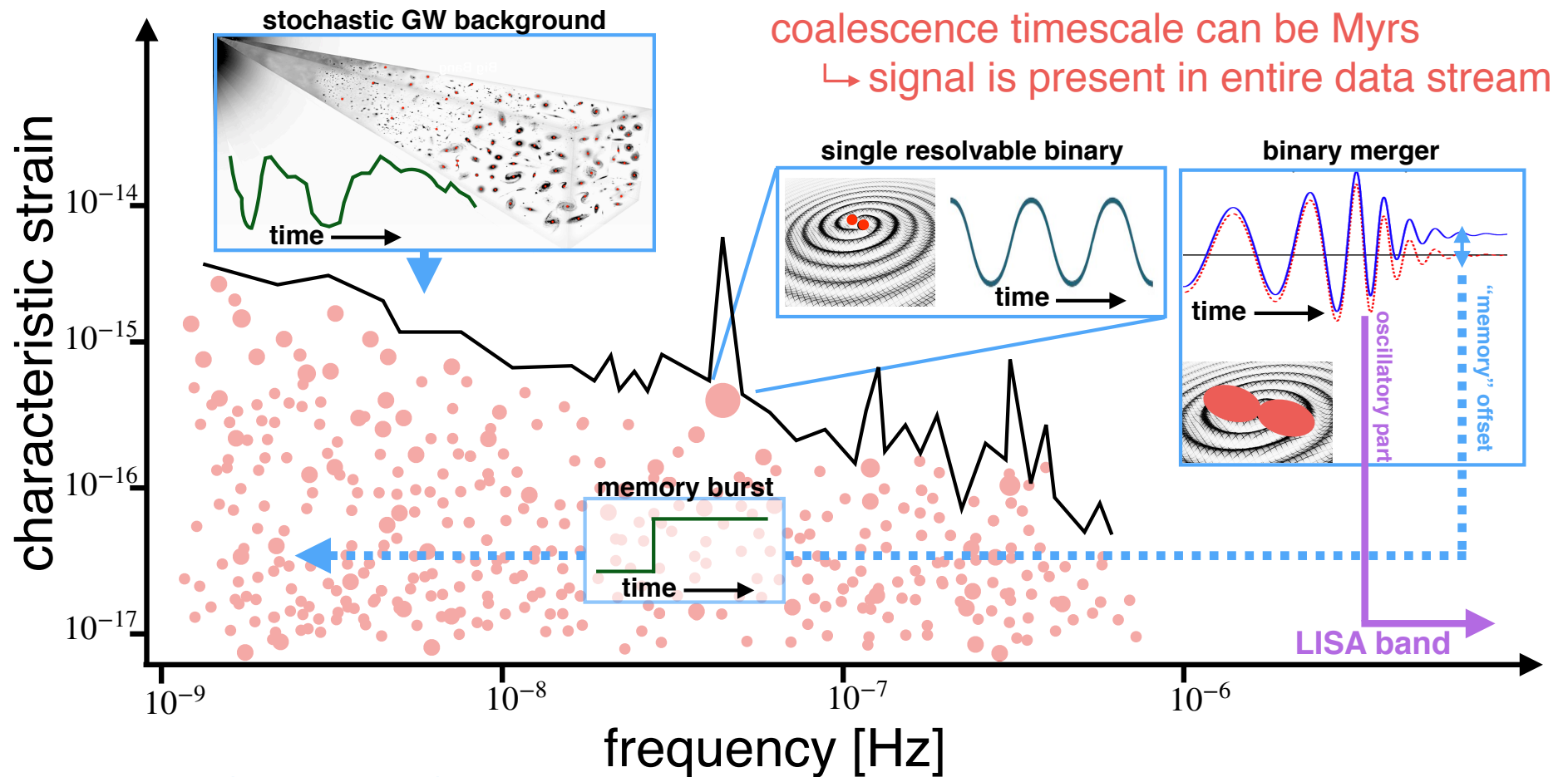


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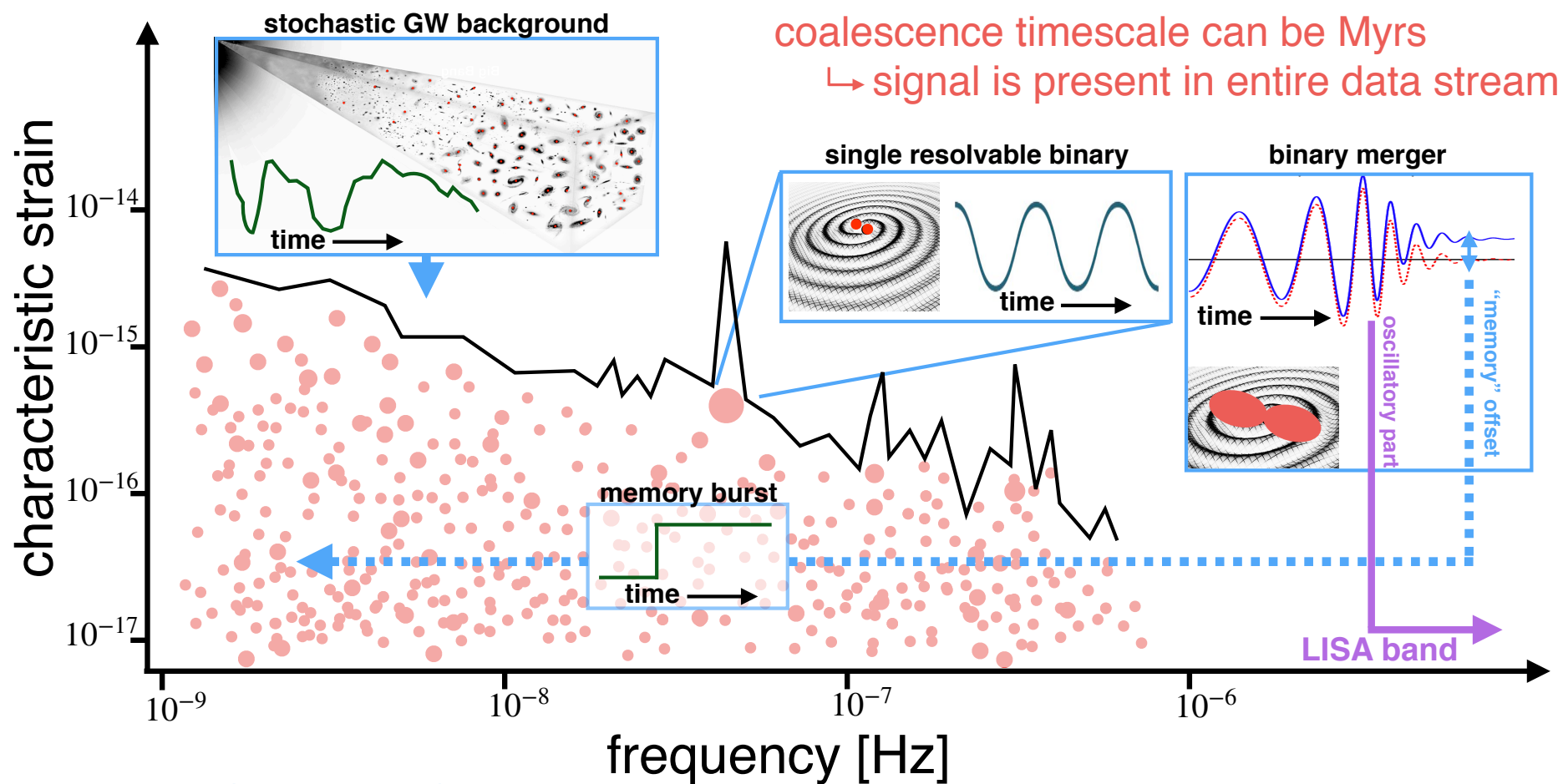


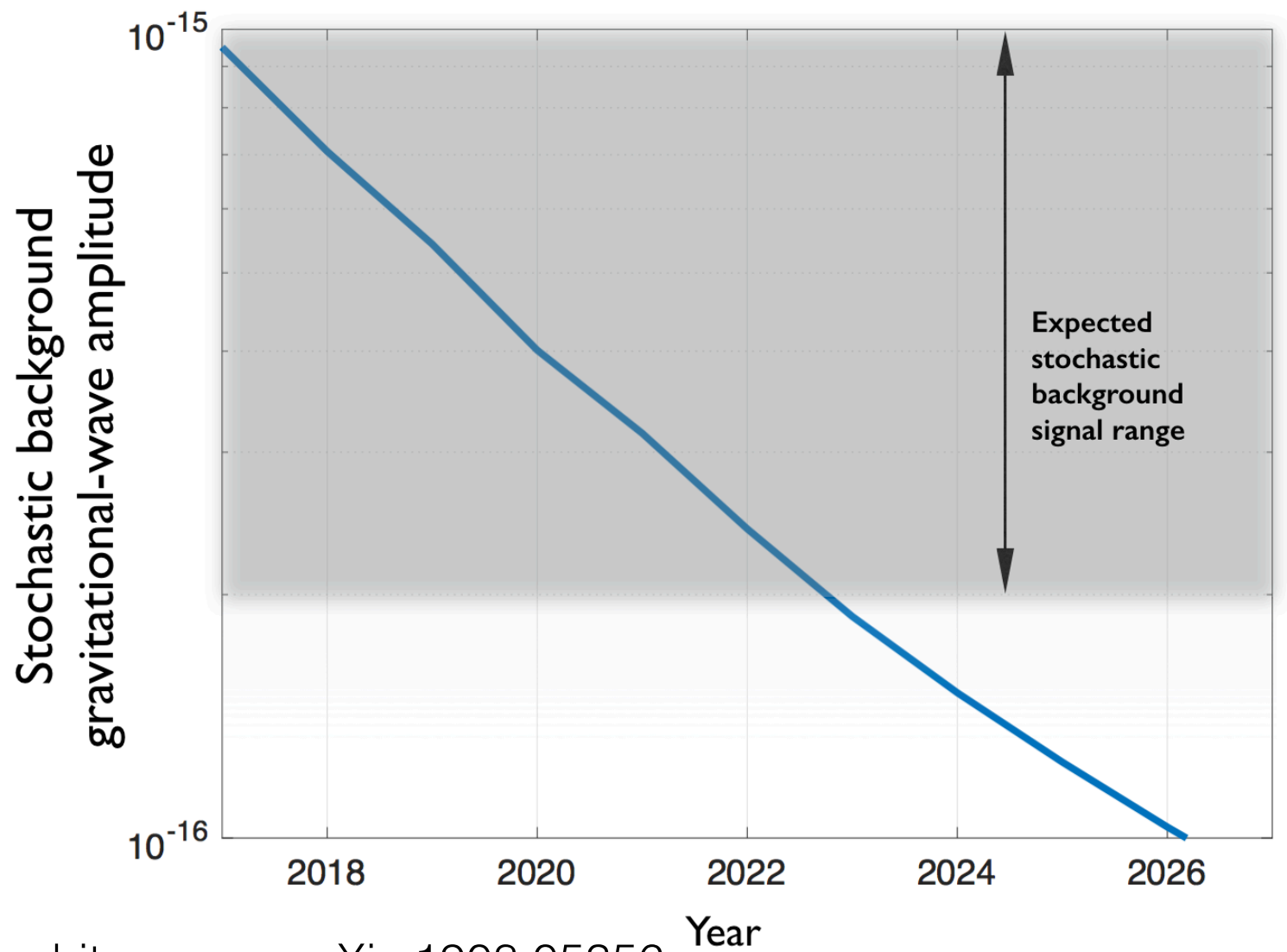
+ ...

Supermassive Binary Black Holes

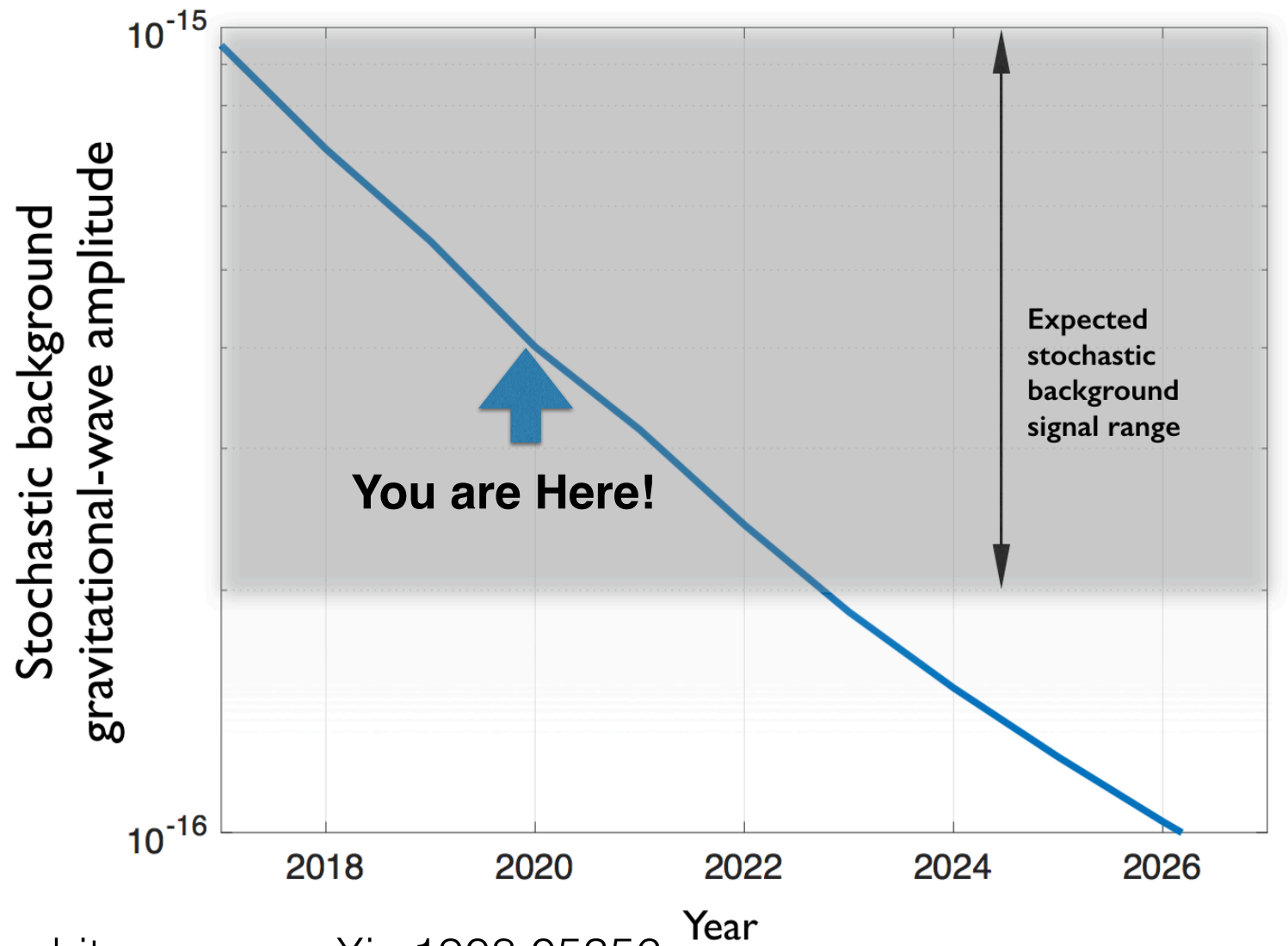


3 signals: stochastic, sinusoidal, burst



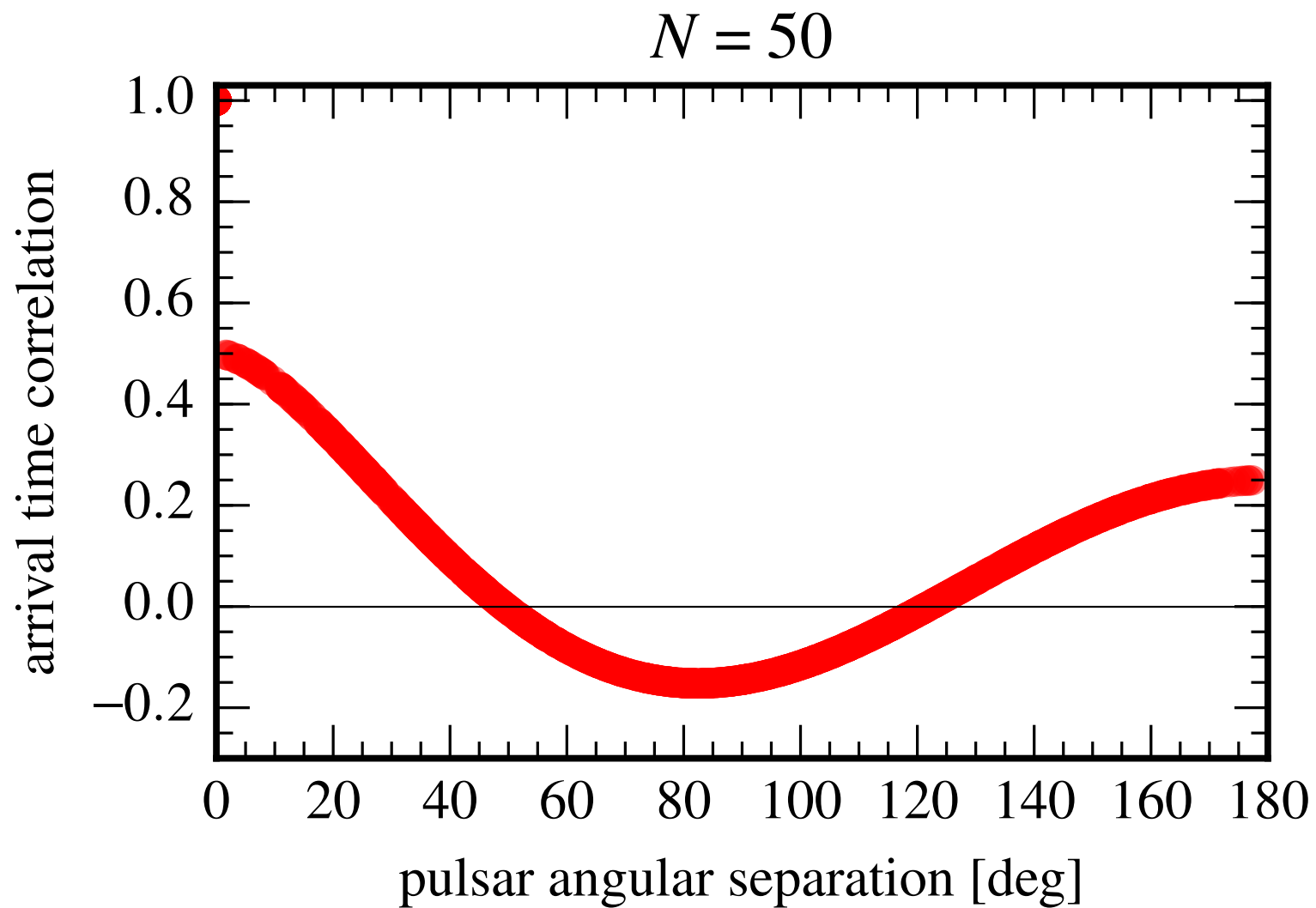


NANOGrav Project white paper: arXiv 1908.05356



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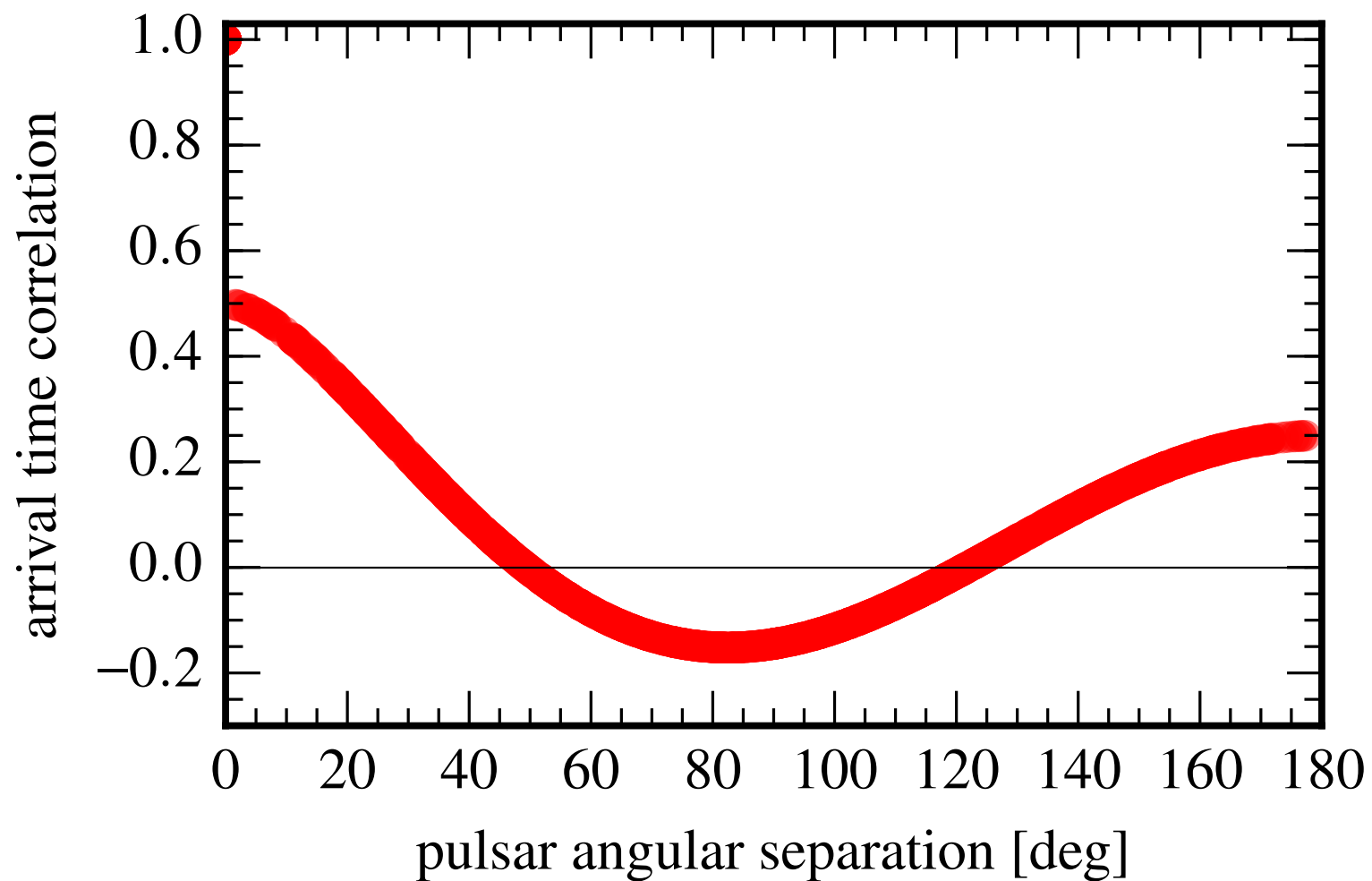
Hellings and Downs curve



Hellings and Downs curve

quadrupolar

$N = 50$

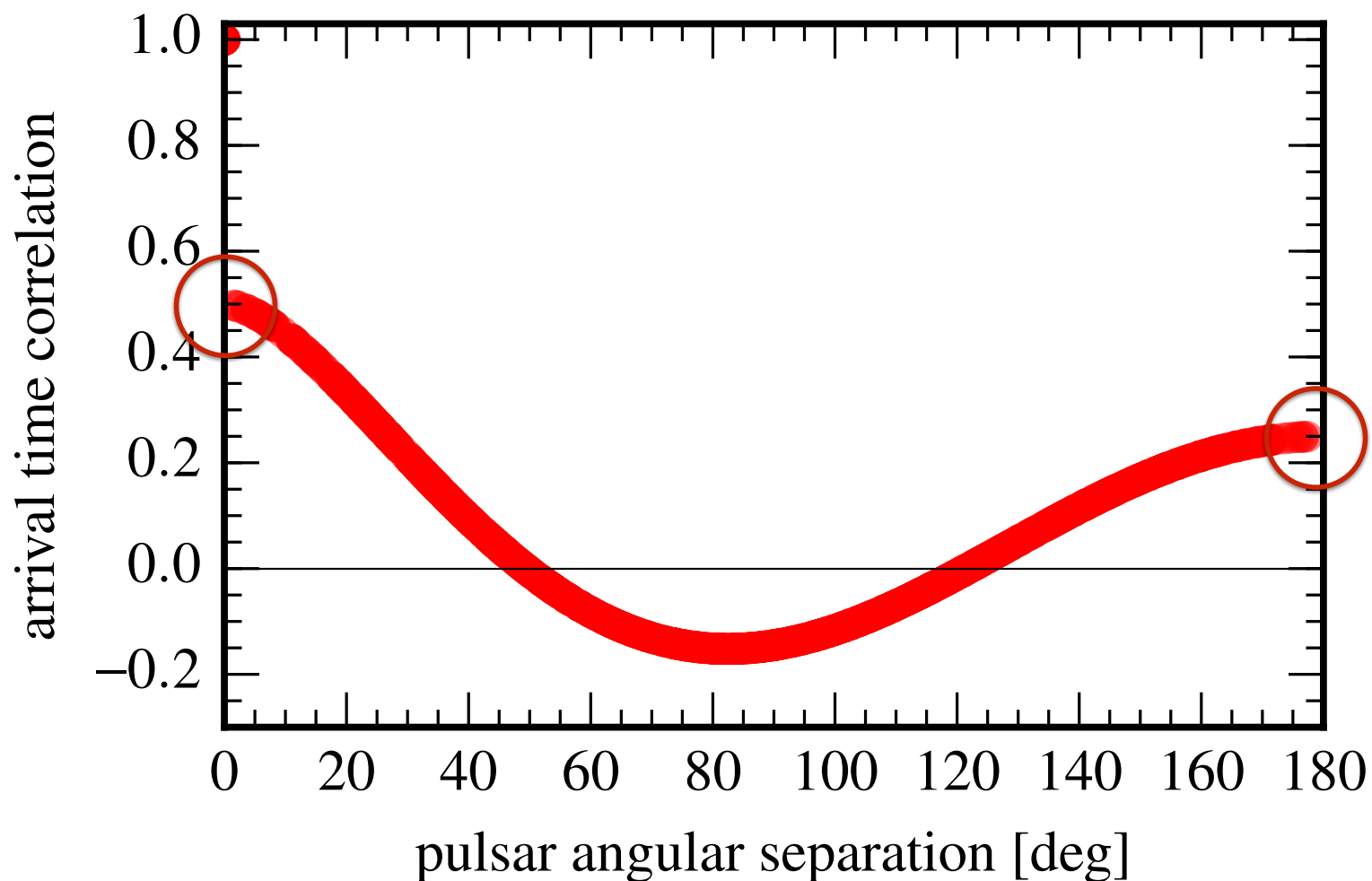


Hellings and Downs curve

quadrupolar

0° and 180°
correlated
delays

$N = 50$

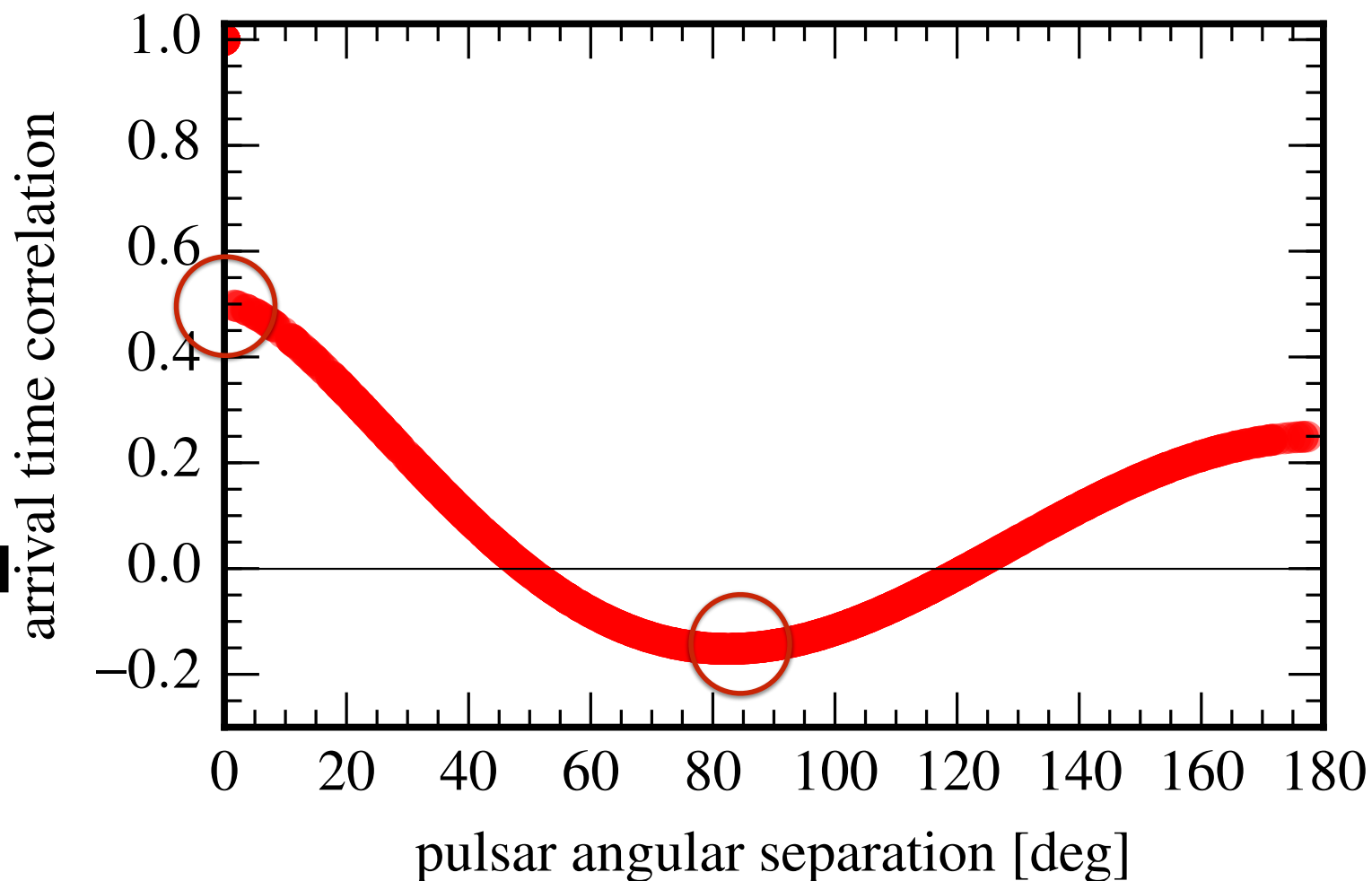


Hellings and Downs curve

quadrupolar

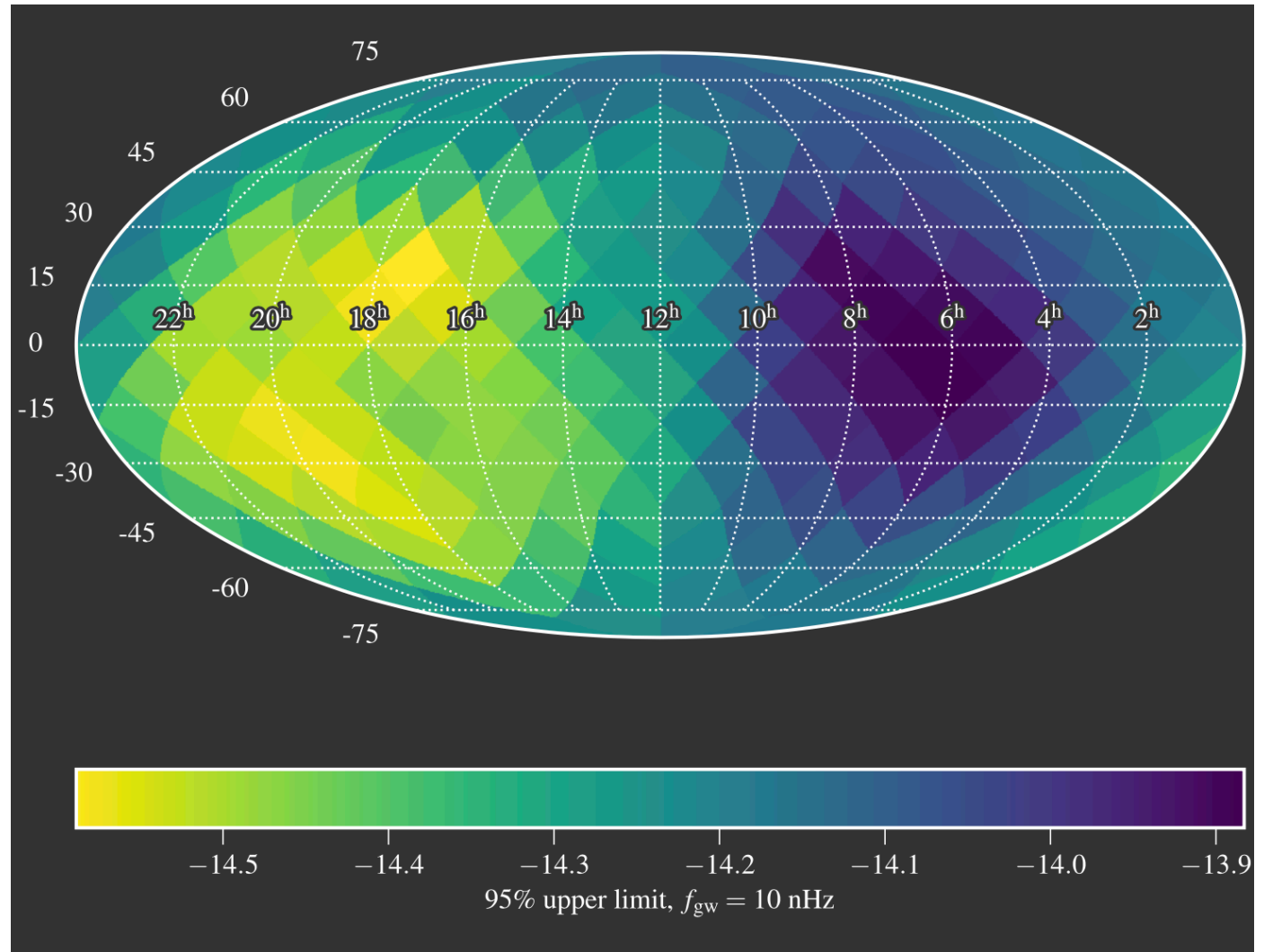
90° apart
anti-correlated
delays

$N = 50$

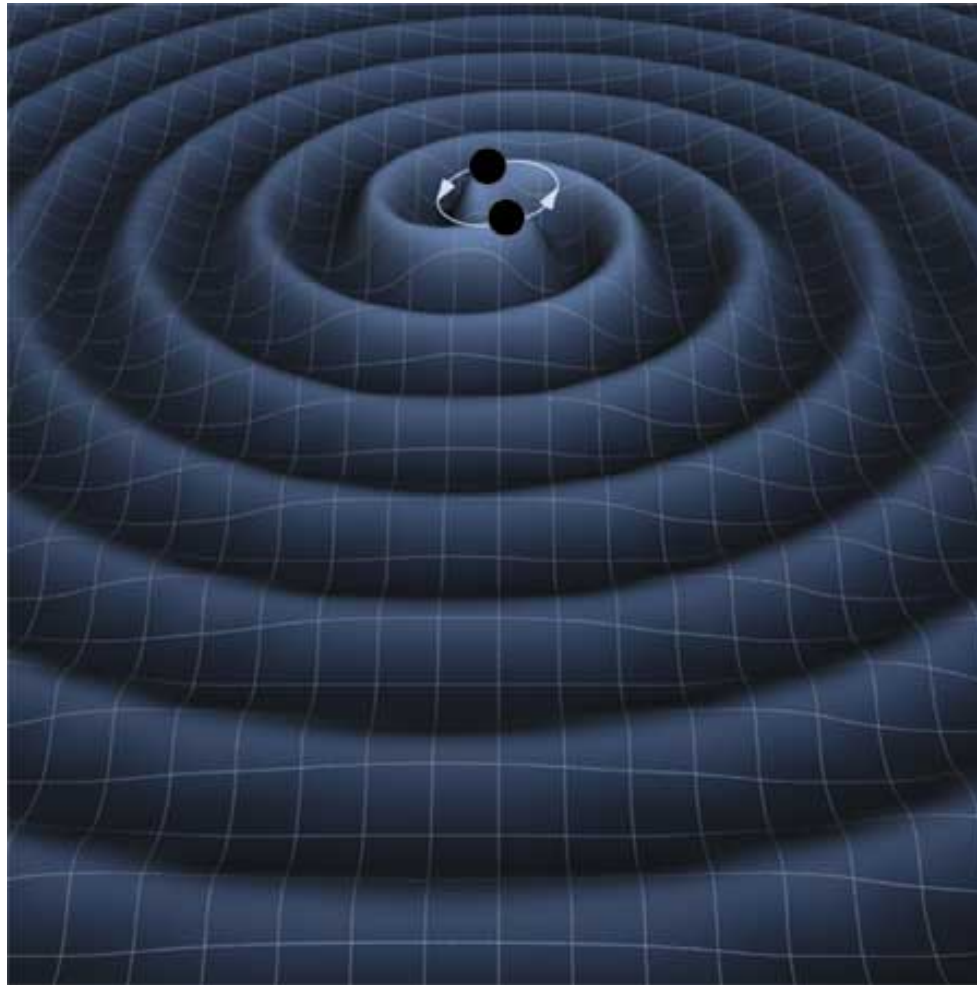


<http://gravcalc.org/>

**Andrea Lommen
(Haverford)
and students**



NANOGrav: 9 year, 11 year, 12.5 year, 14 year



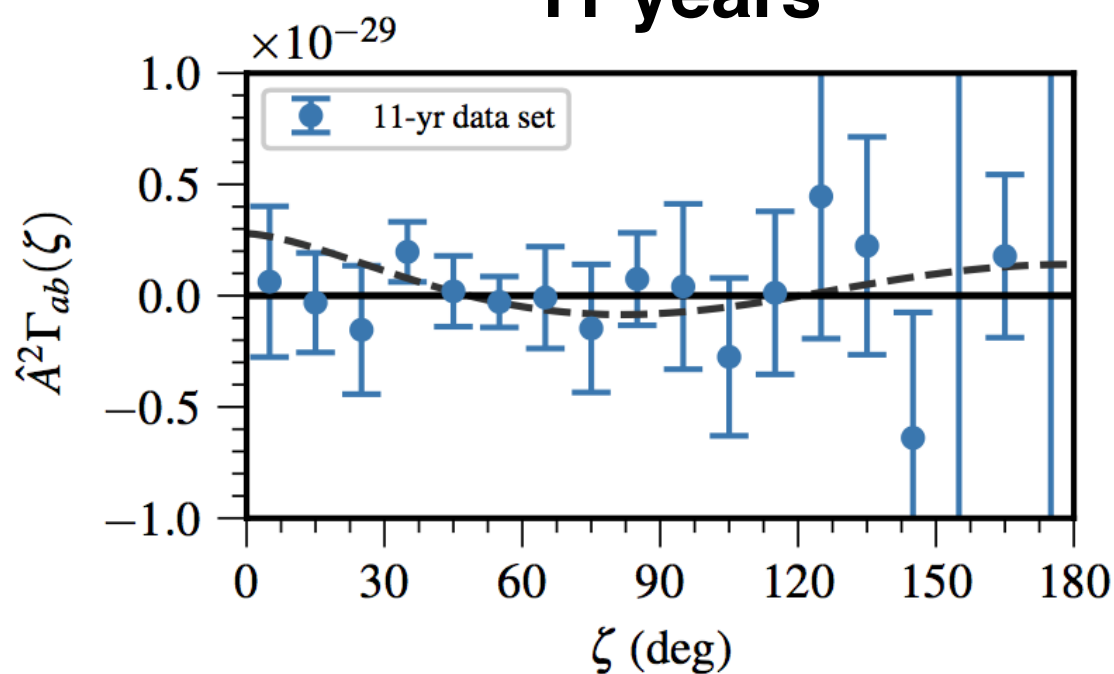
NANOGrav: 9 year, 11 year, 12.5 year, 14 year



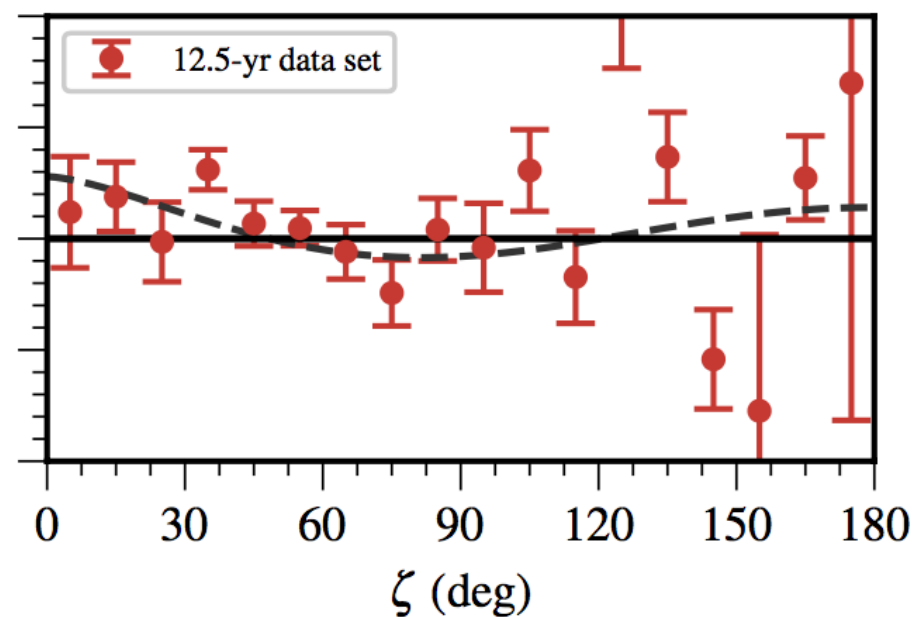
The GW upper limit has stopped going down at the expected rate

Hellings & Downs curve

11 years



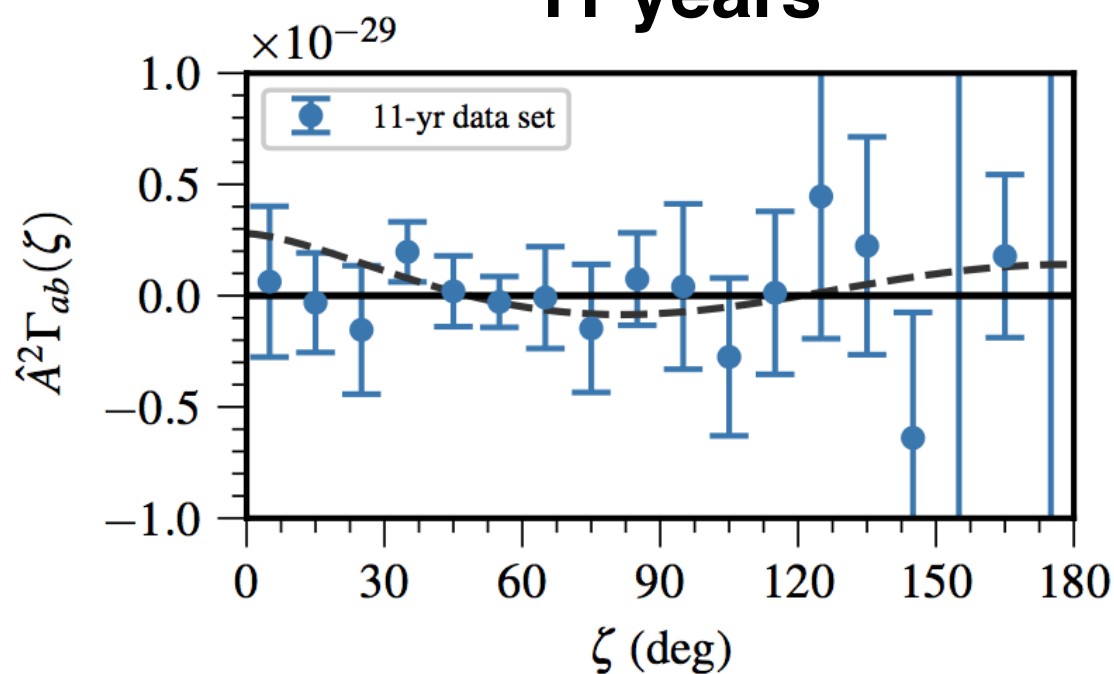
12.5 years



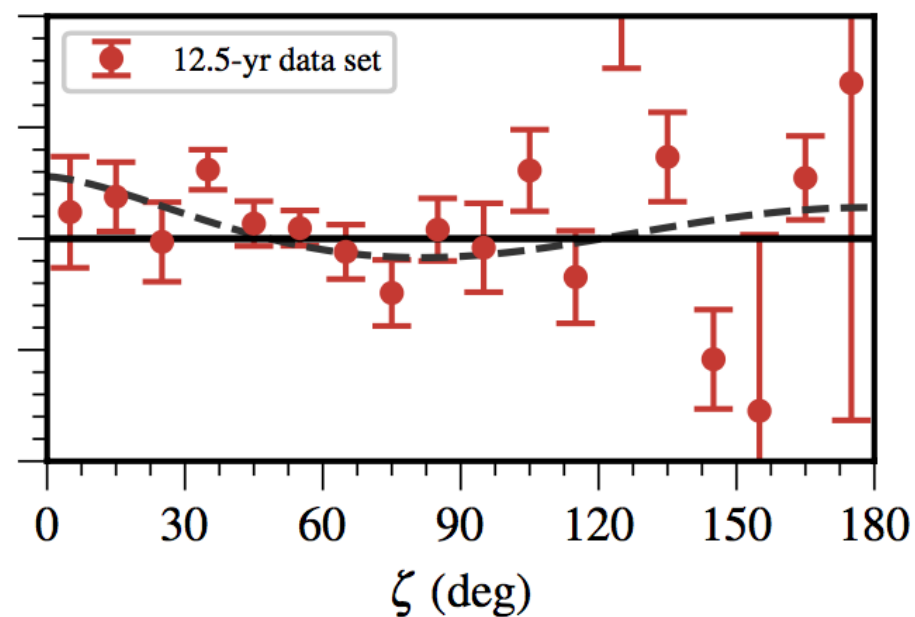
credit: **Sarah Vigeland** (U Wisconsin-Milwaukee)

Hellings & Downs curve (emerging?)

11 years



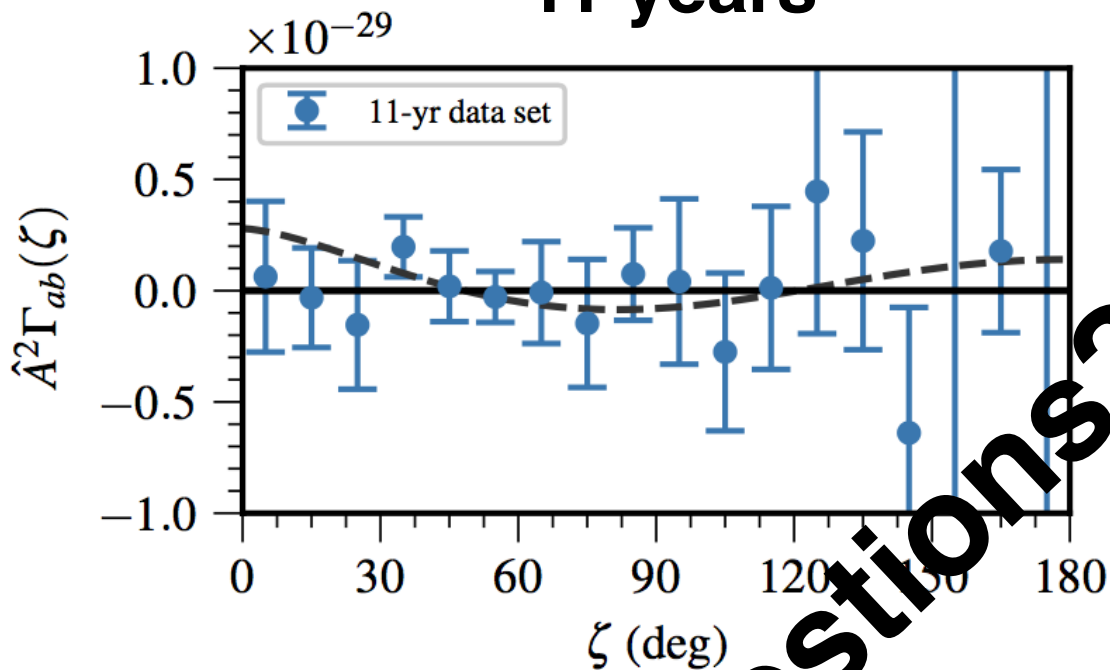
12.5 years



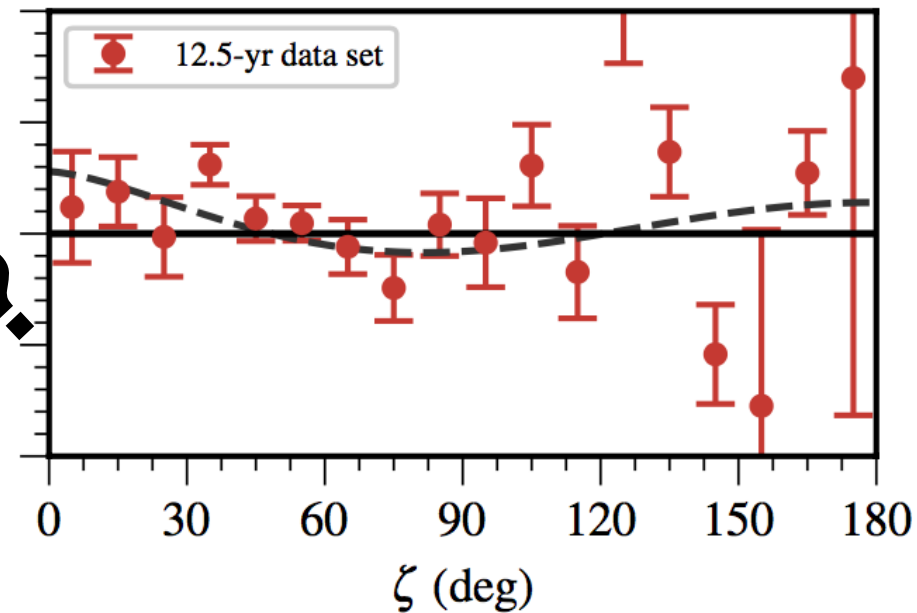
credit: **Sarah Vigeland** (U Wisconsin-Milwaukee)

Hellings & Downs curve (emerging?)

11 years



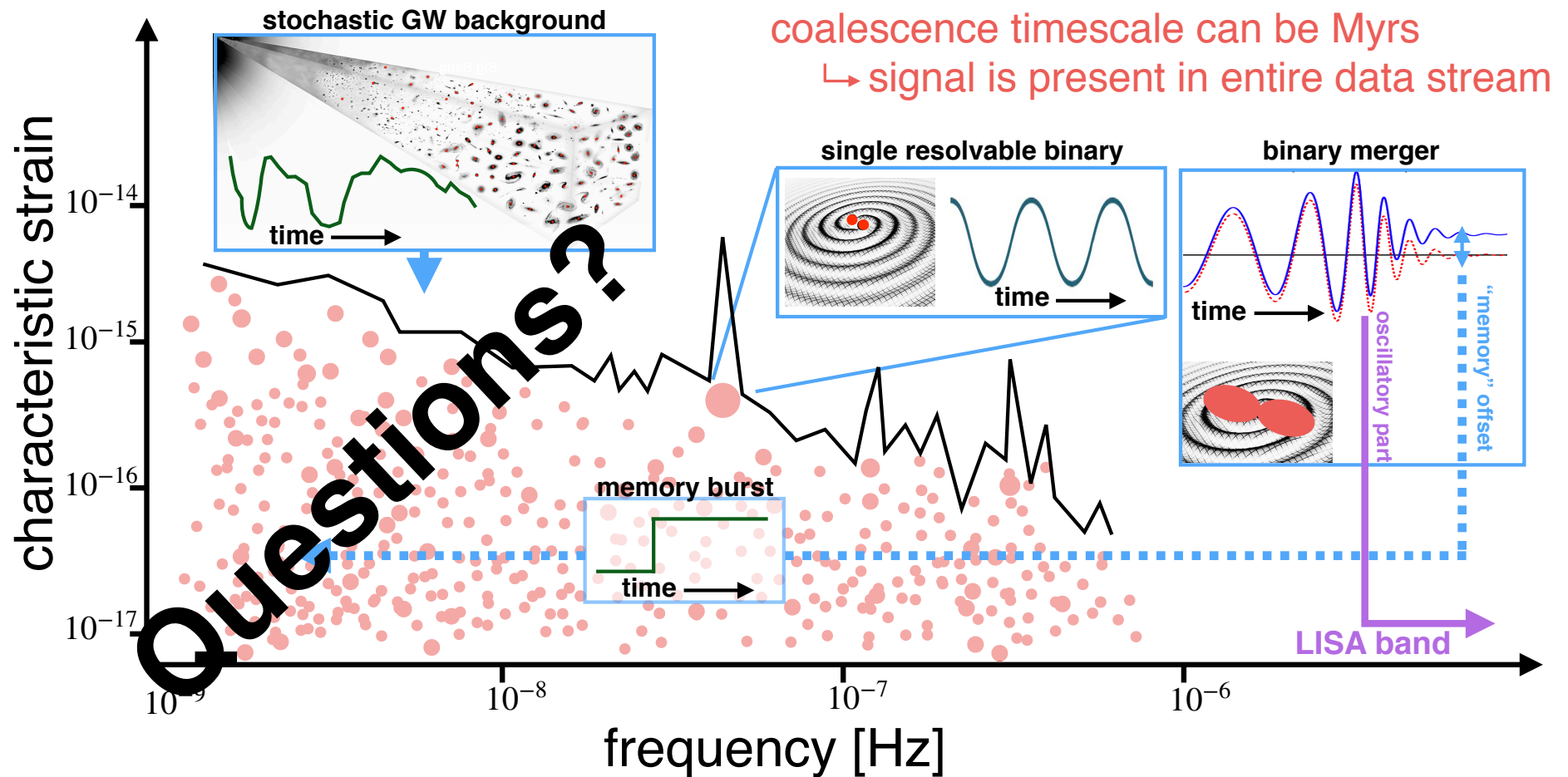
12.5 years

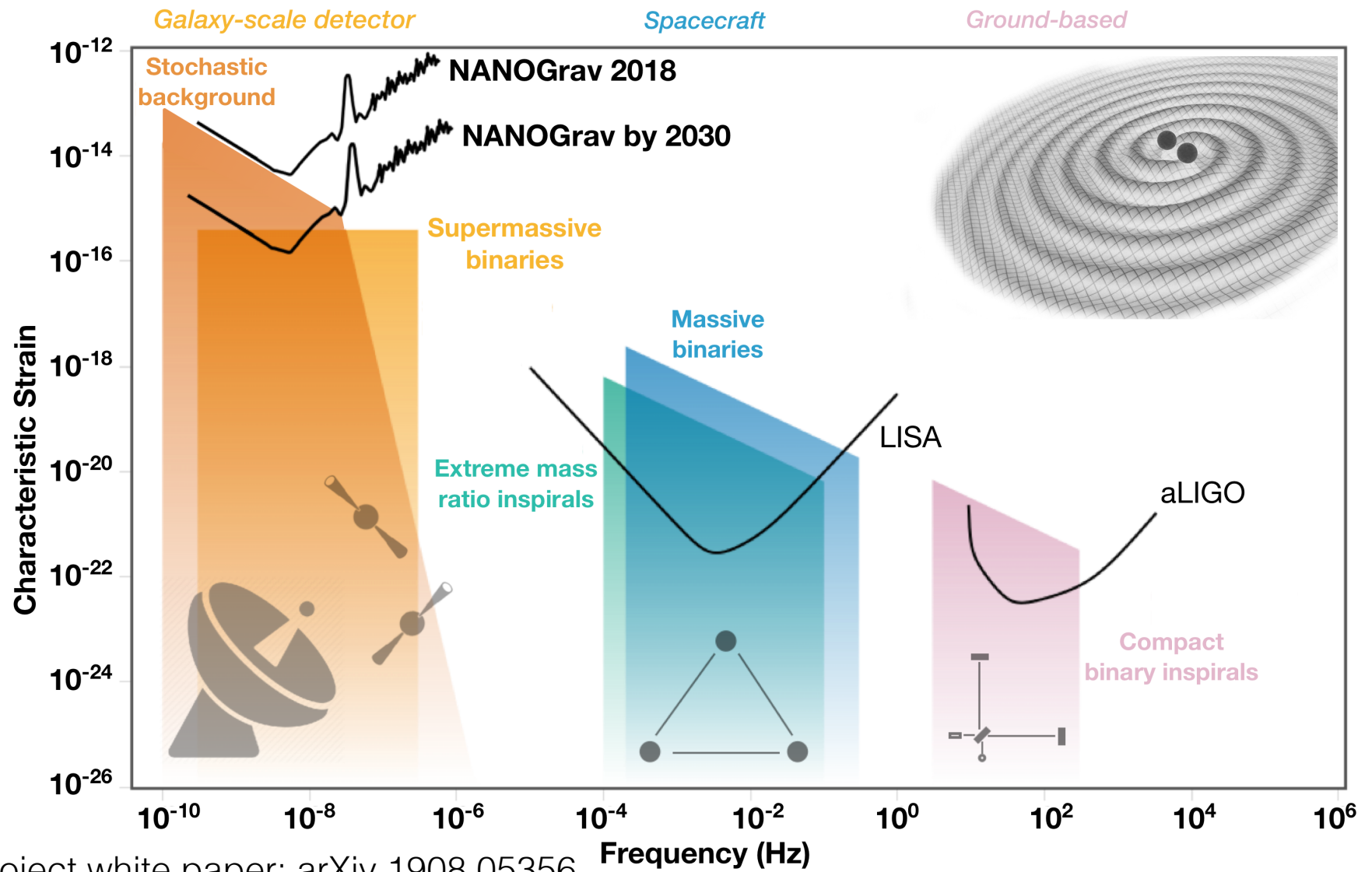


Questions?

credit: **Sarah Vigeland** (U Wisconsin-Milwaukee)

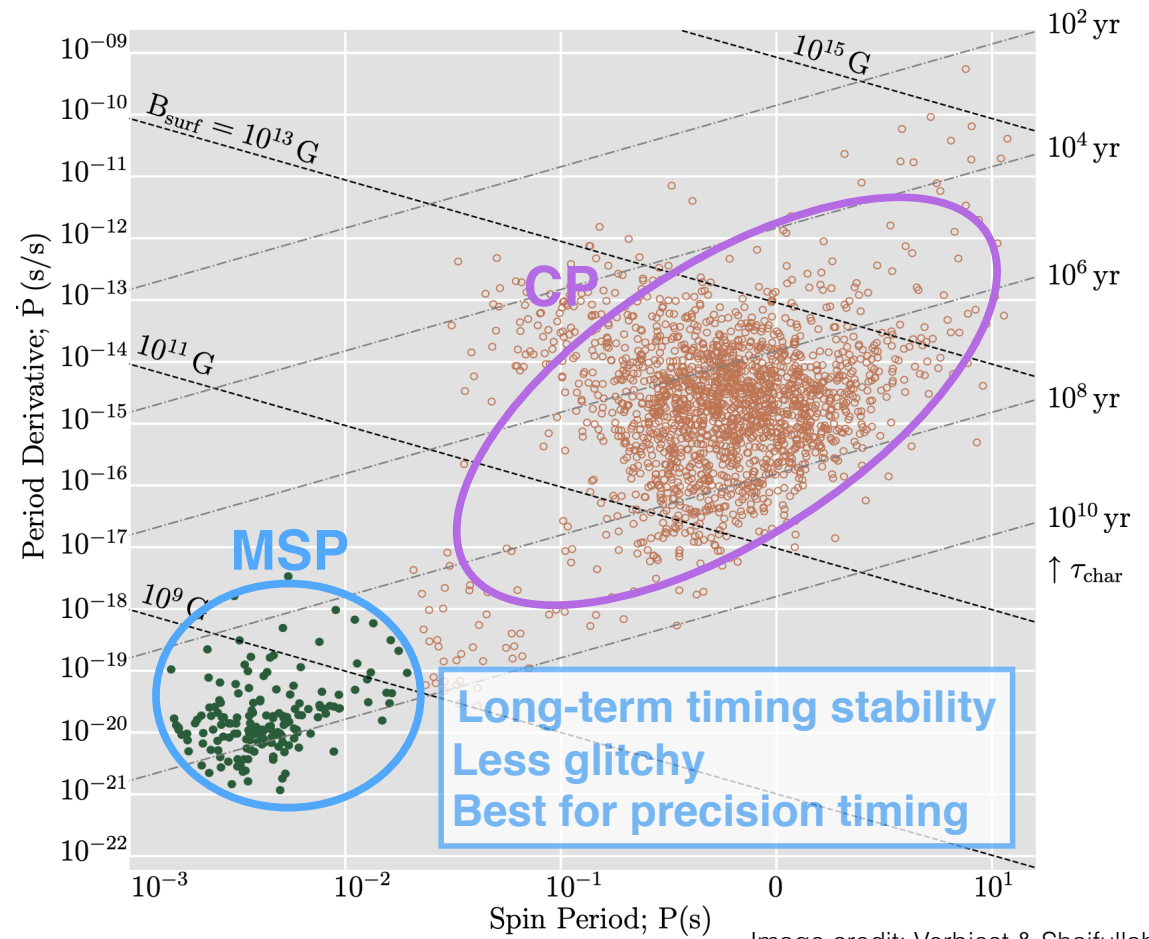
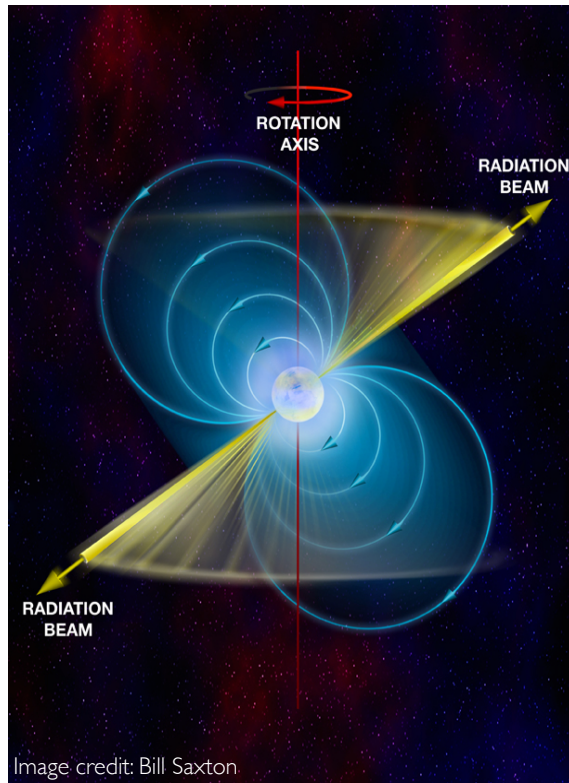
Supermassive Binary Black Holes



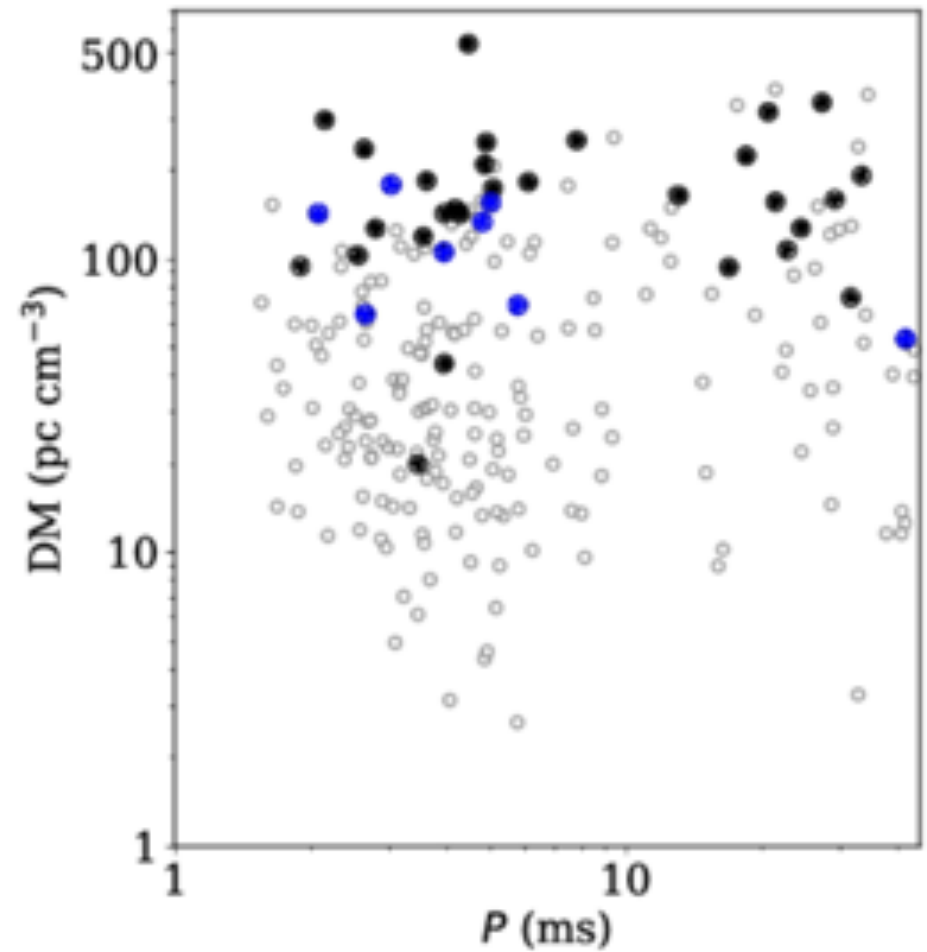


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Pulsars



Adding pulsars to the Array
an international effort



Adding pulsars to the Array
an international effort

