Black Hole Physics With Gravitational Waves

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and
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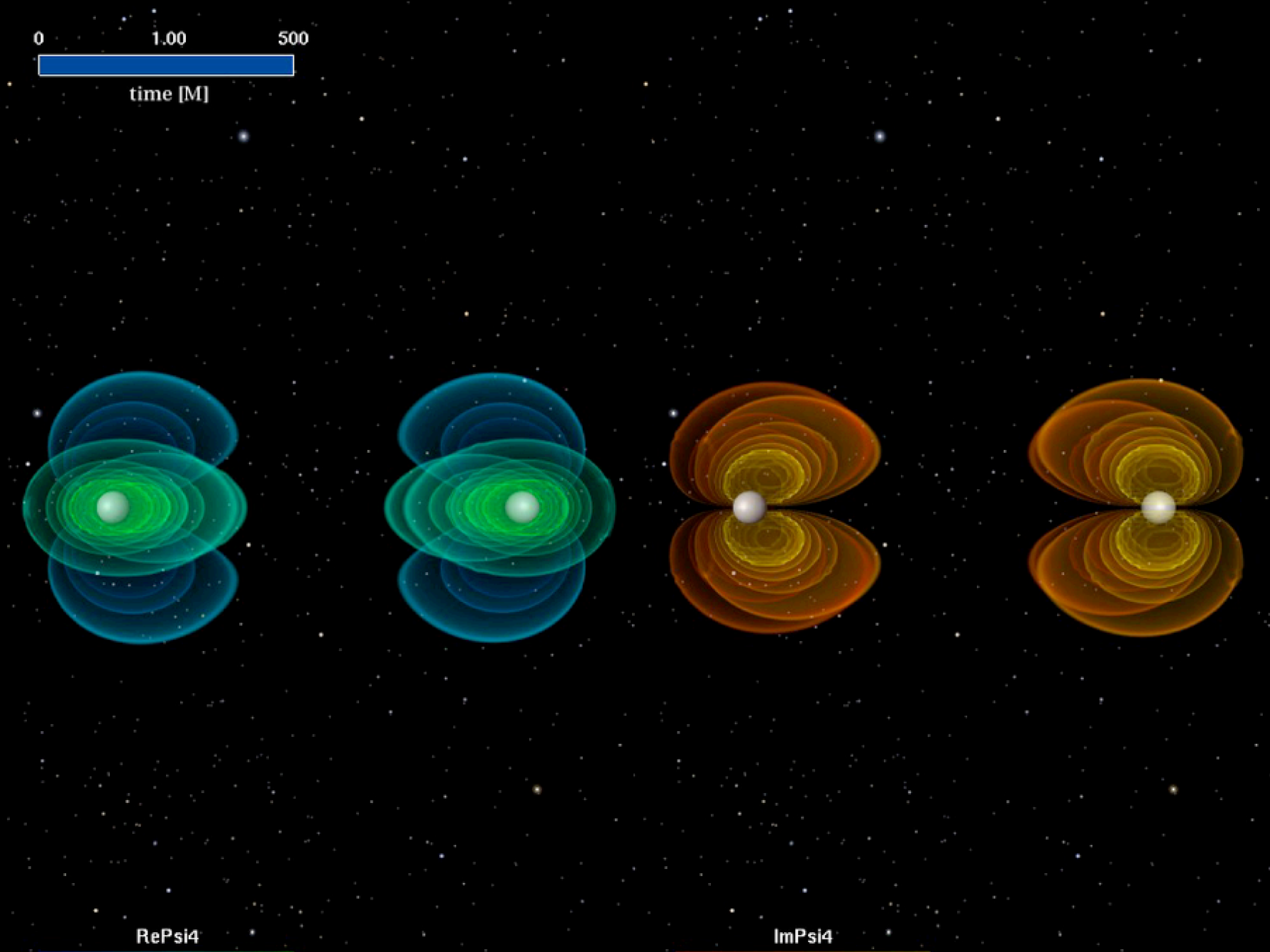
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- Similarly, the rate of BH-NS coalescences is 10 yr^{-1} within an interval $(0.2, 300)$ yr^{-1}.

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- See talk by Kokkotas about NS sources of GWs.

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  - H_0 likely determined to better than 1% in one year, test for inhomogeneities (local void), anisotropies

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- See talk by Cutler on cosmology with these systems.

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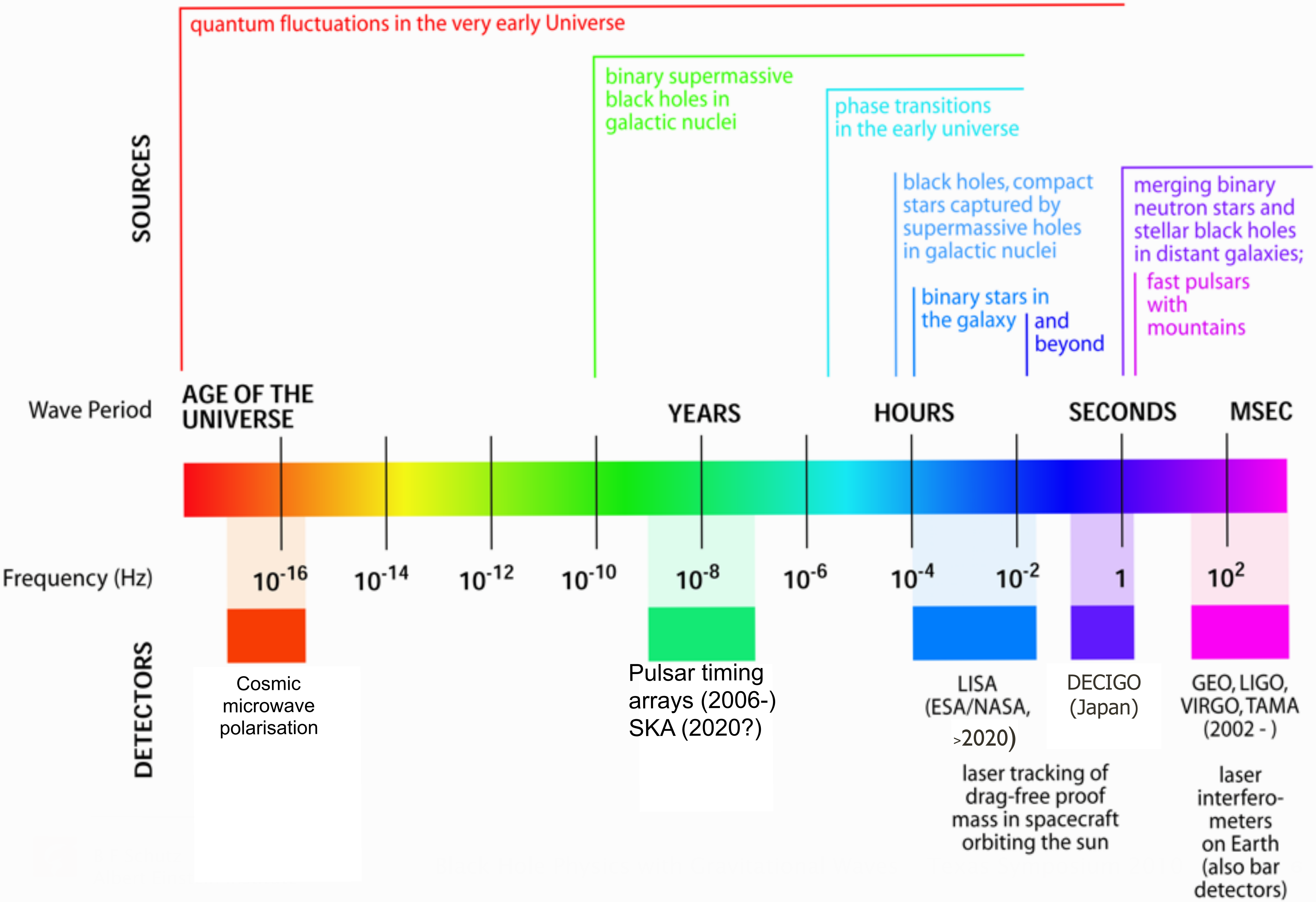

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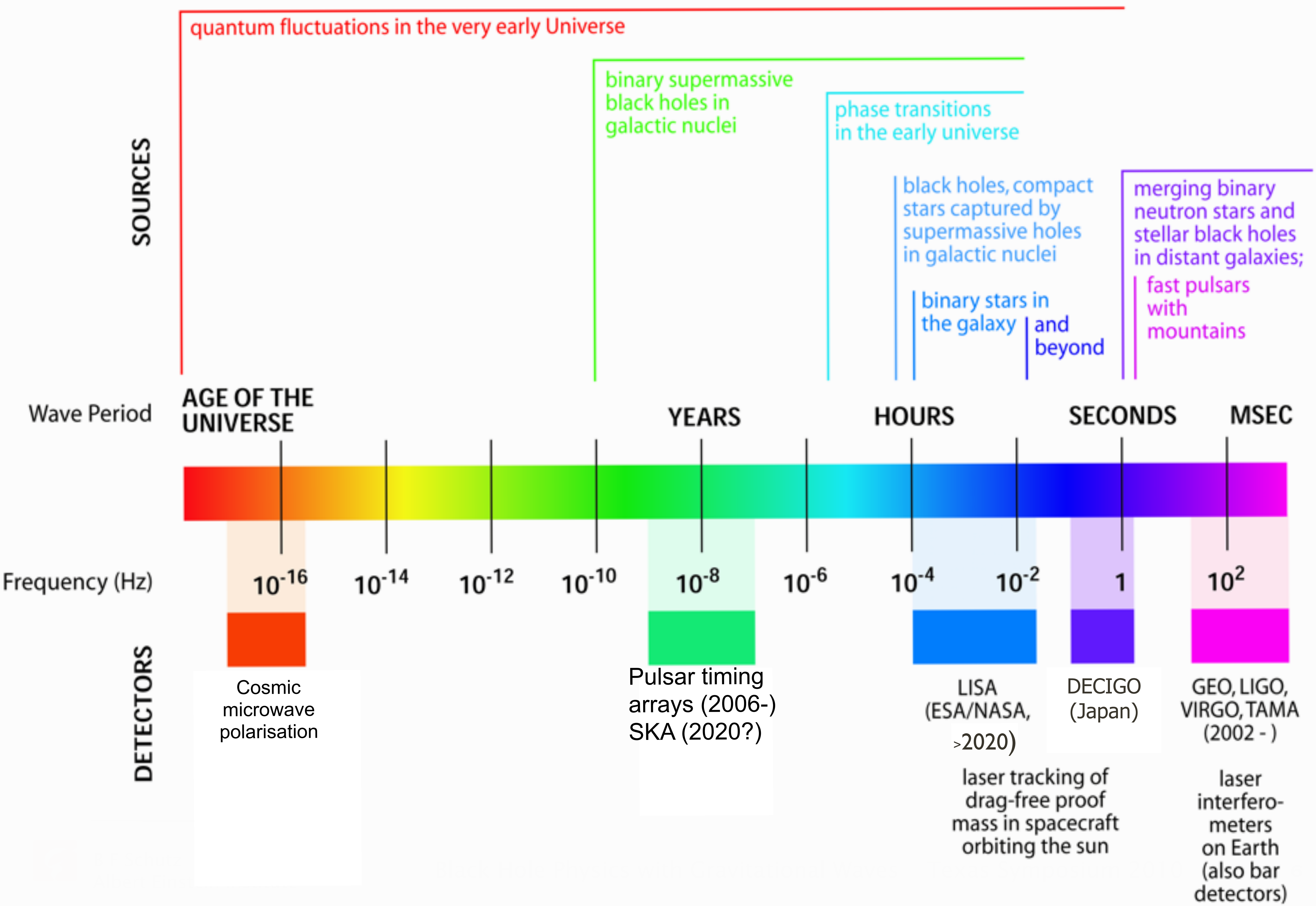

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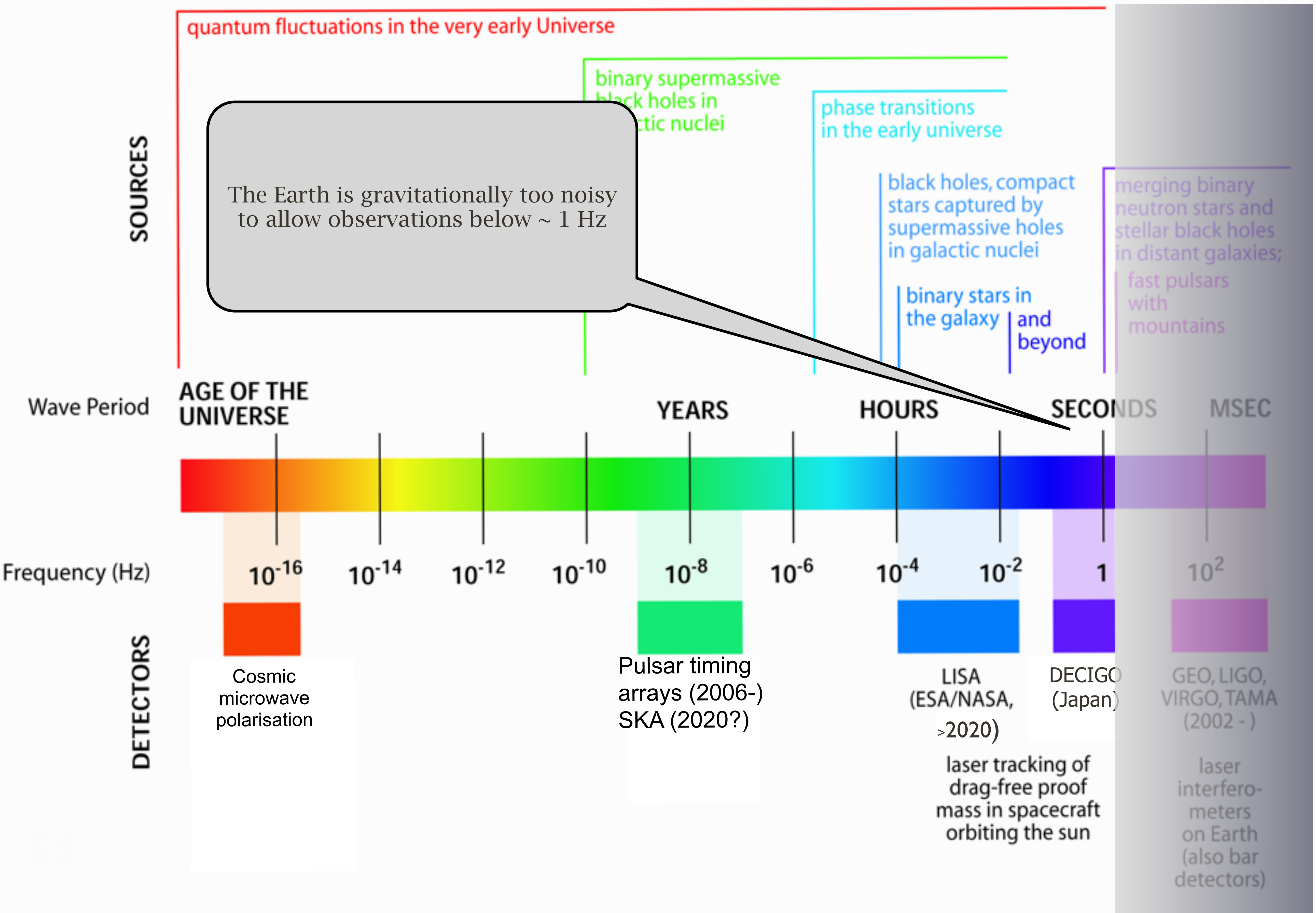
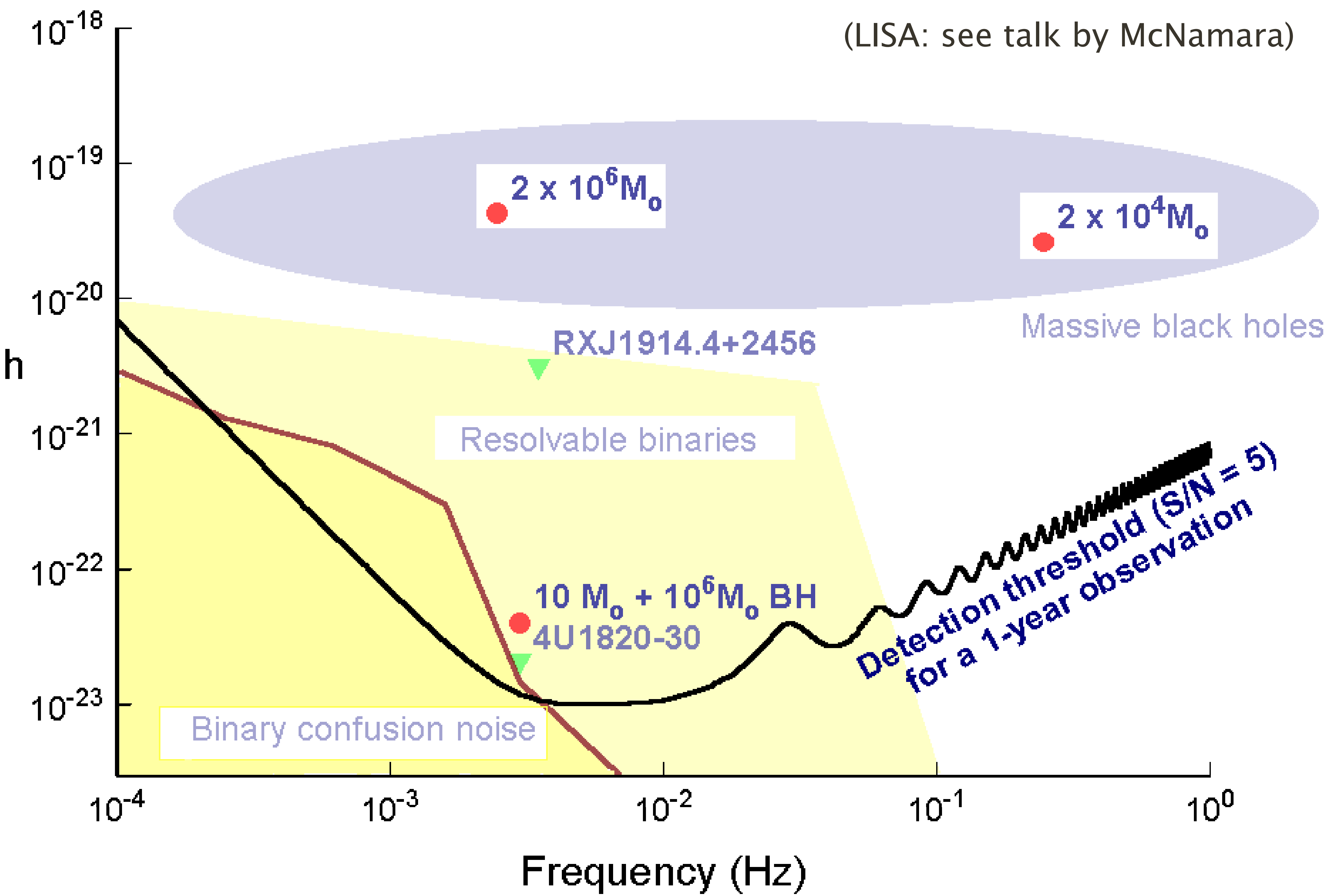


LISA Sensitivity



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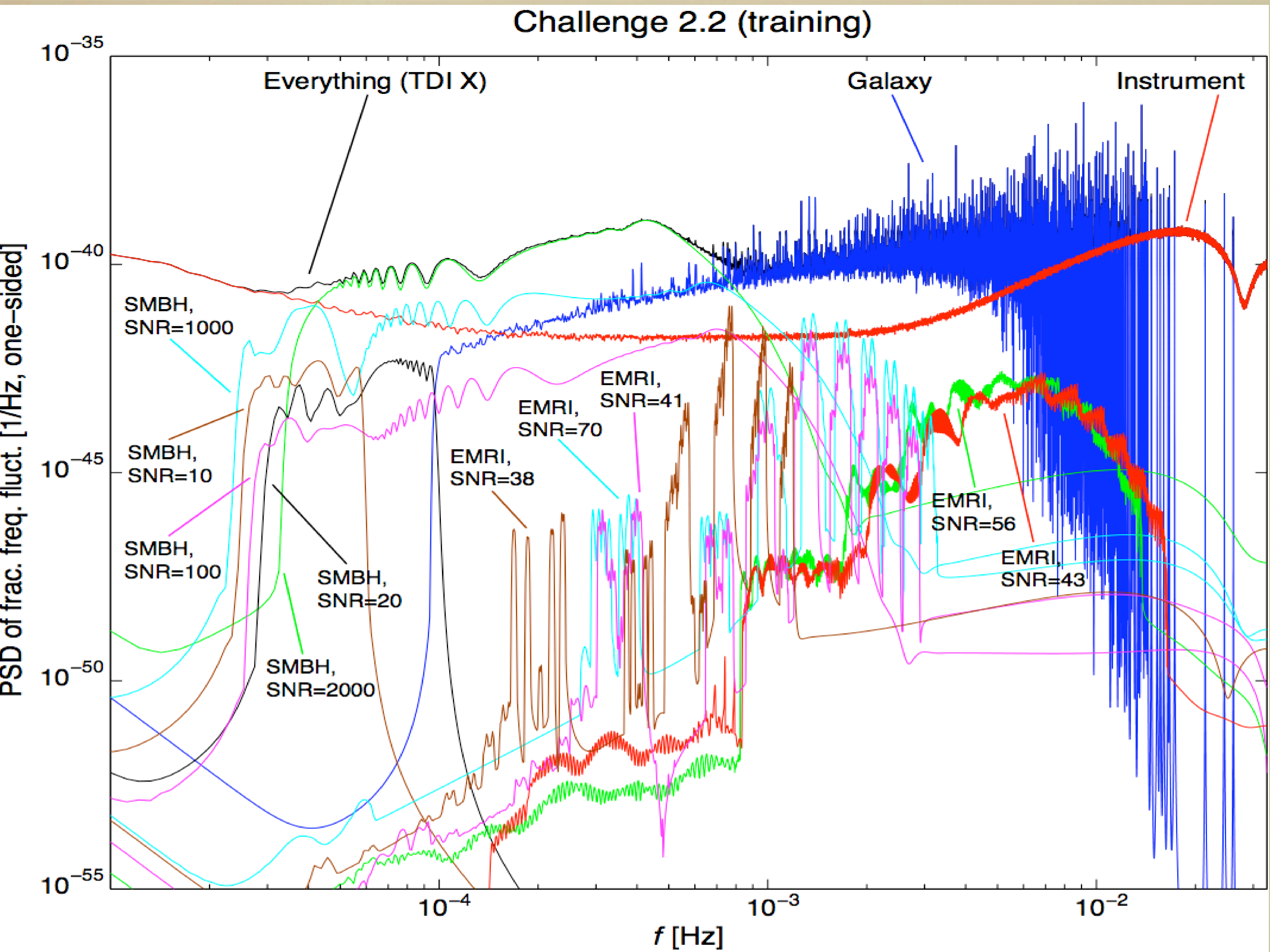

Challenge 2.2 (training)
Everything (TDI X)
Galaxy
Instrument
SMBH,
SNR=1000
SMBH,
SNR=10
SMBH,
SNR=100
SMBH,
SNR=20
SMBH,
SNR=2000
EMRI,
SNR=38
EMRI,
SNR=70
EMRI,
SNR=41
EMRI,
SNR=56
EMRI,
SNR=43
PSD of frac. freq. fluct. [1/Hz, one-sided]
10^{-35}
10^{-40}
10^{-45}
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f [Hz]

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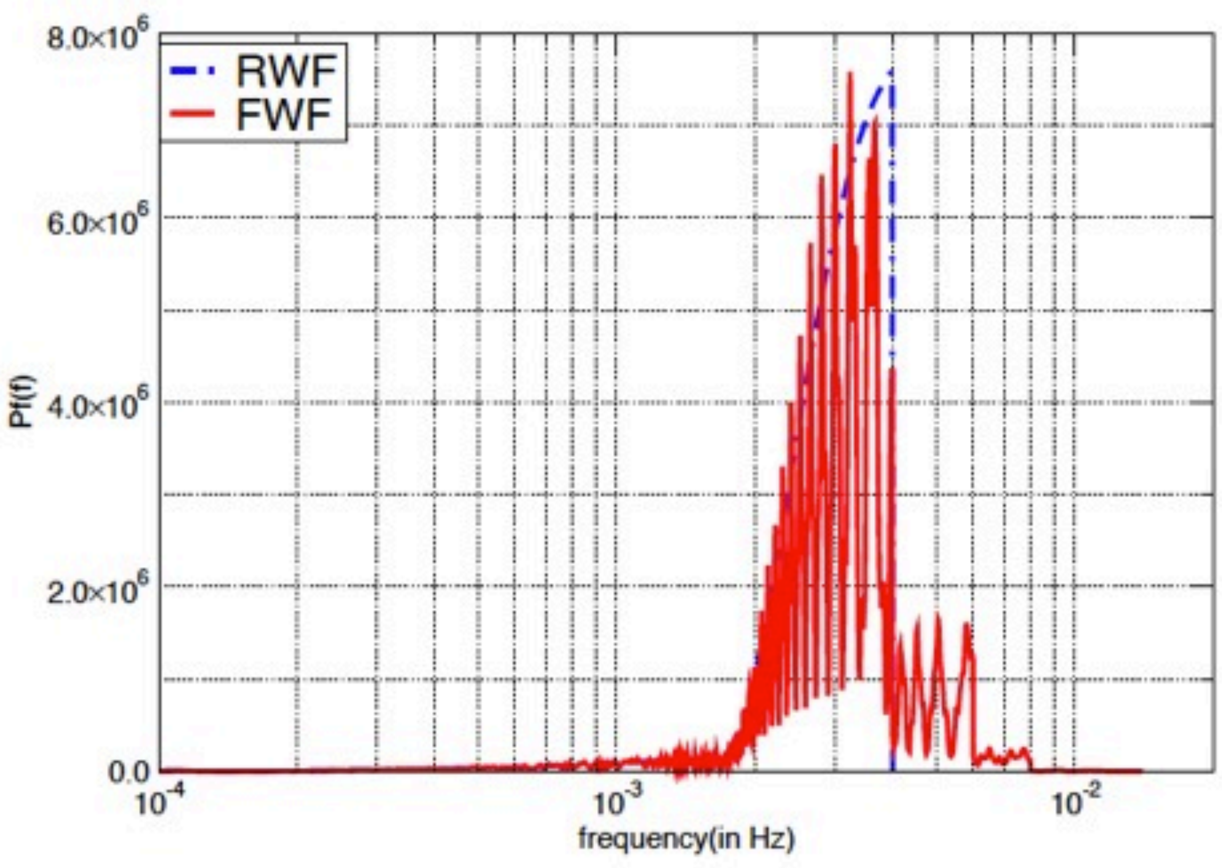
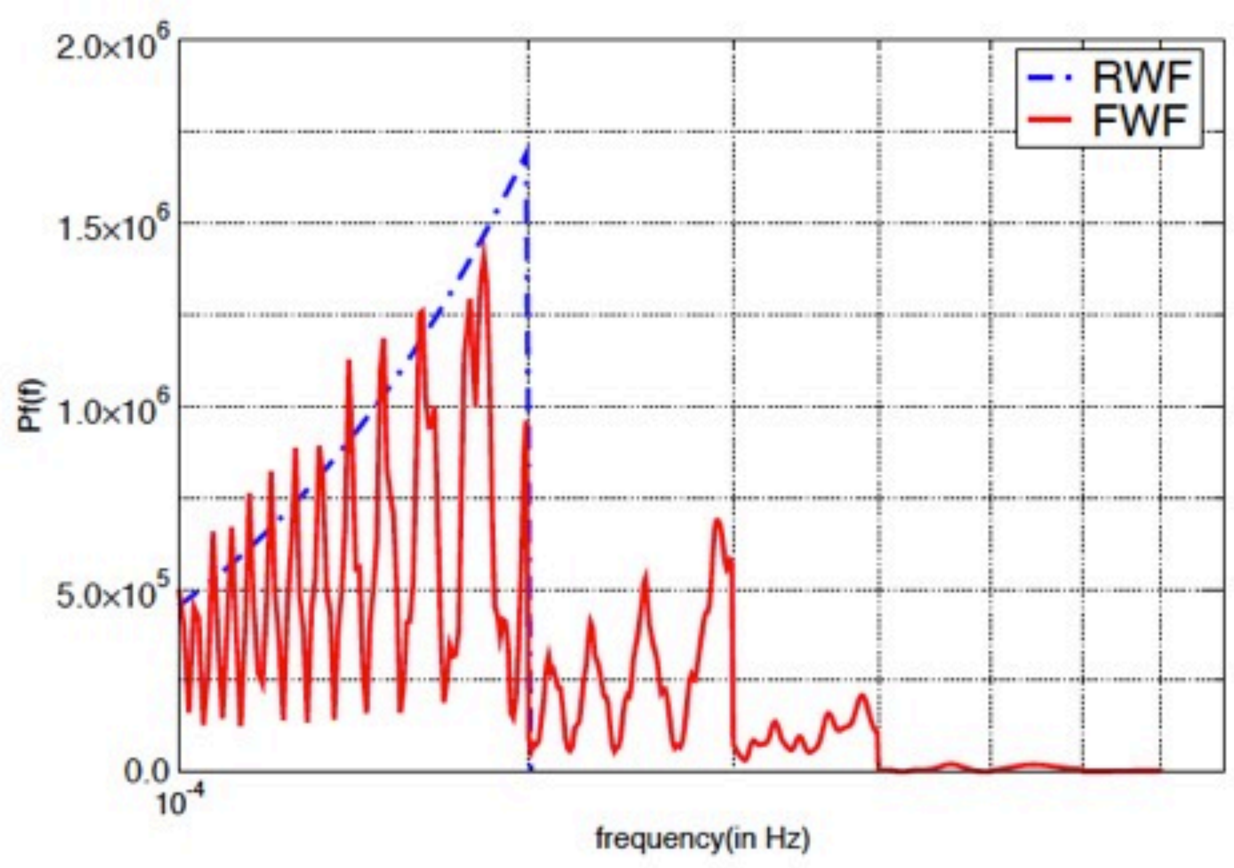
Arun, et al, 2007





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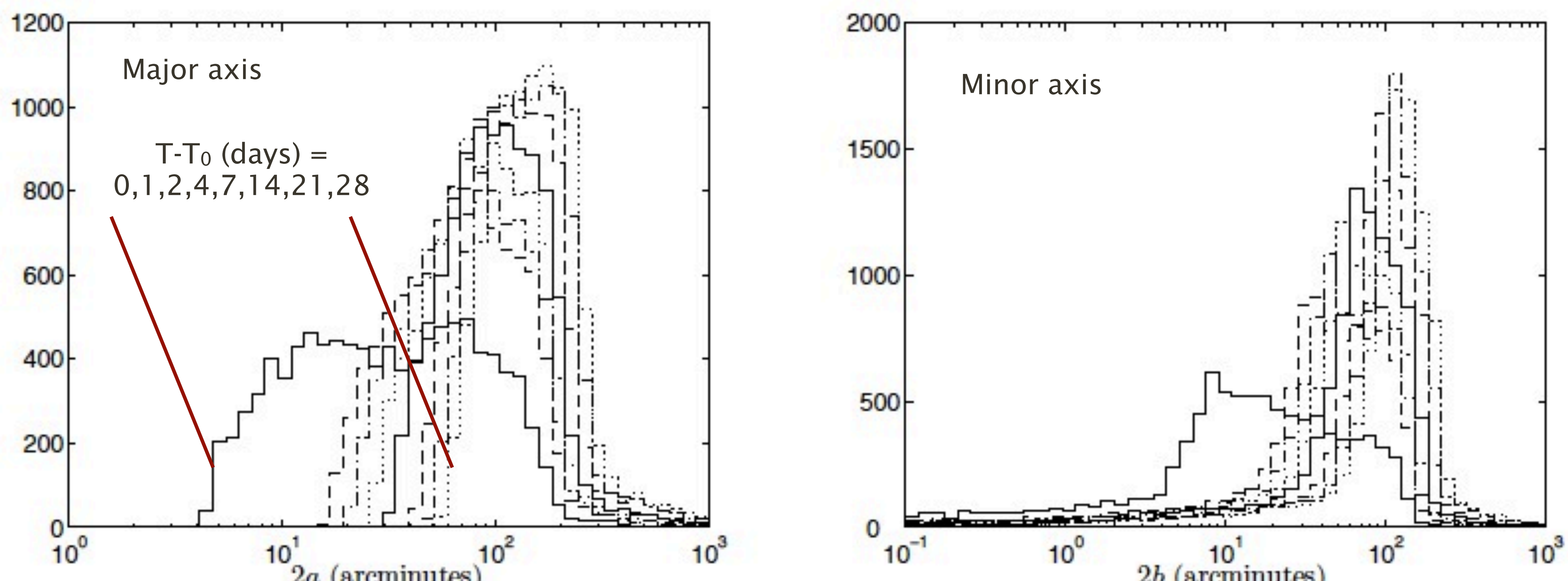

Lang & Hughes (2007)

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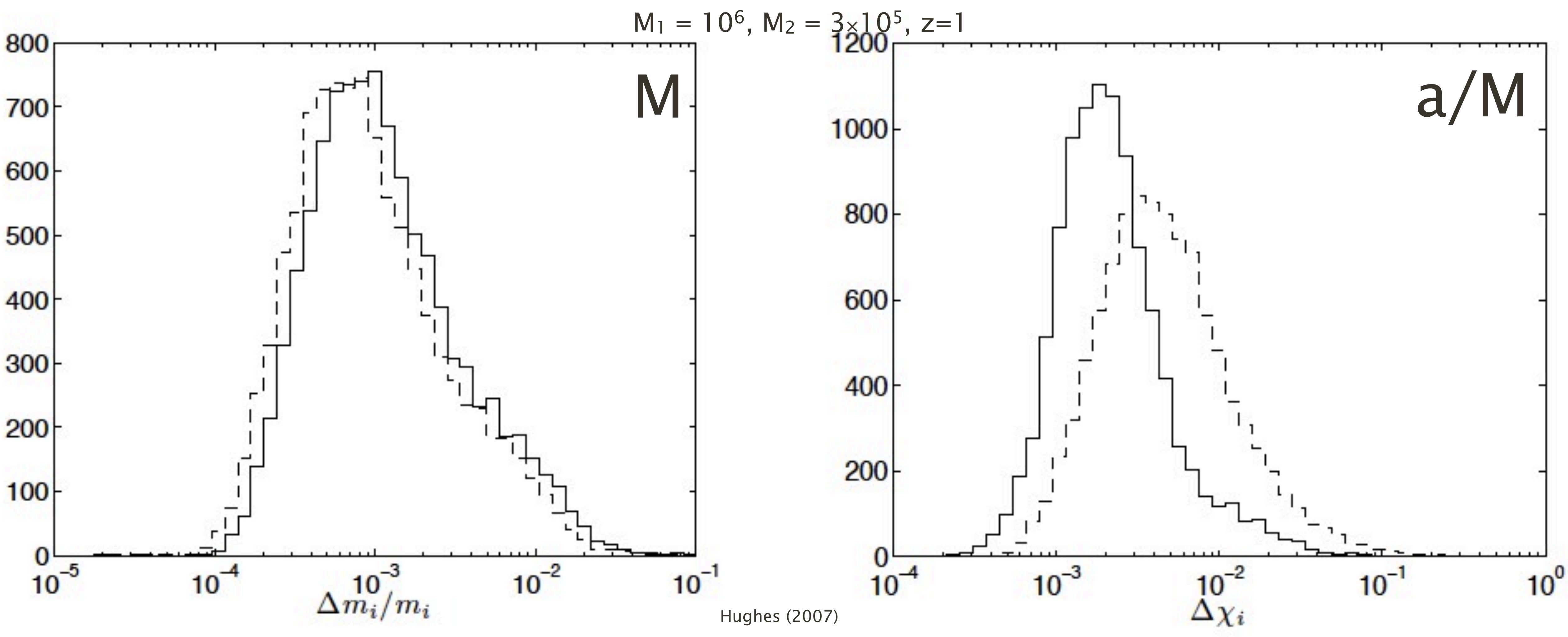

Hughes (2007)

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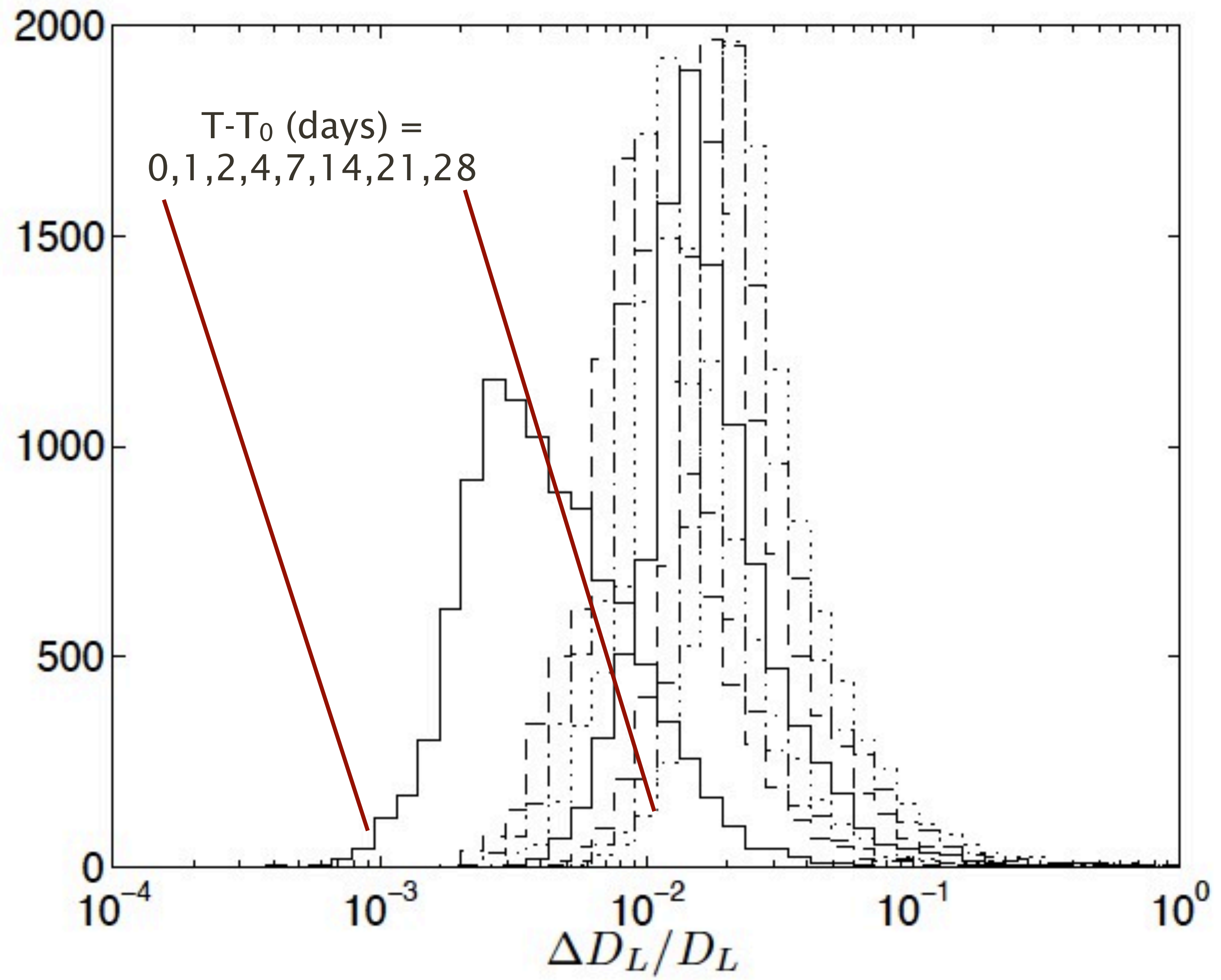

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    - these *measurement uncertainties* may be overwhelmed by weak lensing distortion

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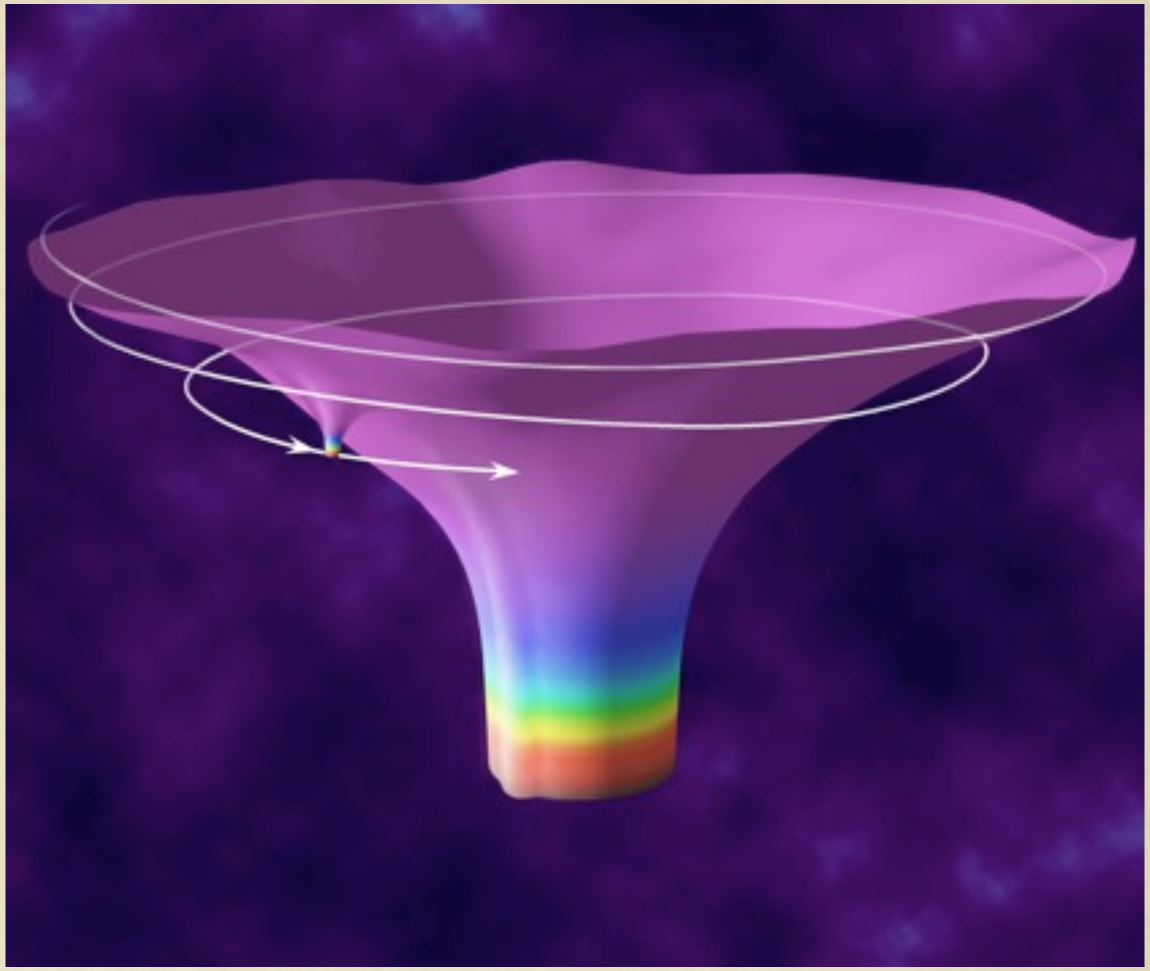
- Extreme mass-ratio inspiral (EMRI) mergers are captures of a stellar-mass black hole by a massive or supermassive hole. They happen regularly in the centers of isolated galaxies.

At the Black Hole Edge: EMRIs



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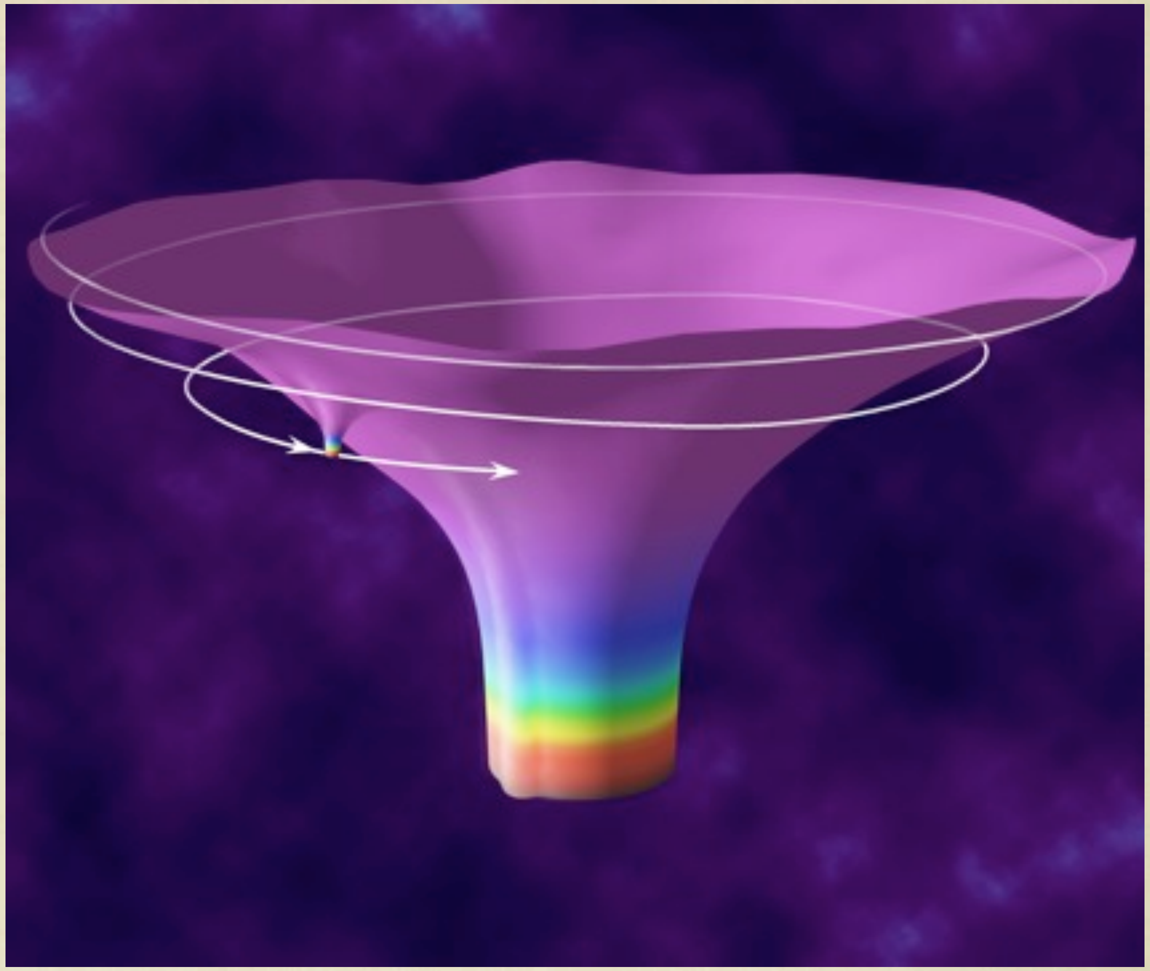

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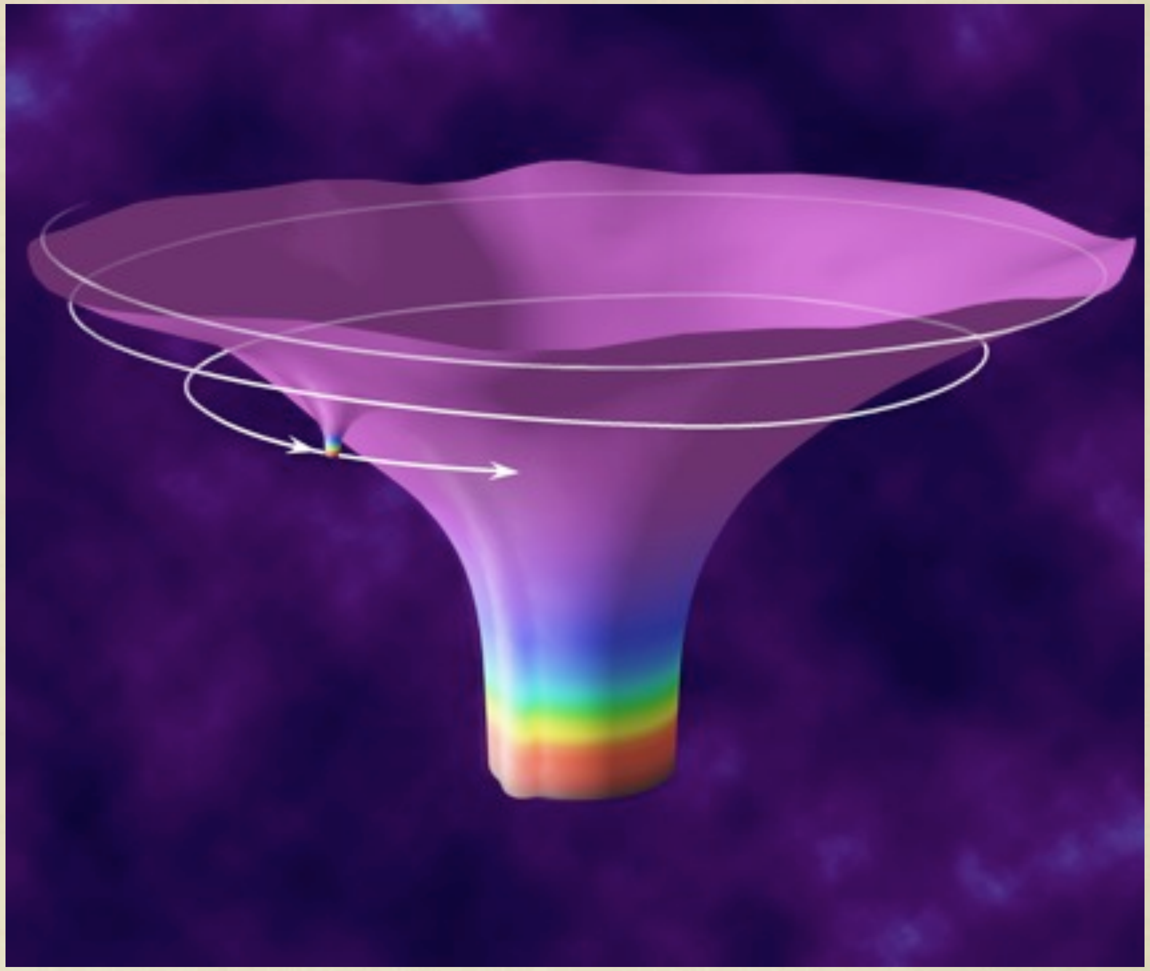

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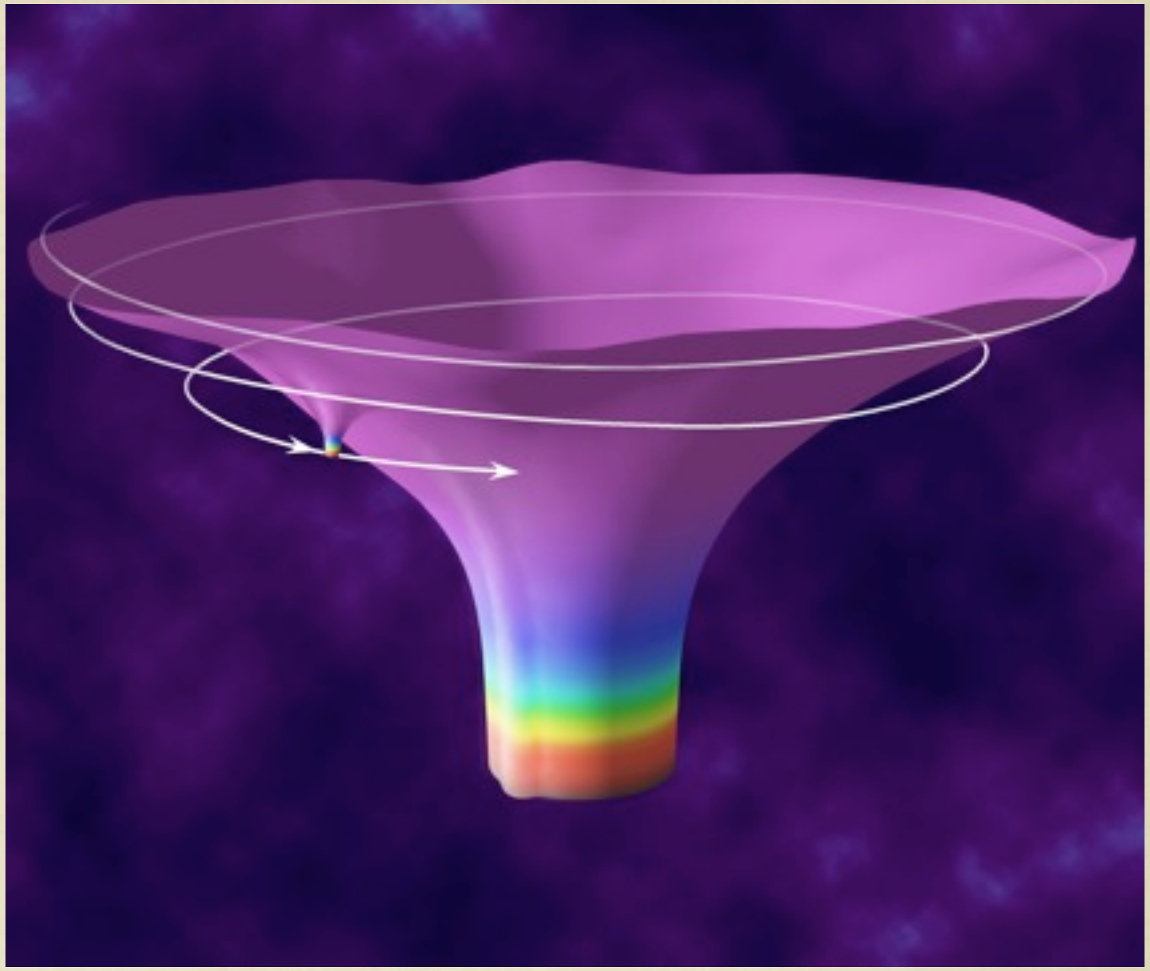

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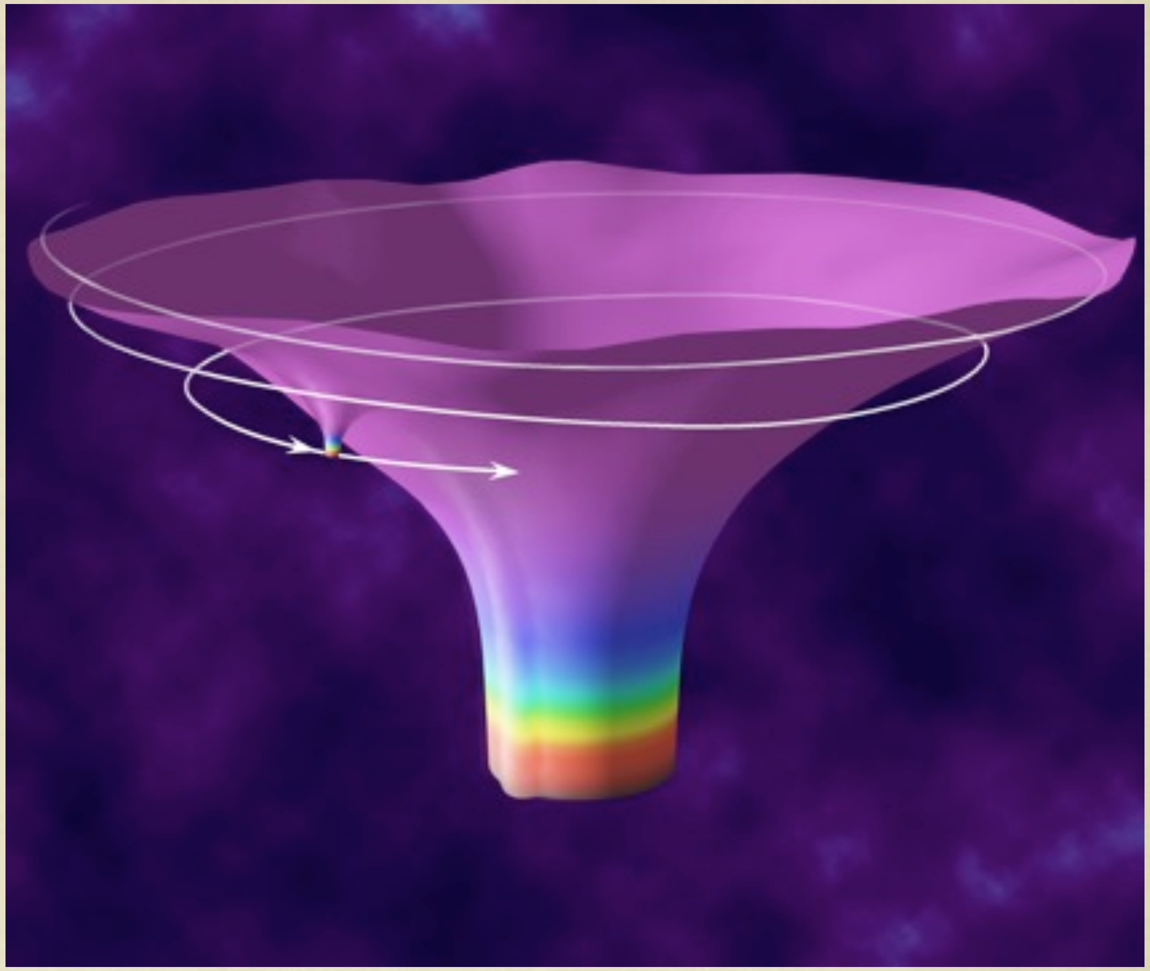

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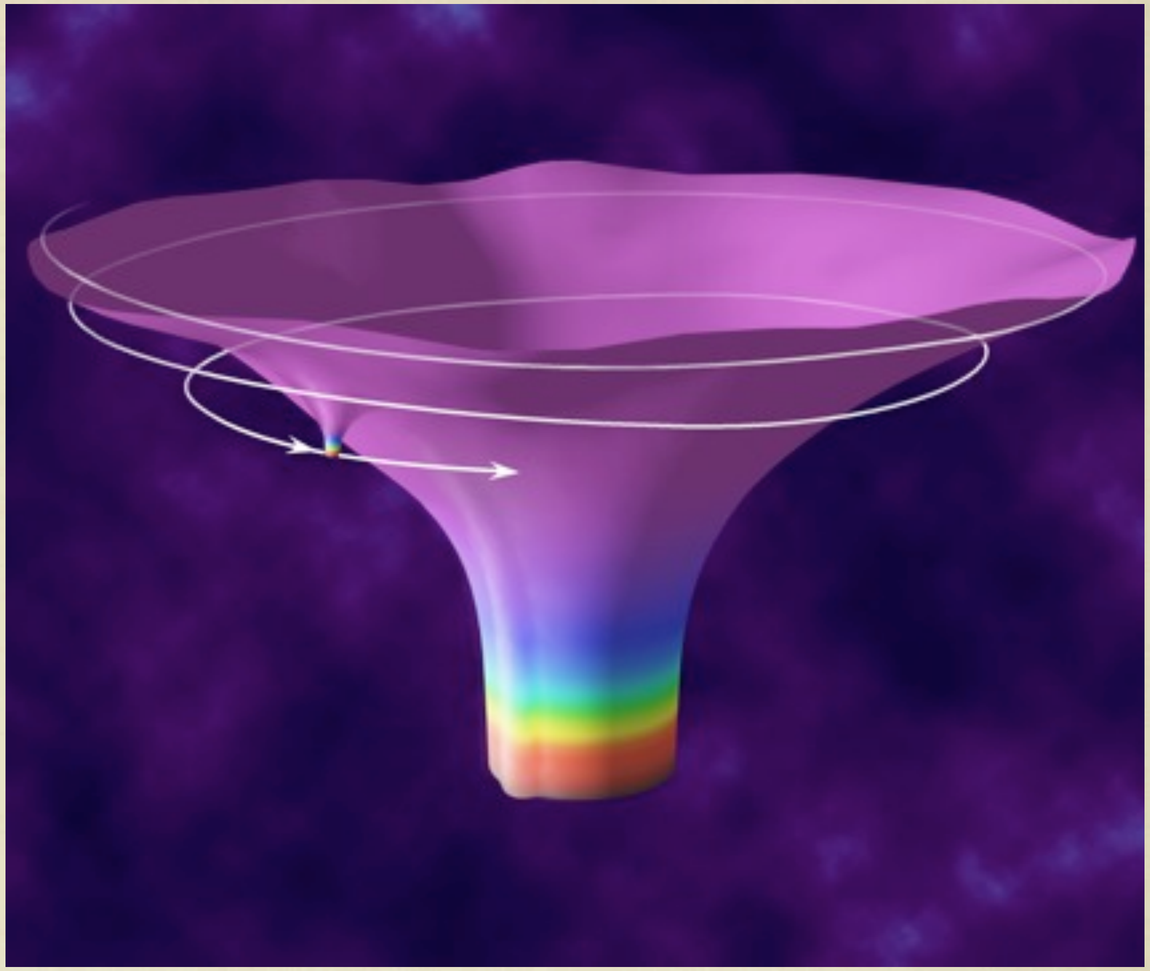
- Very numerous: 100s per year possible, typically z ~ 0.1, leads to source confusion.



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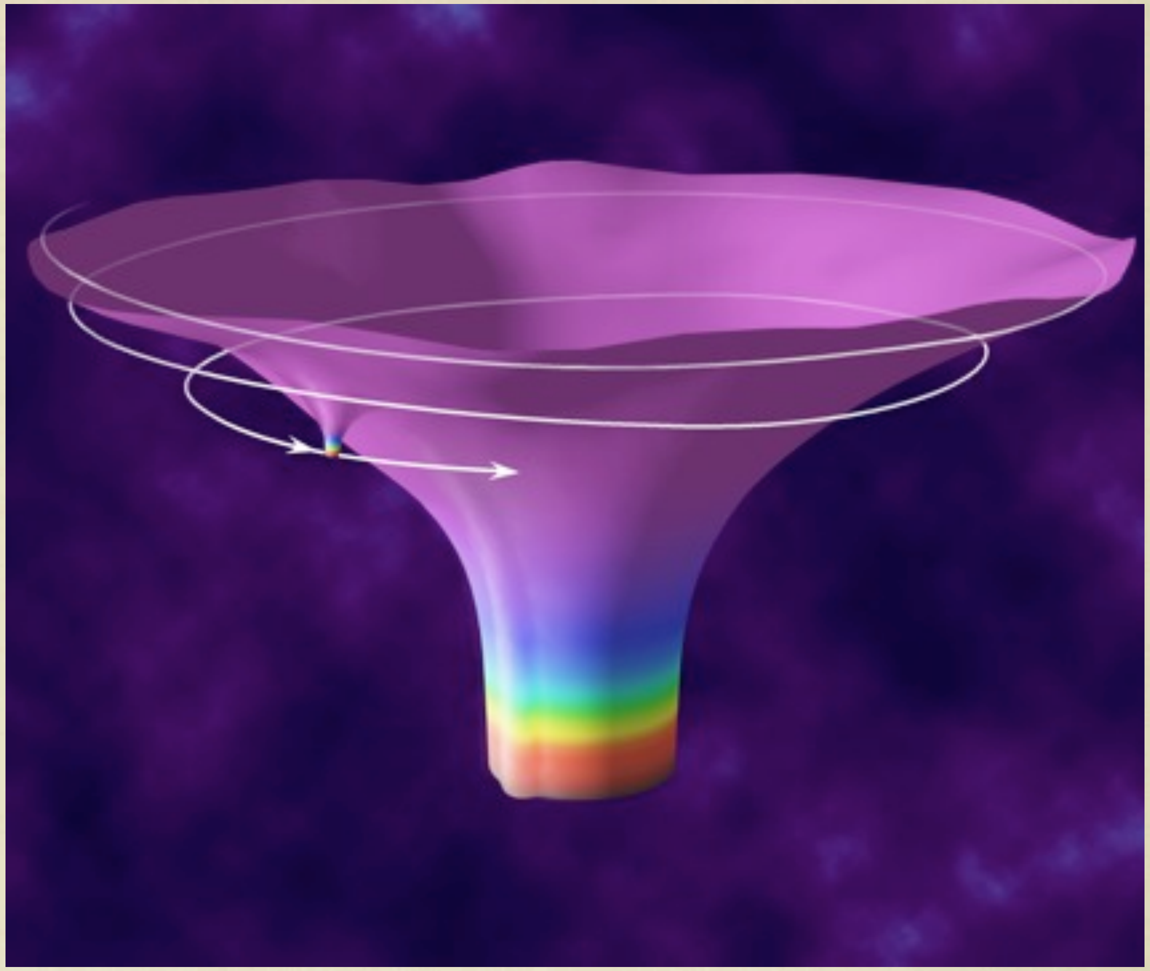

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- Allows tests of many predictions of General Relativity including the remarkable “no hair” theorem.
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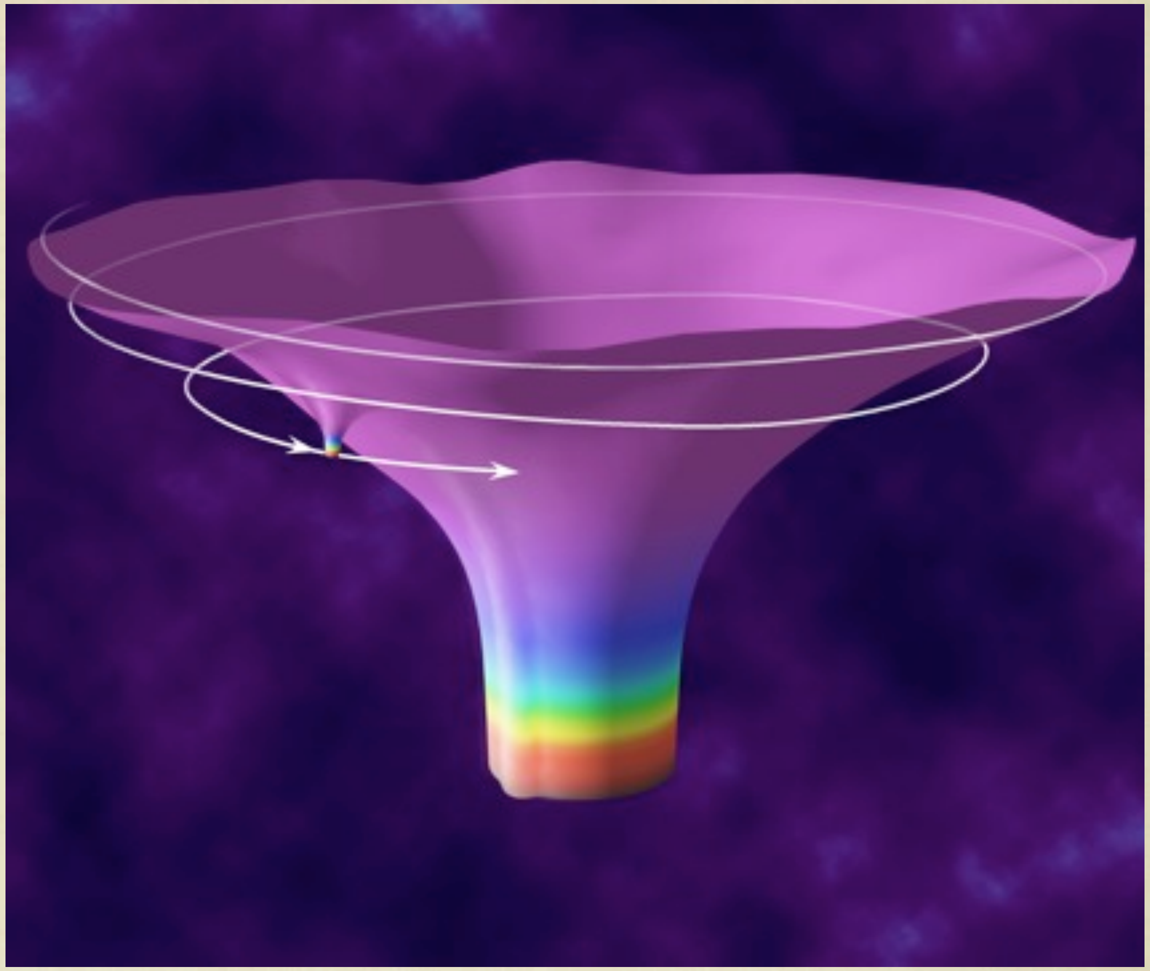

EMRI signal: Mock LISA Data Challenge

Comparable-mass Mergers

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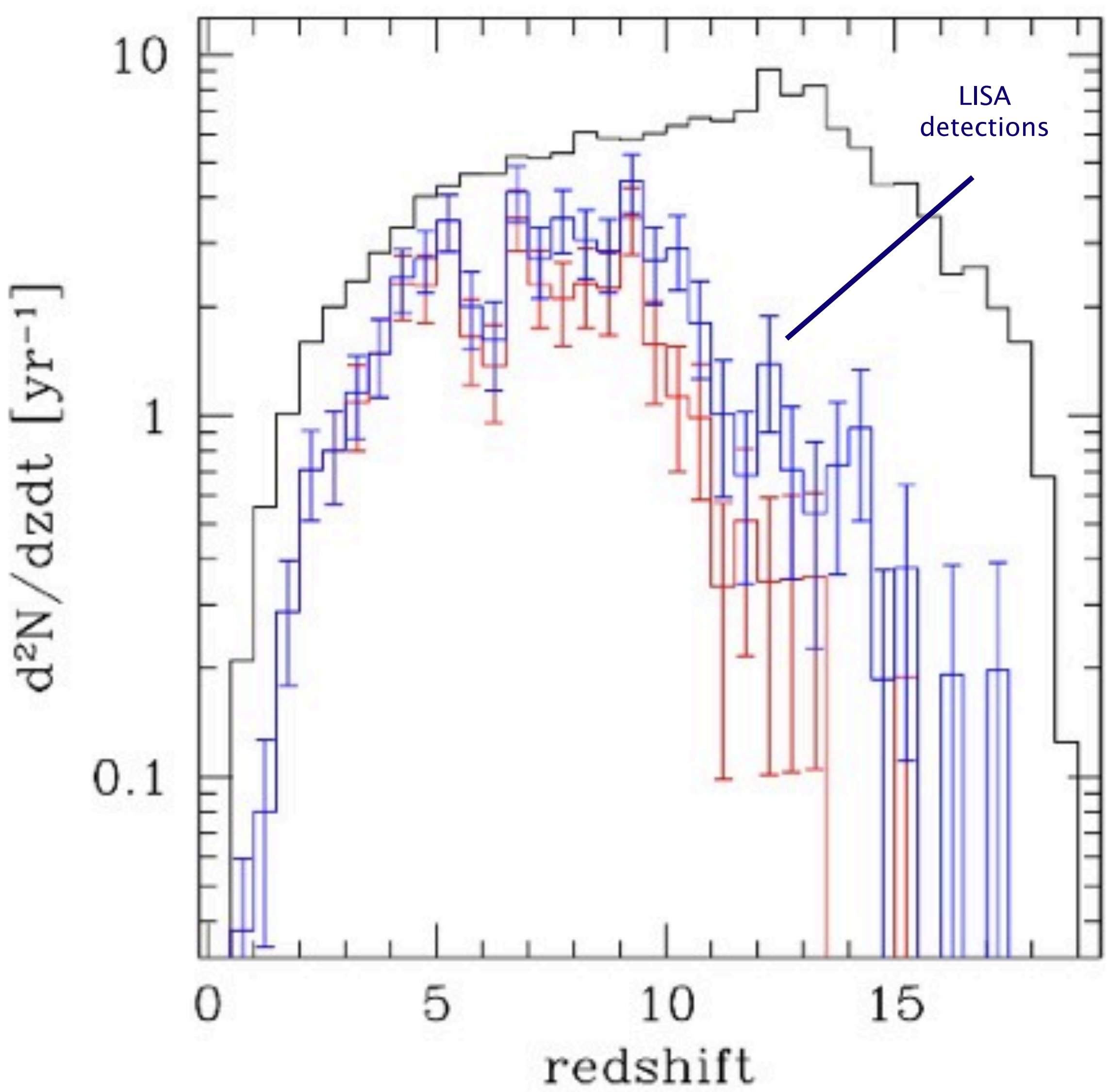
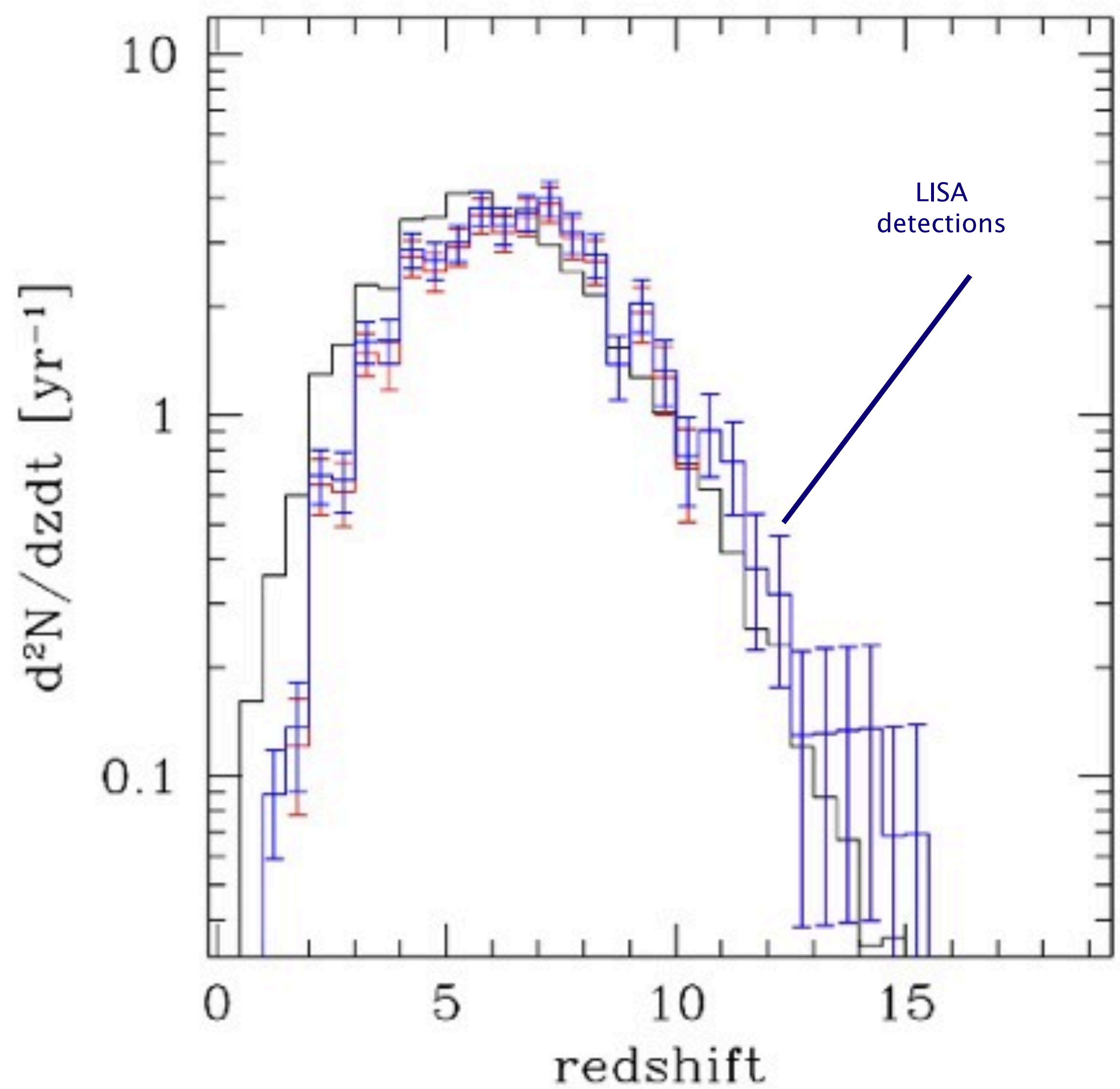
Pop III seeds



Volonteri (2010)

Gas collapse seeds



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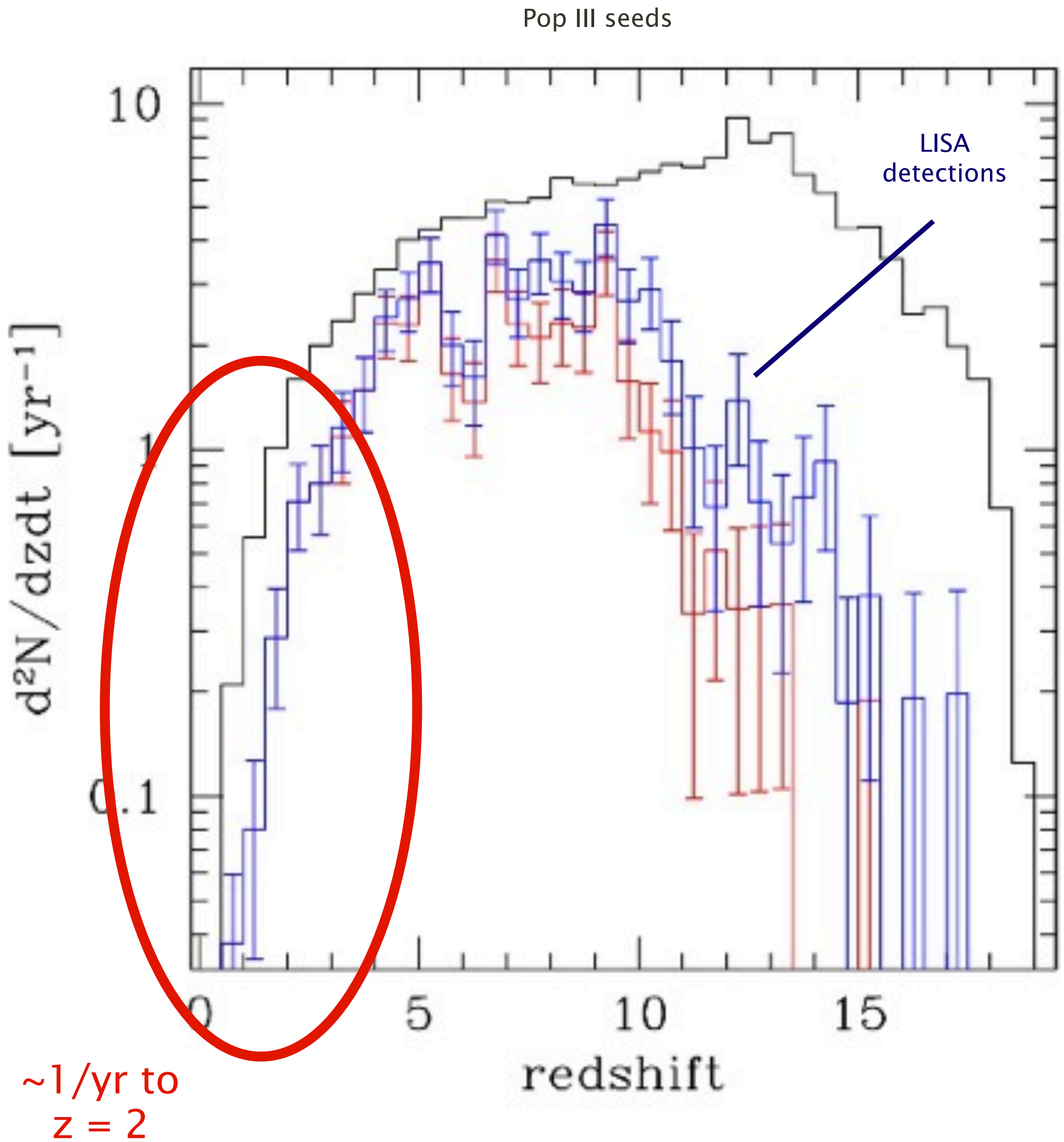

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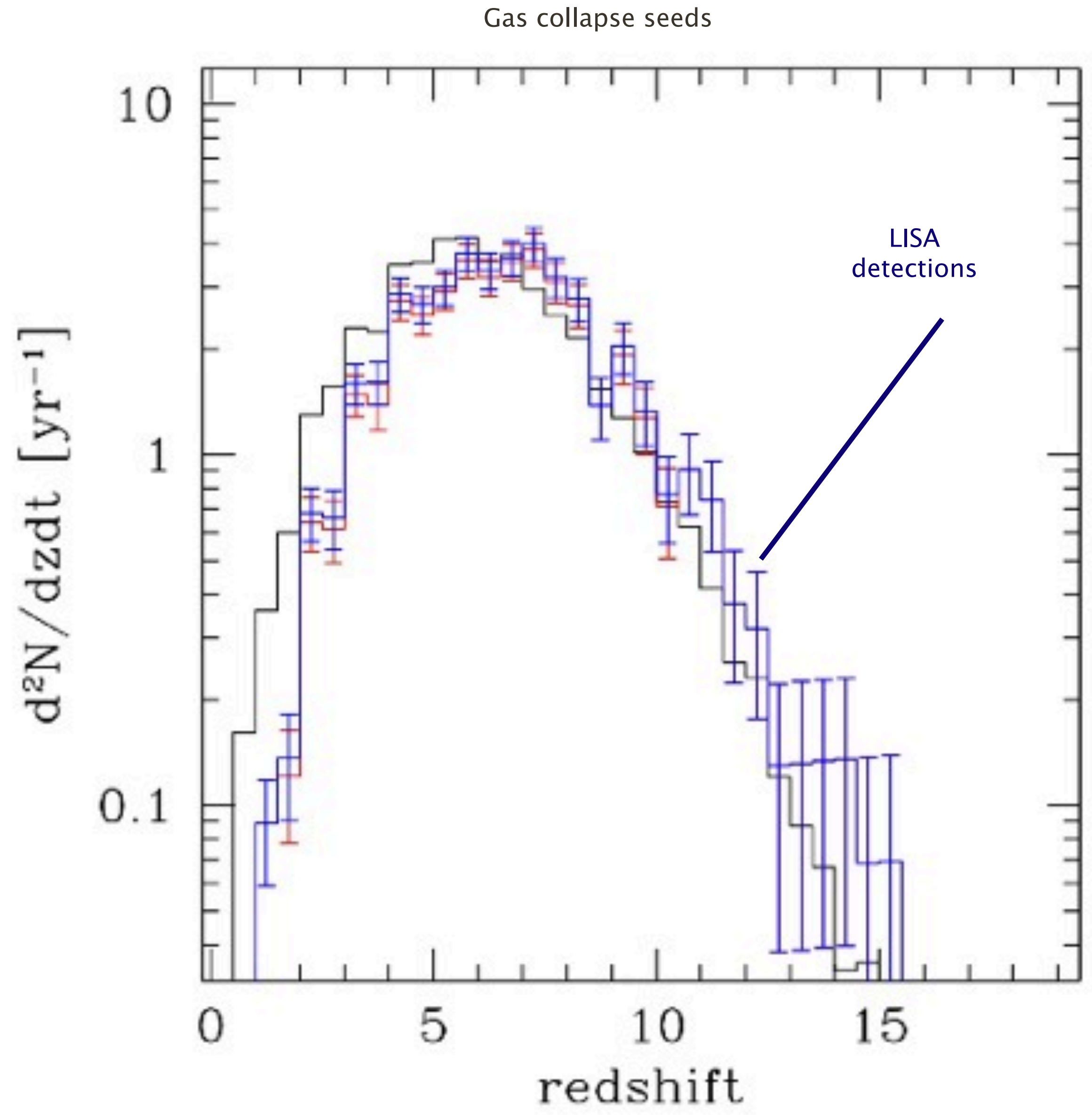

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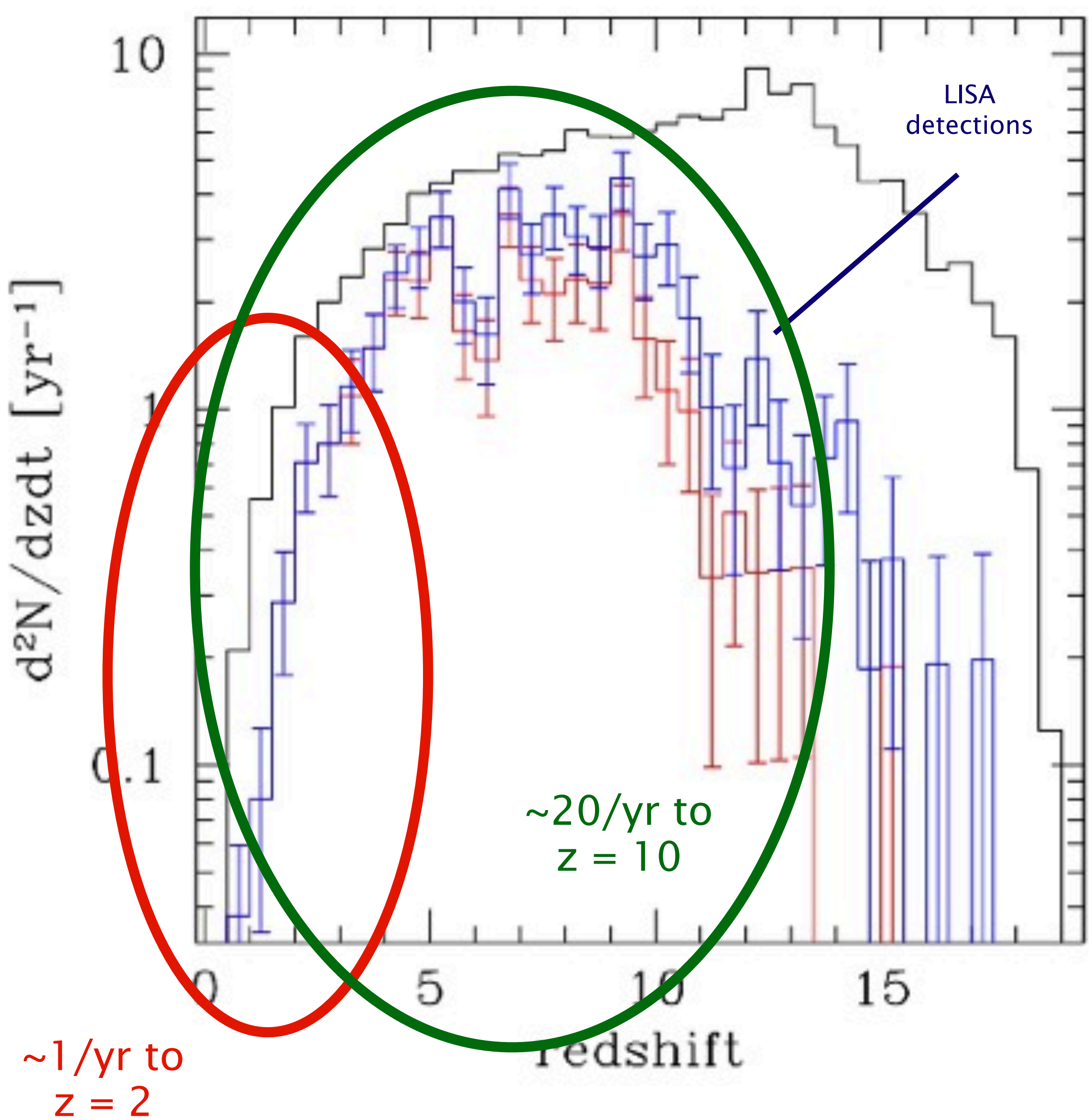

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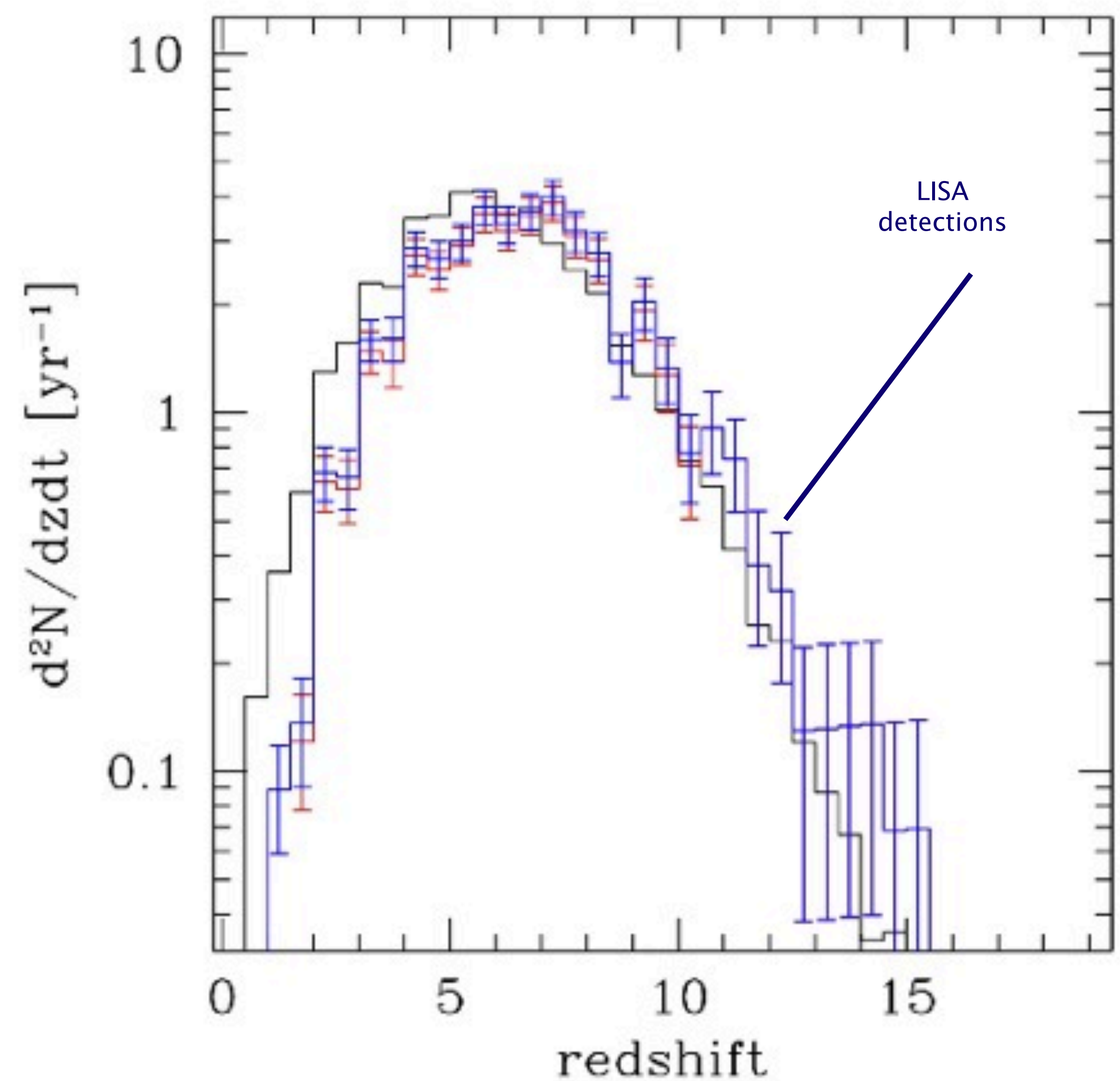

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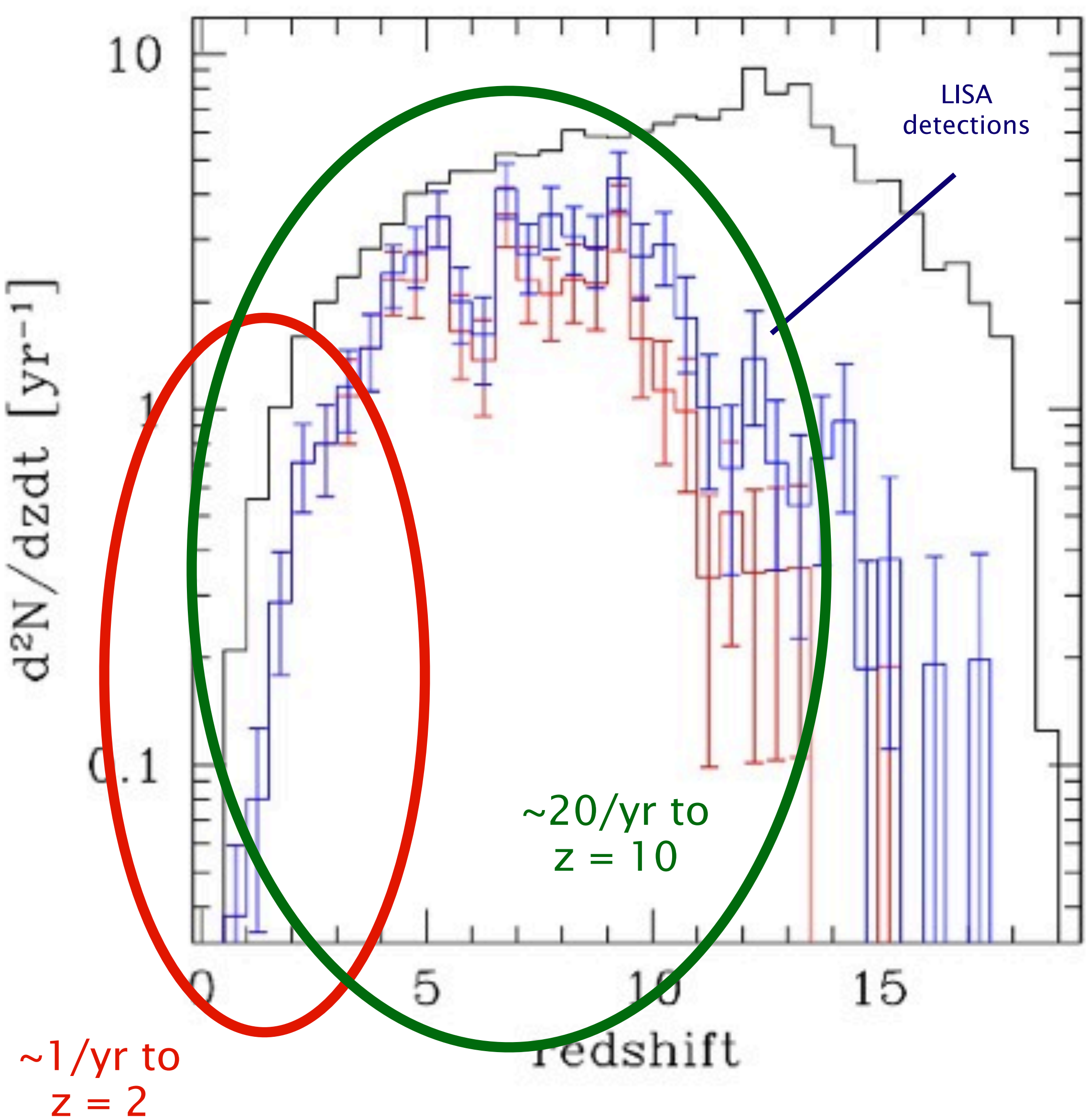

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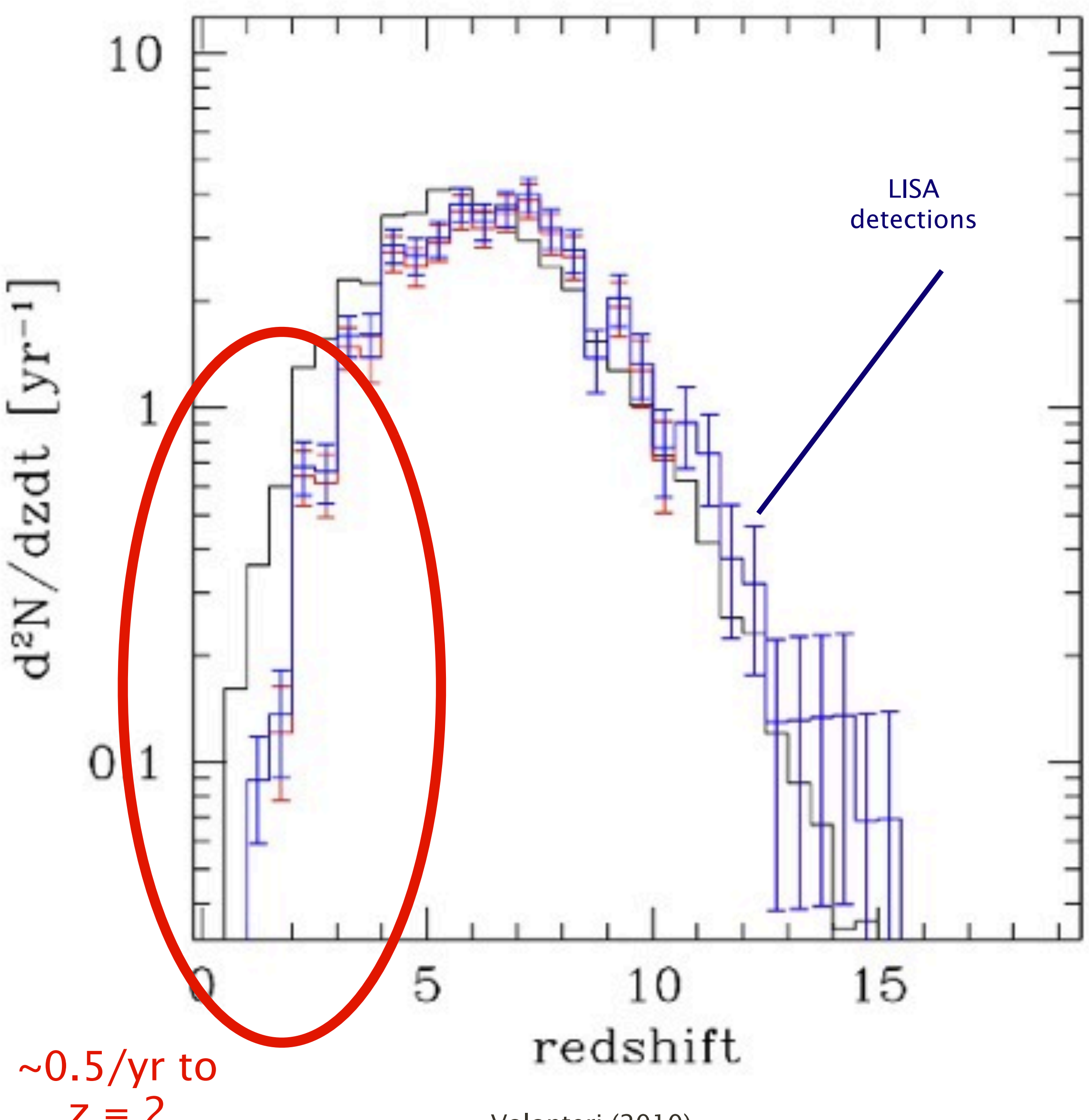

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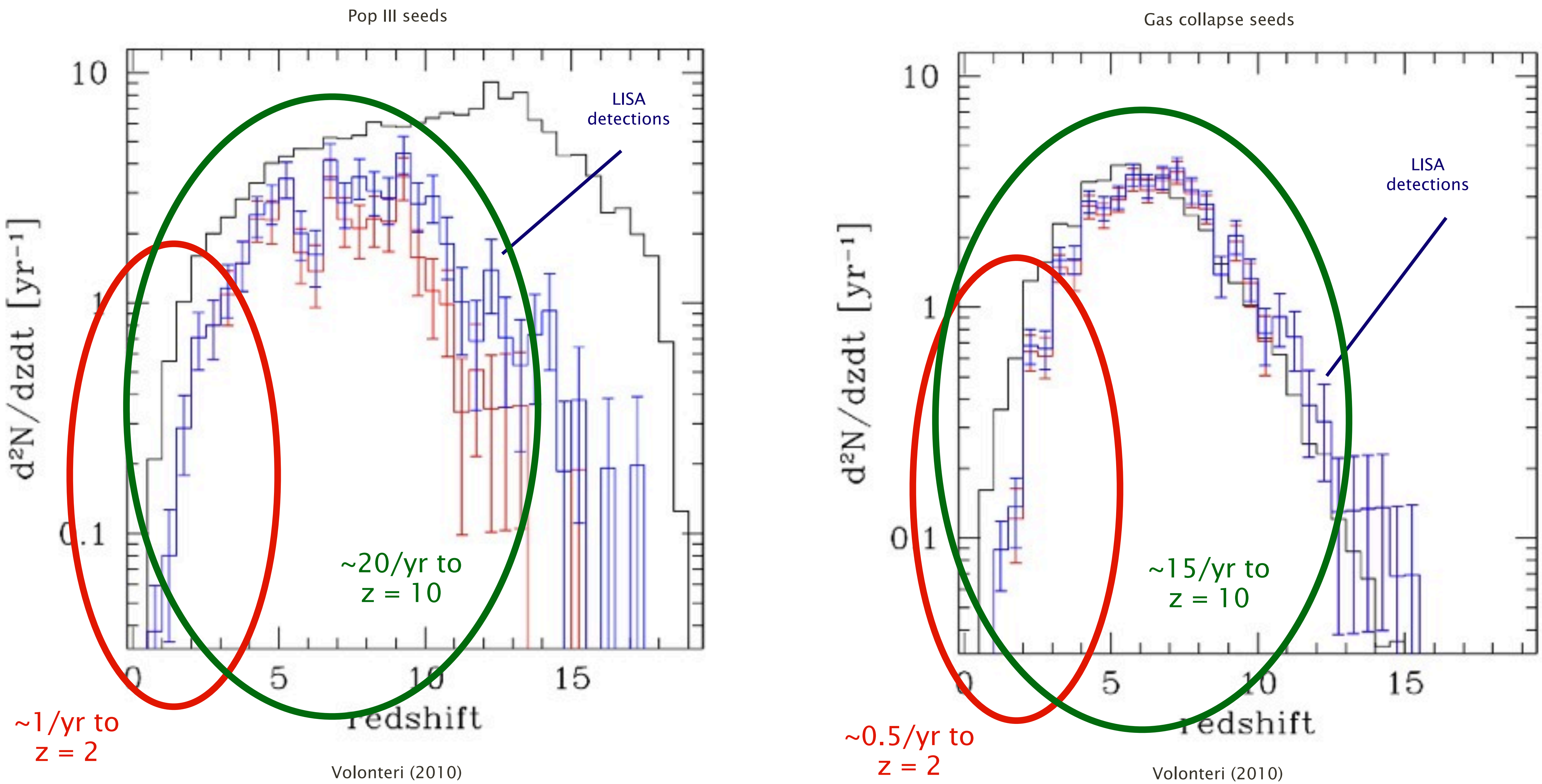

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  - Weak lensing maps may be able to cut errors in half (Jössen et al 2006, Linder 2008, Shapiro et al 2009). Problem being examined by a LISA International Science Team Study Group.

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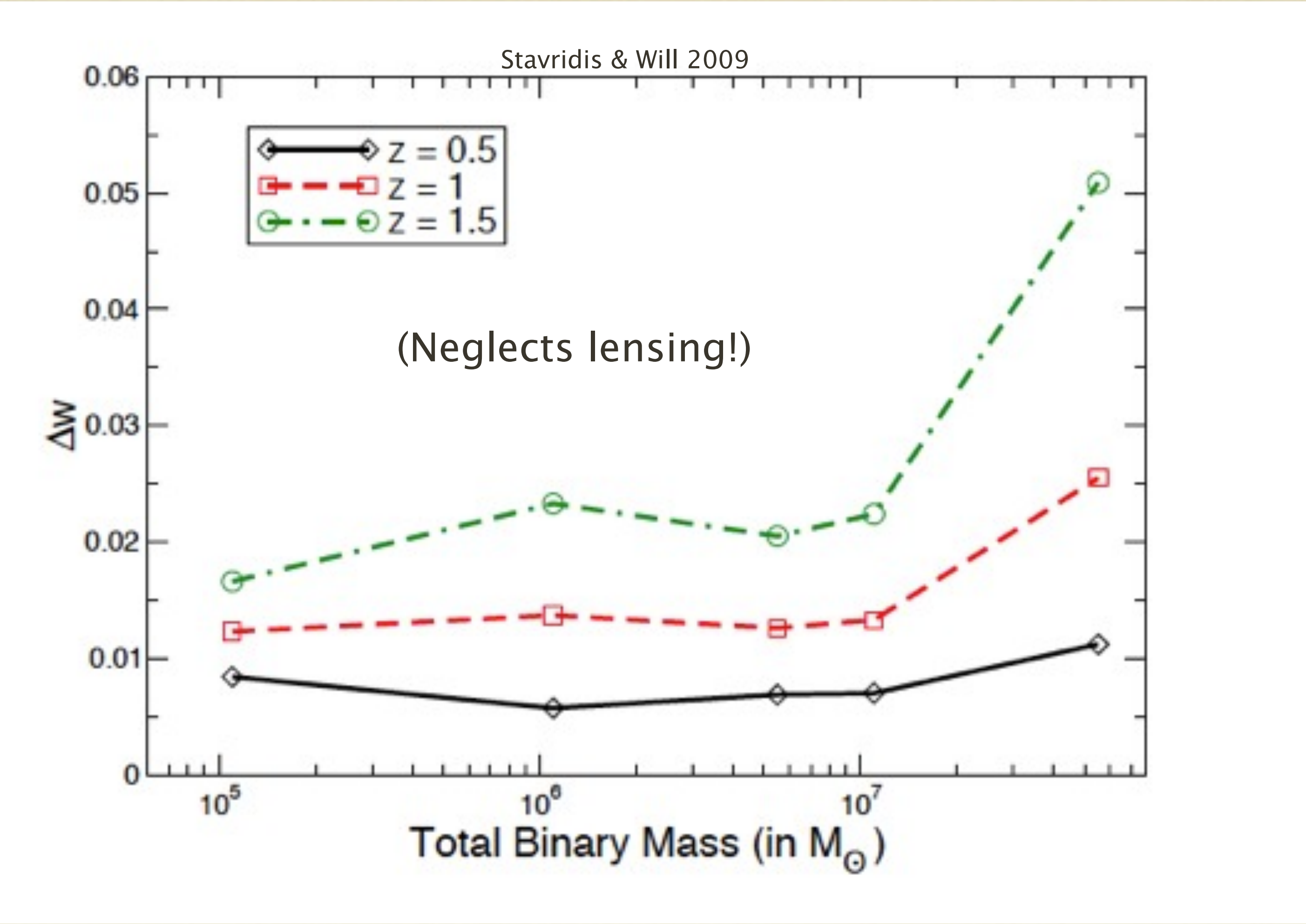

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