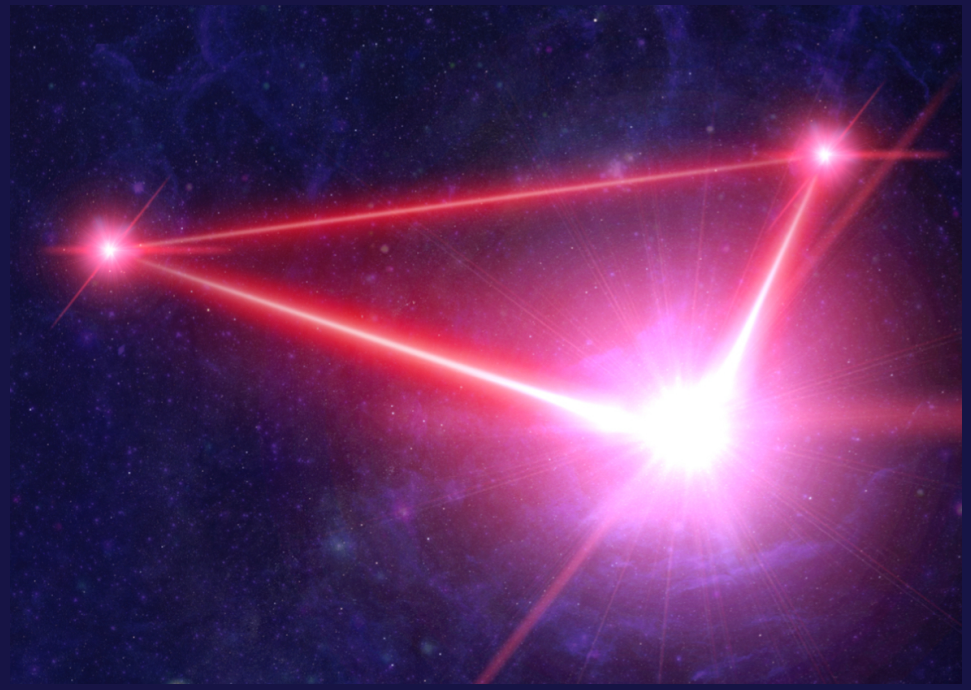
GRAVITATIONAL WAVE SCIENCE WITH LISA

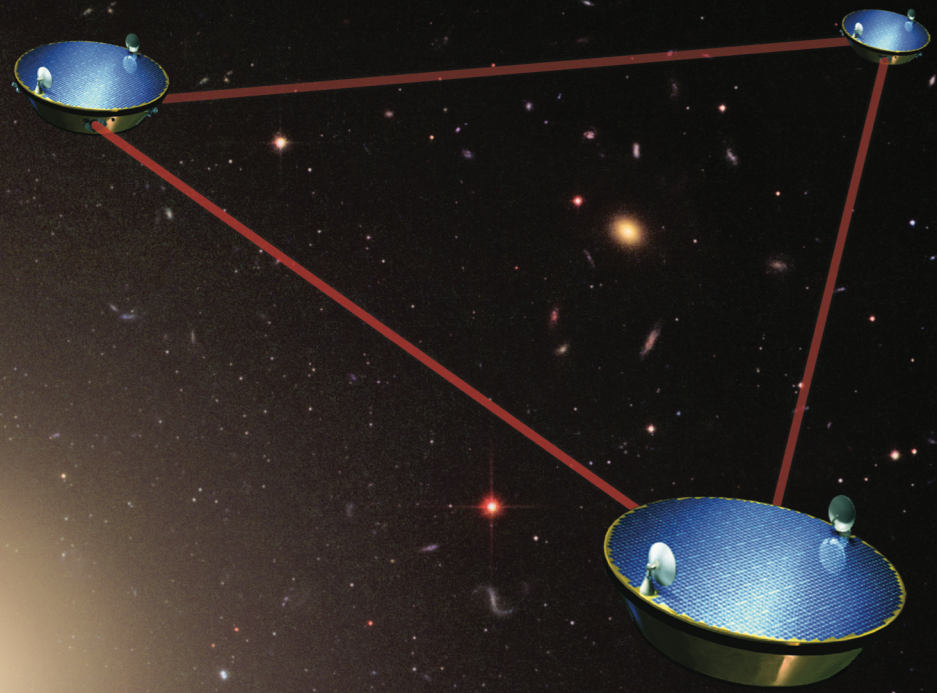


Joey Shapiro Key
University of Washington Bothell

BOTHELL

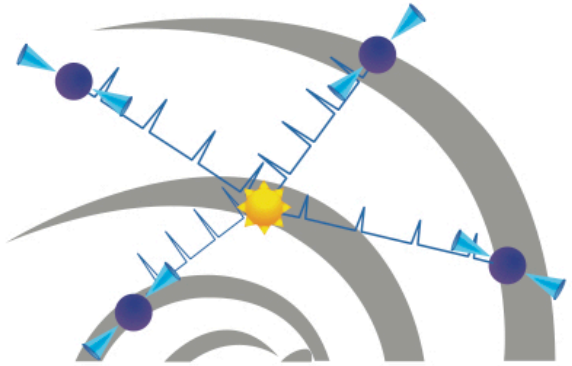
LISA

Laser Interferometer Space Antenna

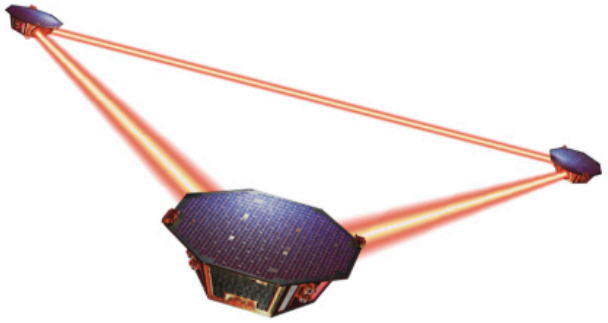


Gravitational Wave Observatories

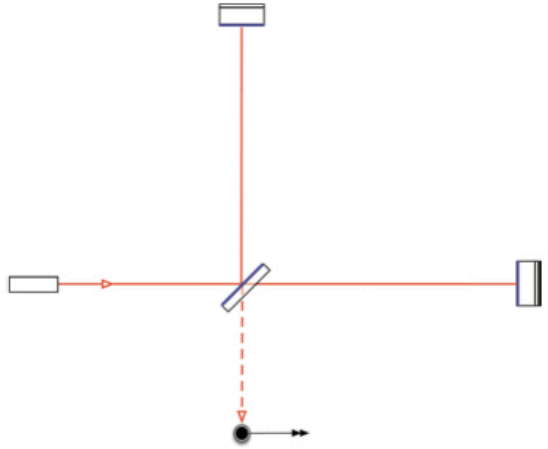
NANOGrav

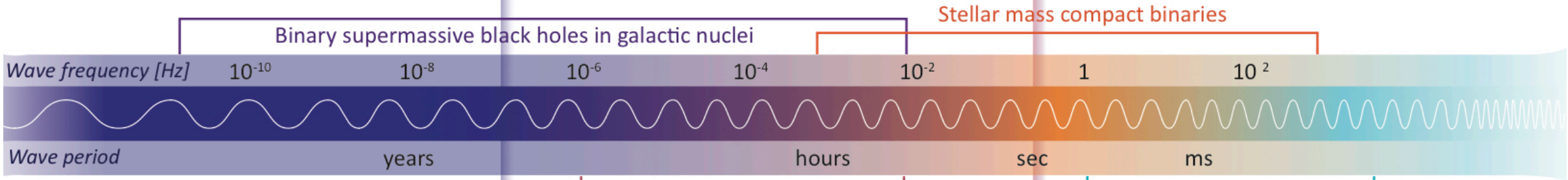


lisa

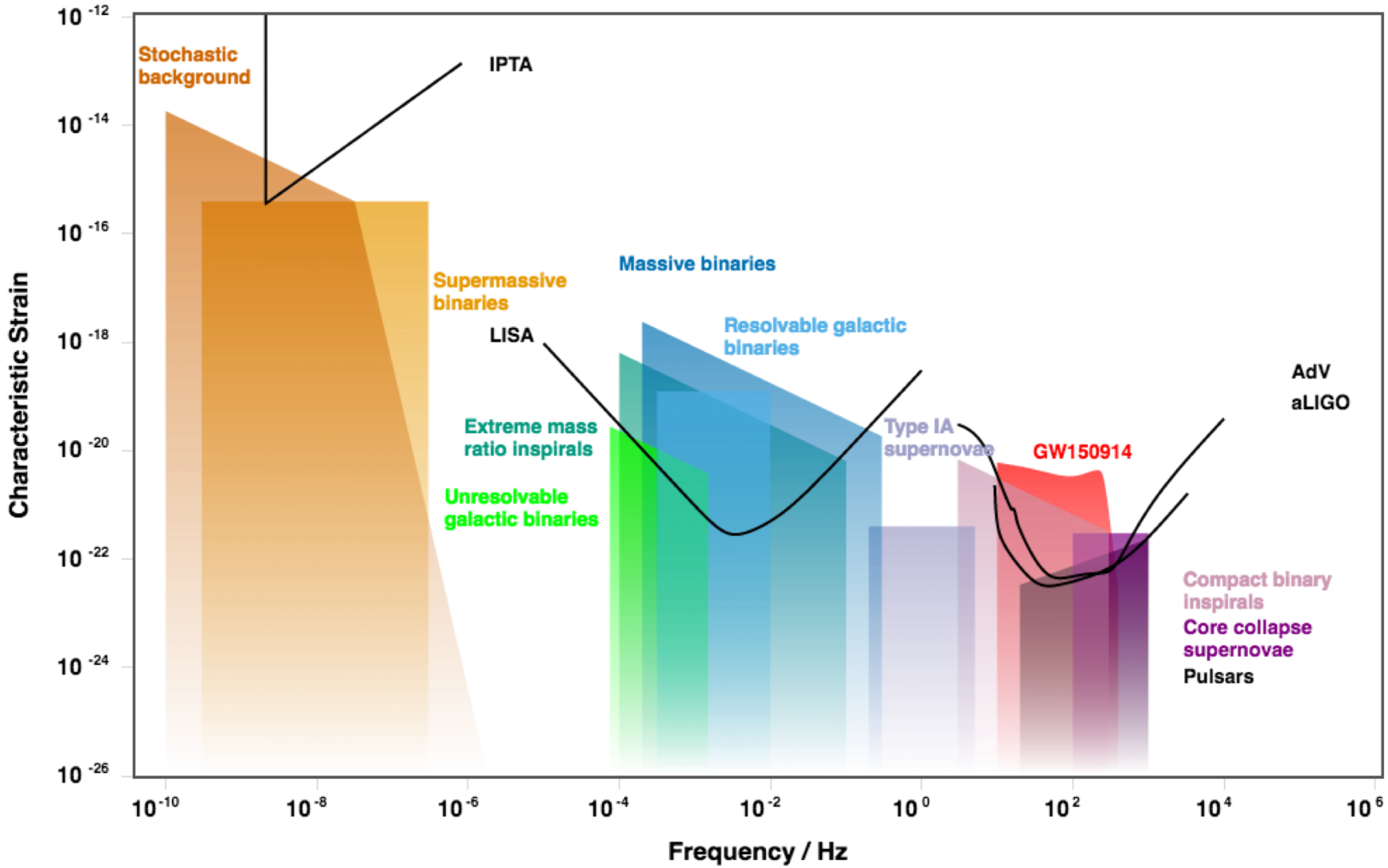


LIGO

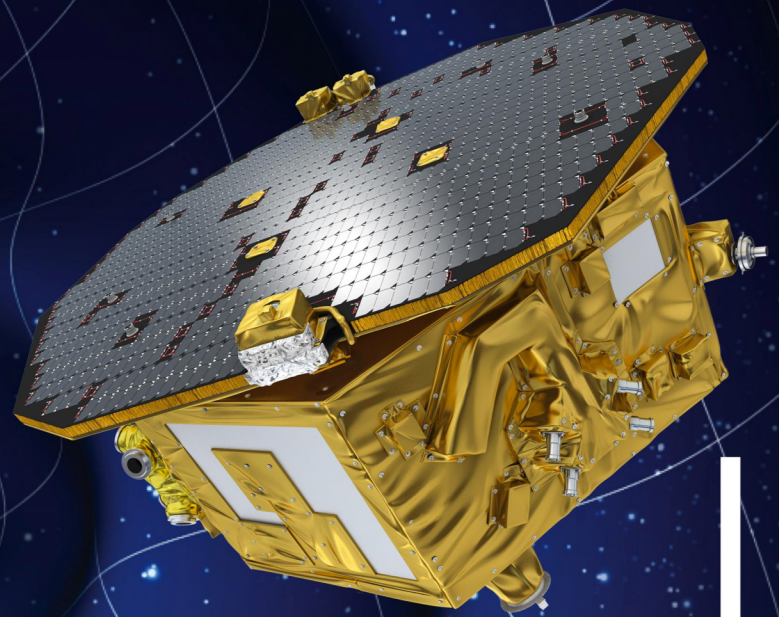




A. Simonnet, Sonoma State University



Moore, Cole, Berry, Class. Quant. Grav. **32**, 015014, 2015



LISA
Pathfinder

PAVING THE WAY TO GRAVITATIONAL WAVE DETECTION IN SPACE

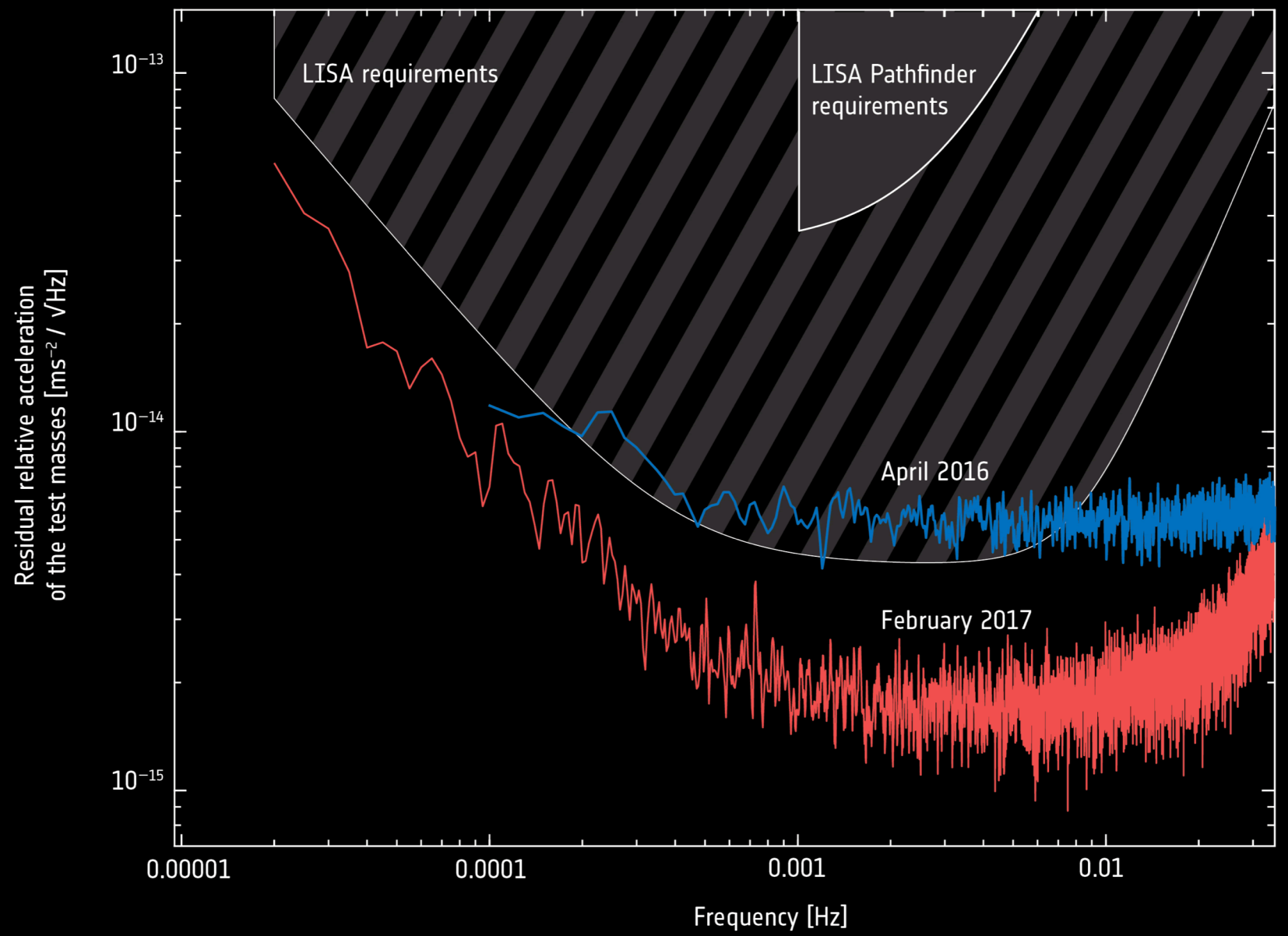
VEGA VV06

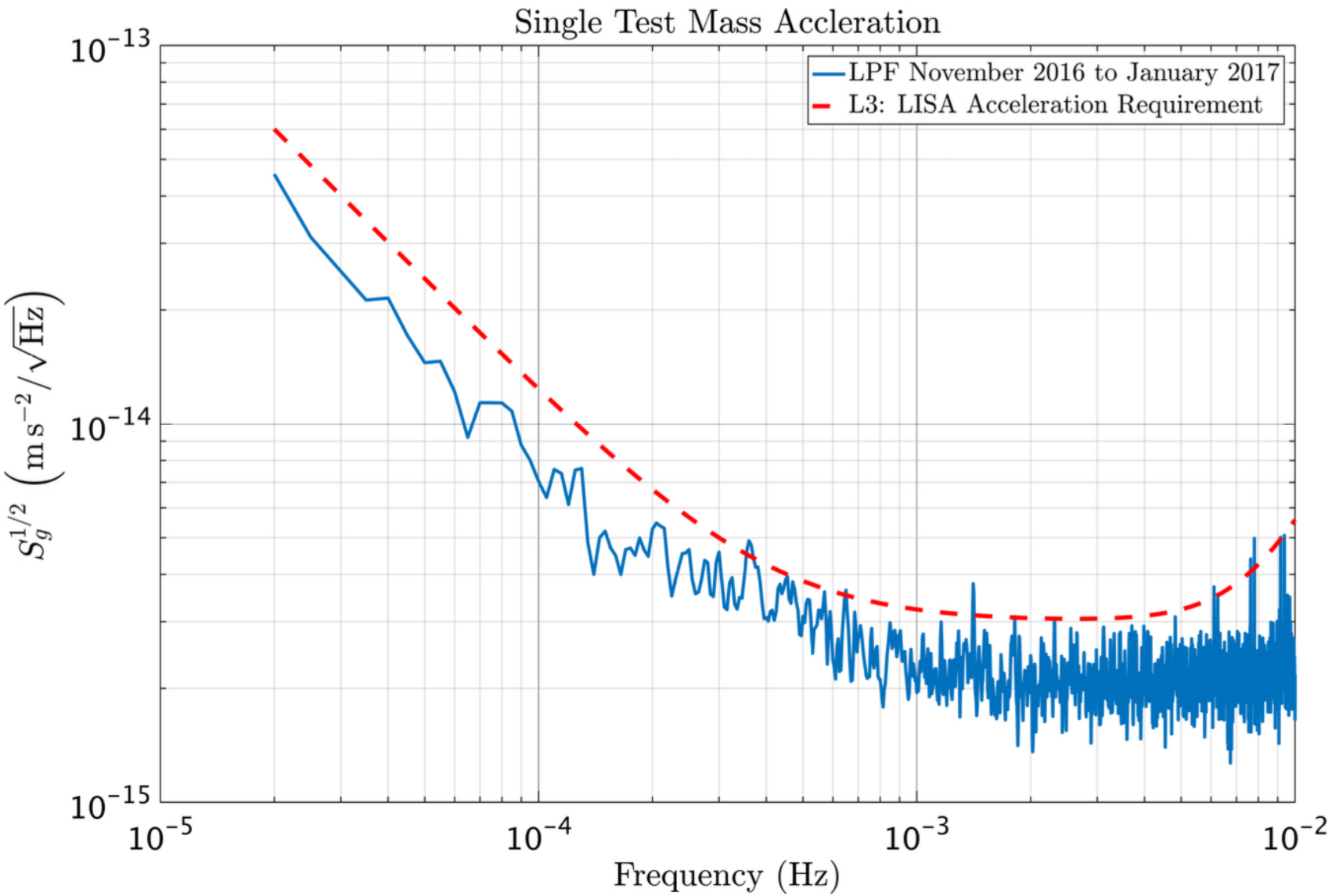
lisa pathfinder

CENTRE SPATIAL GUYANAIS

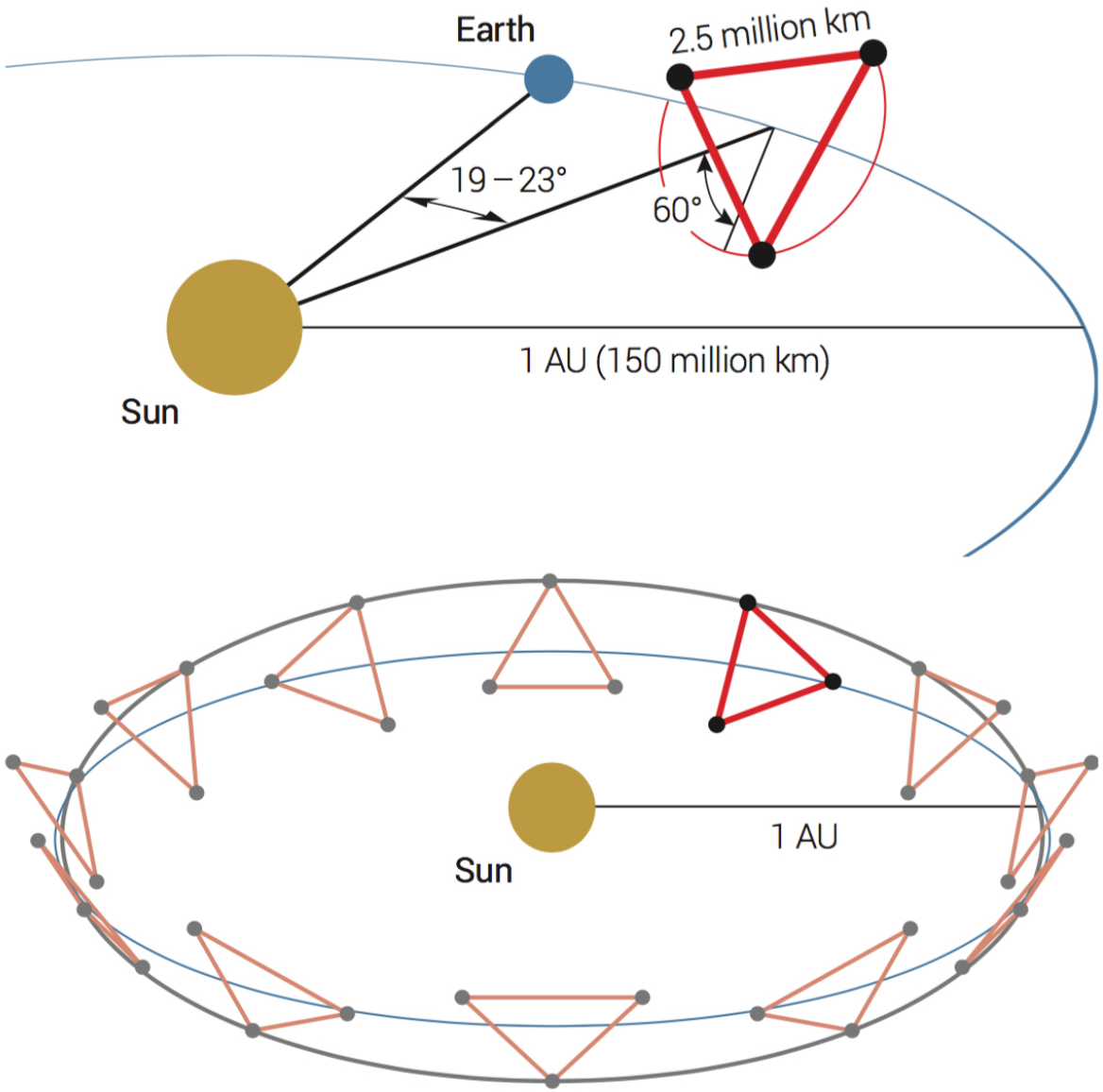
Port spatial de l'Europe
Europe's Spaceport

esa arianespace cnes

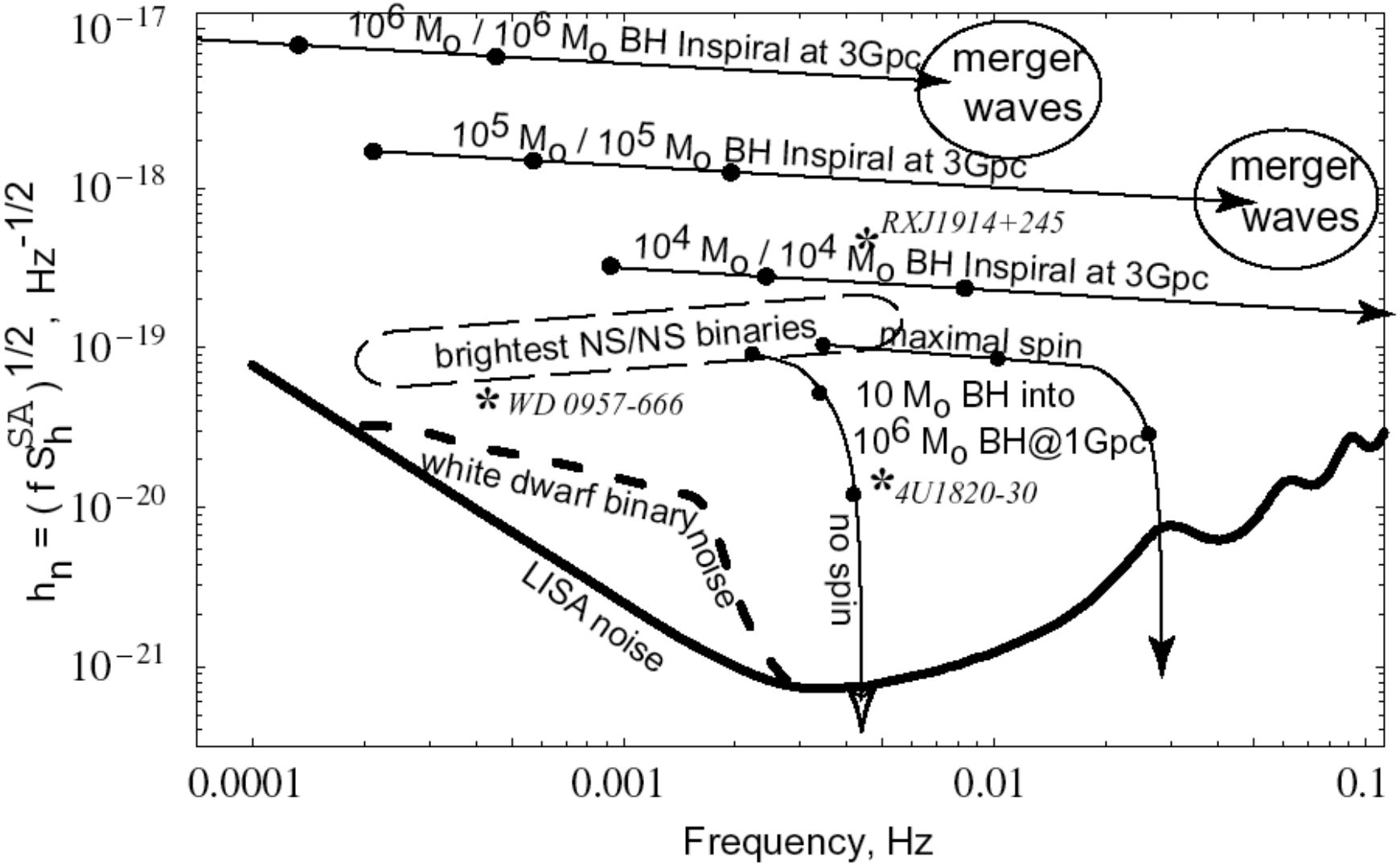

LISA requirements
LISA Pathfinder requirements
April 2016
February 2017
10^{-13}
10^{-14}
10^{-15}
Residual relative acceleration of the test masses [ms^{-2} / √Hz]
0.00001
0.0001
0.001
0.01
Frequency [Hz]



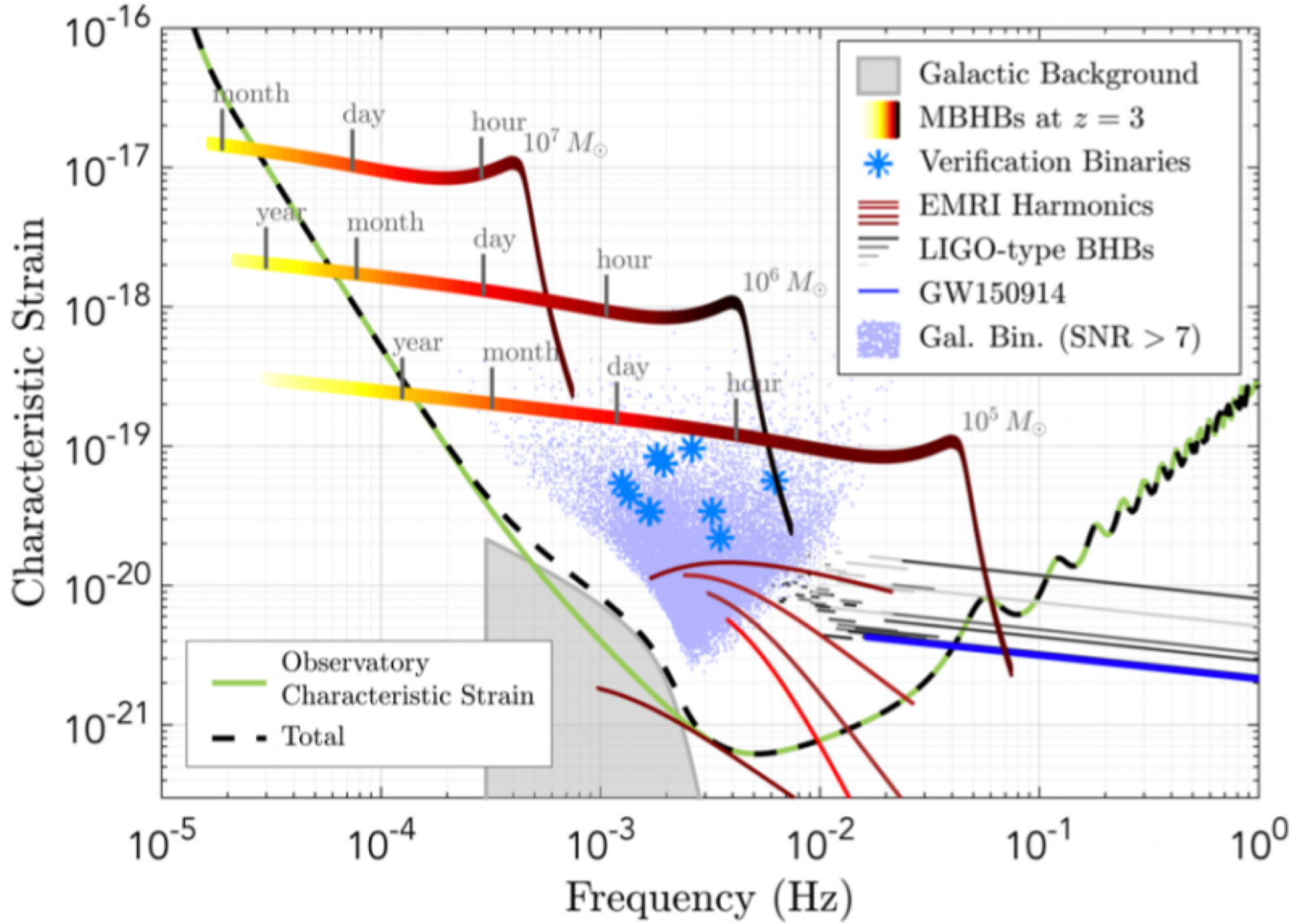
from the [LISA Mission L3 Proposal]



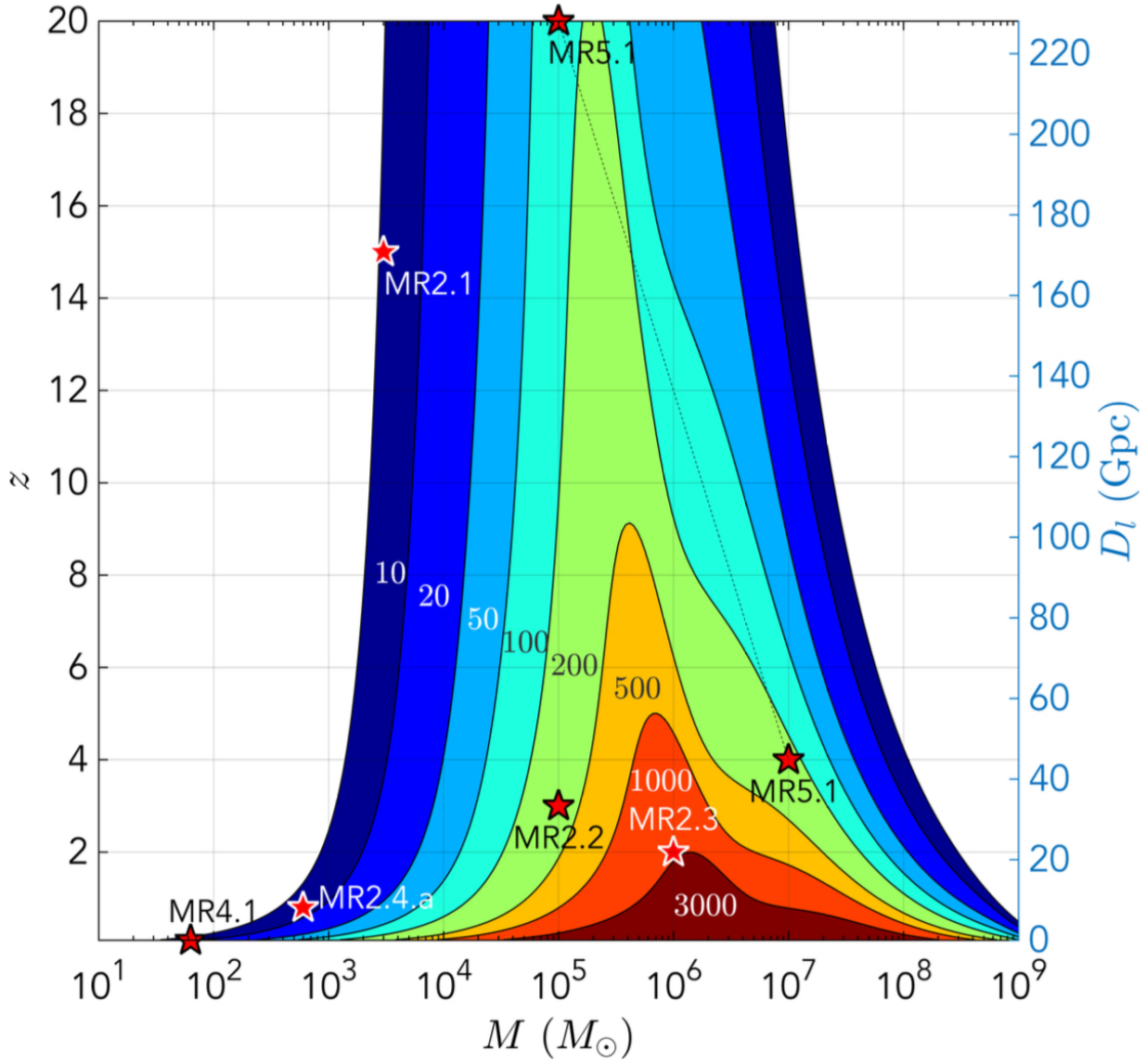
from the [LISA Mission L3 Proposal]



Kip Thorne, pre-2000



from the [LISA Mission L3 Proposal]

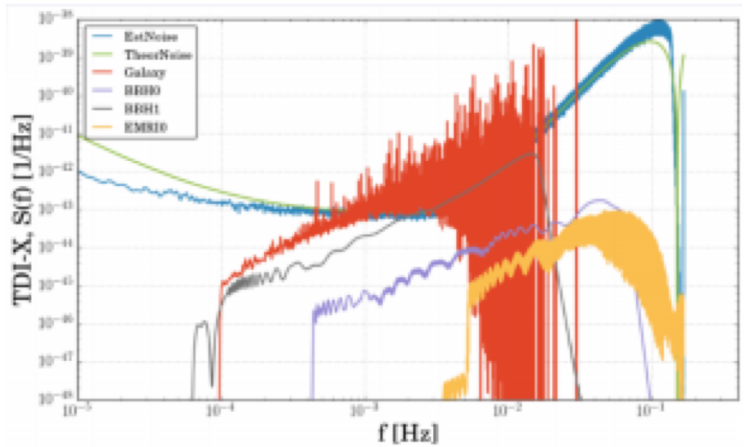


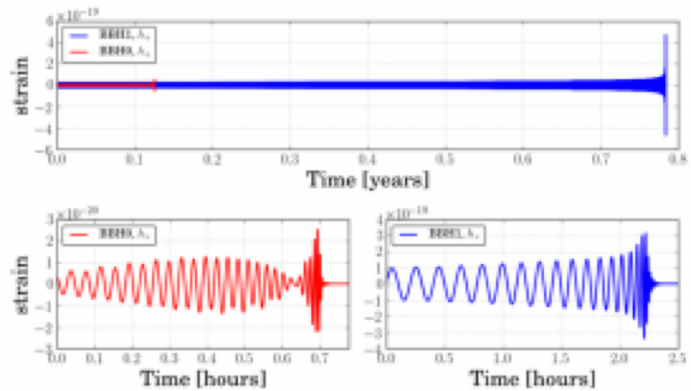
threshold binaries used to define the mission requirements (MR)

from the [LISA Mission L3 Proposal]

LISA Data Challenges

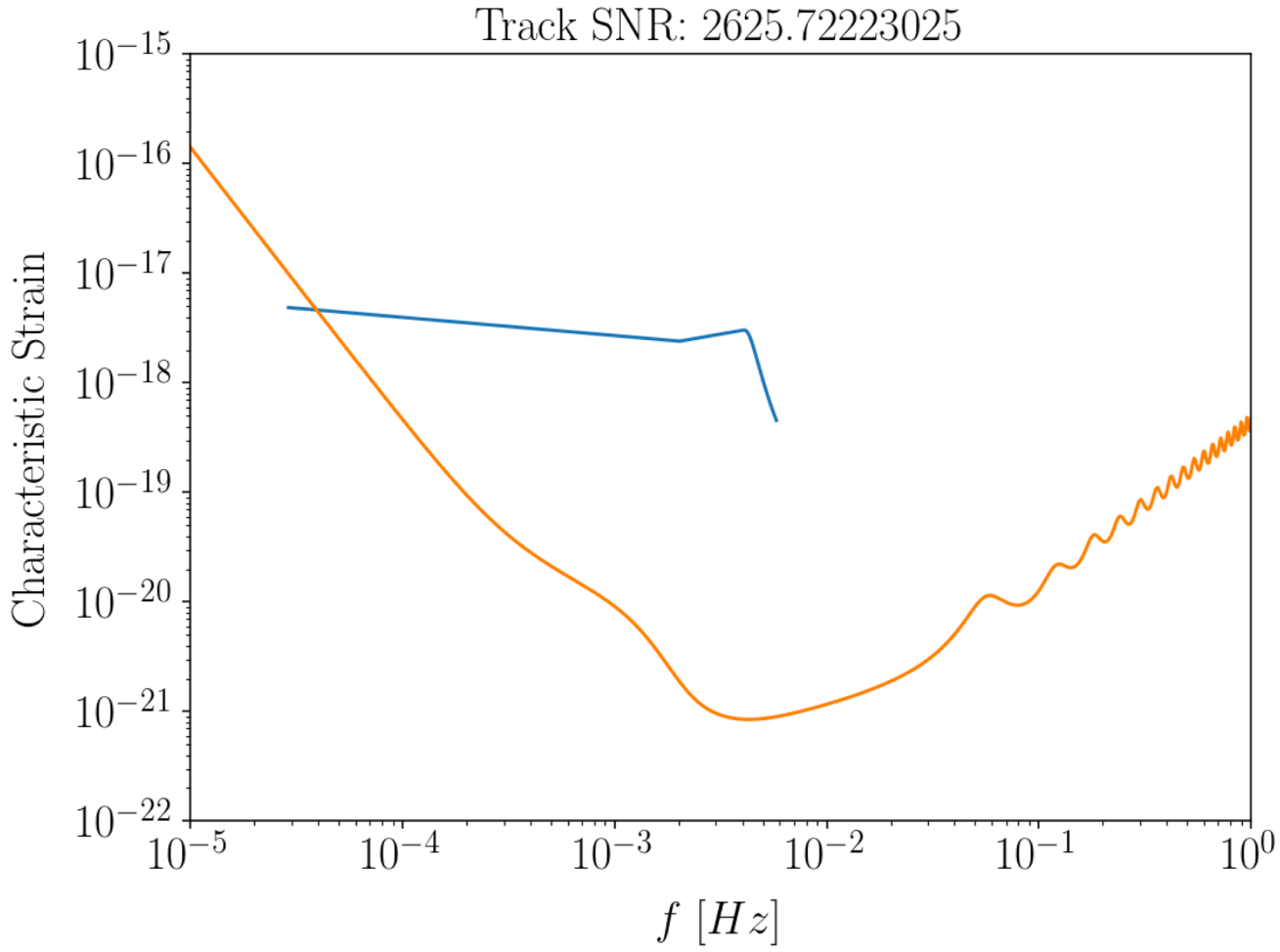
- Working Group to coordinate and develop LISA Data Challenges
  - a platform to develop and test data analysis pipelines and scientific investigations
- Project based challenges
  - focus development and answering of questions
- Strong ties to the LDPG and LSG
- Bi-weekly teleconferences





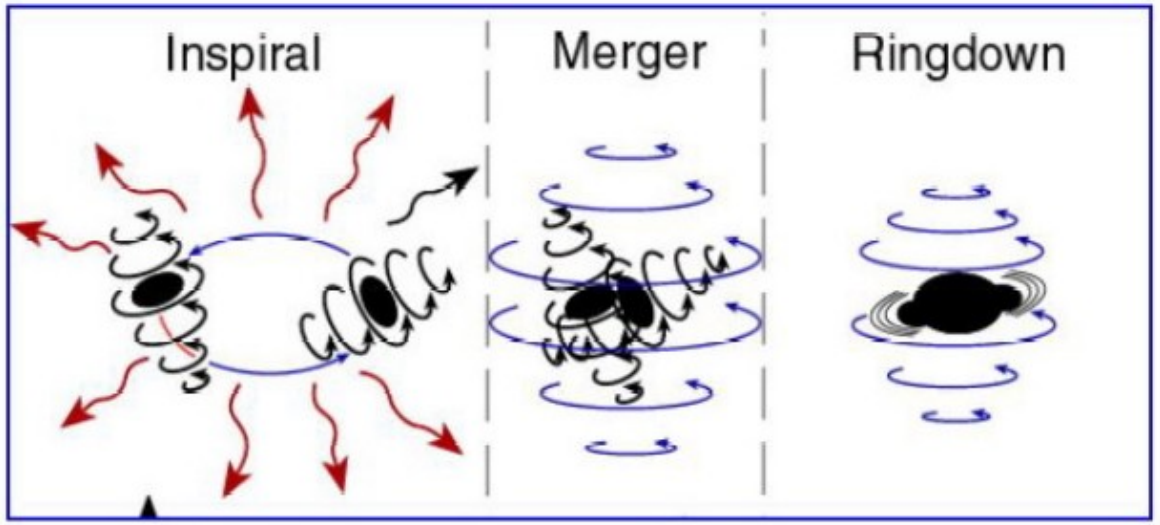
Sign up: https://gitlab.in2p3.fr/stas/MLDC

LISA Sensitivity Notebook



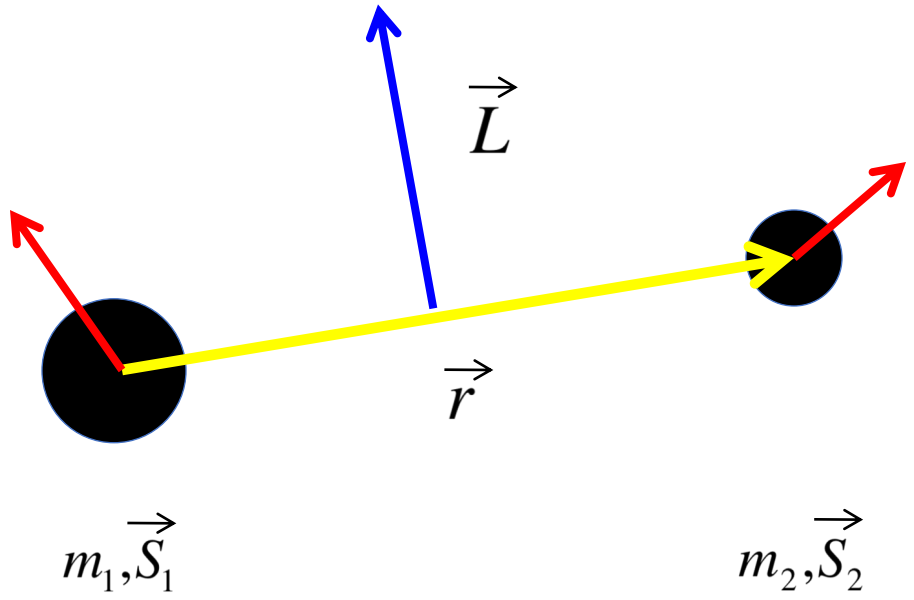
https://github.com/eXtremeGravityInstitute/LISA_Sensitivity
arxiv.org/abs/1803.01944

Binary Black Hole Systems



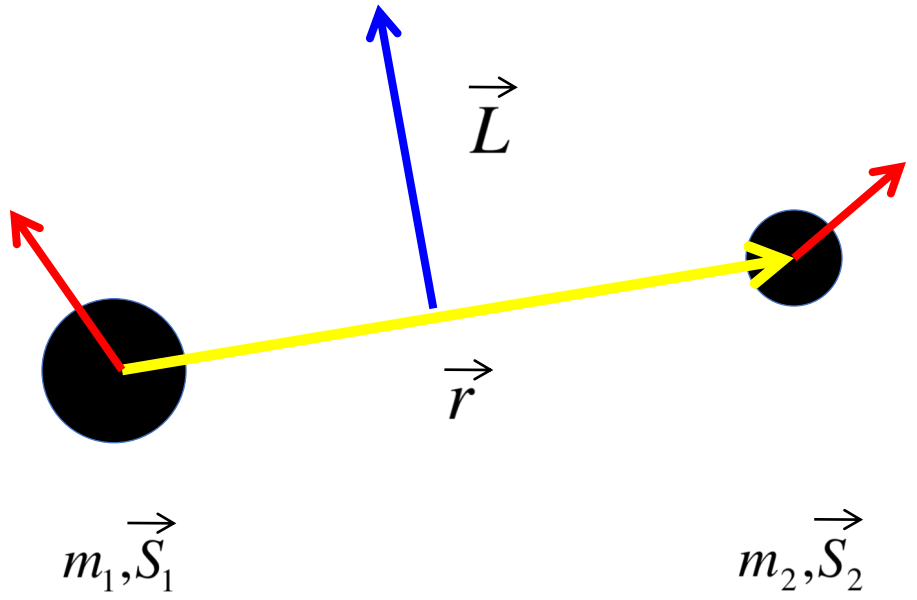
Kip Thorne

Binary Black Hole Systems



$$m = m_1 + m_2 \qquad \mu = \frac{m_1 m_2}{m} \qquad \vec{J} = \vec{L} + \vec{S}_1 + \vec{S}_2$$

Binary Black Hole Systems



m_1, m_2

e, a

χ_1, χ_2

D_L

(θ, ϕ)

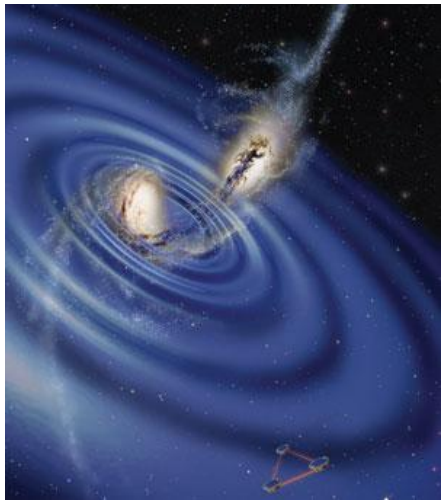
$(\theta, \phi)_L$

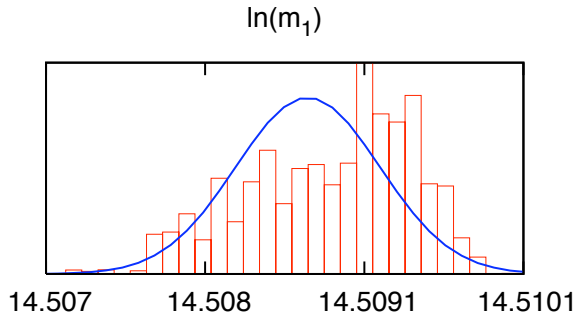
$(\theta, \phi)_{S_1}$

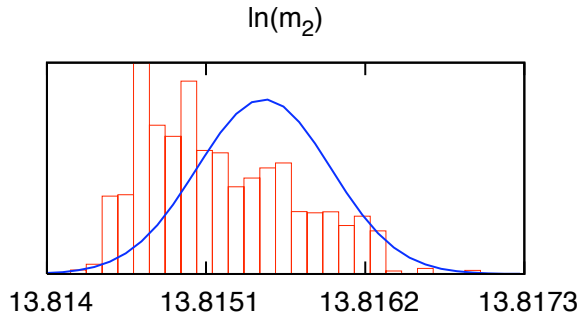
$(\theta, \phi)_{S_2}$

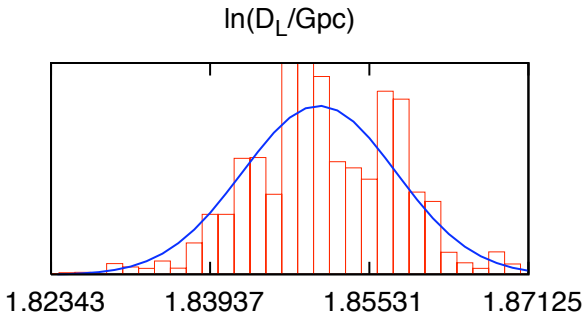
n_0, ϕ_0

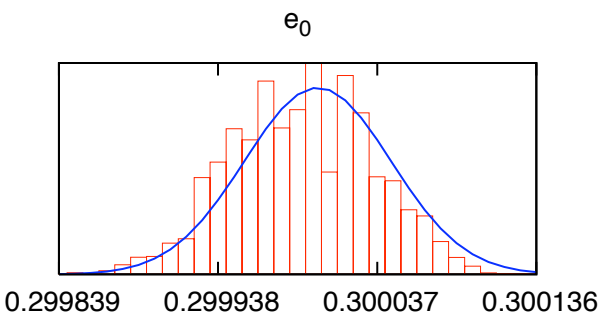
LISA Observations of Massive Black Hole Binaries

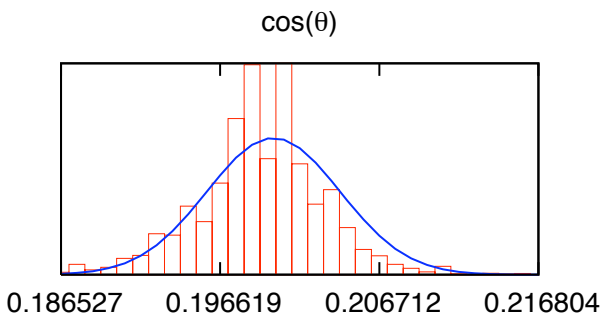


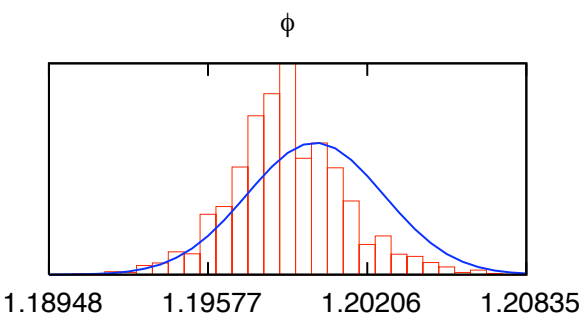






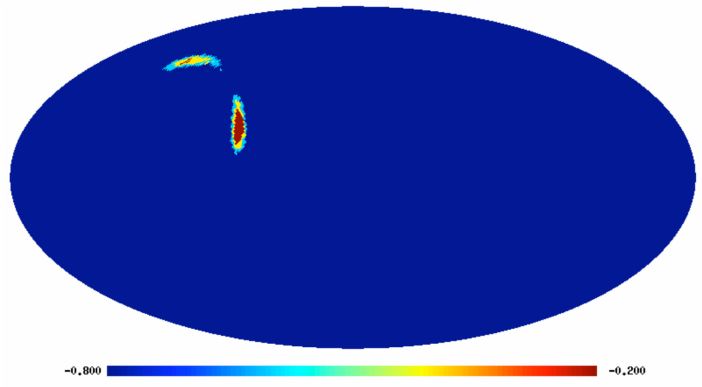


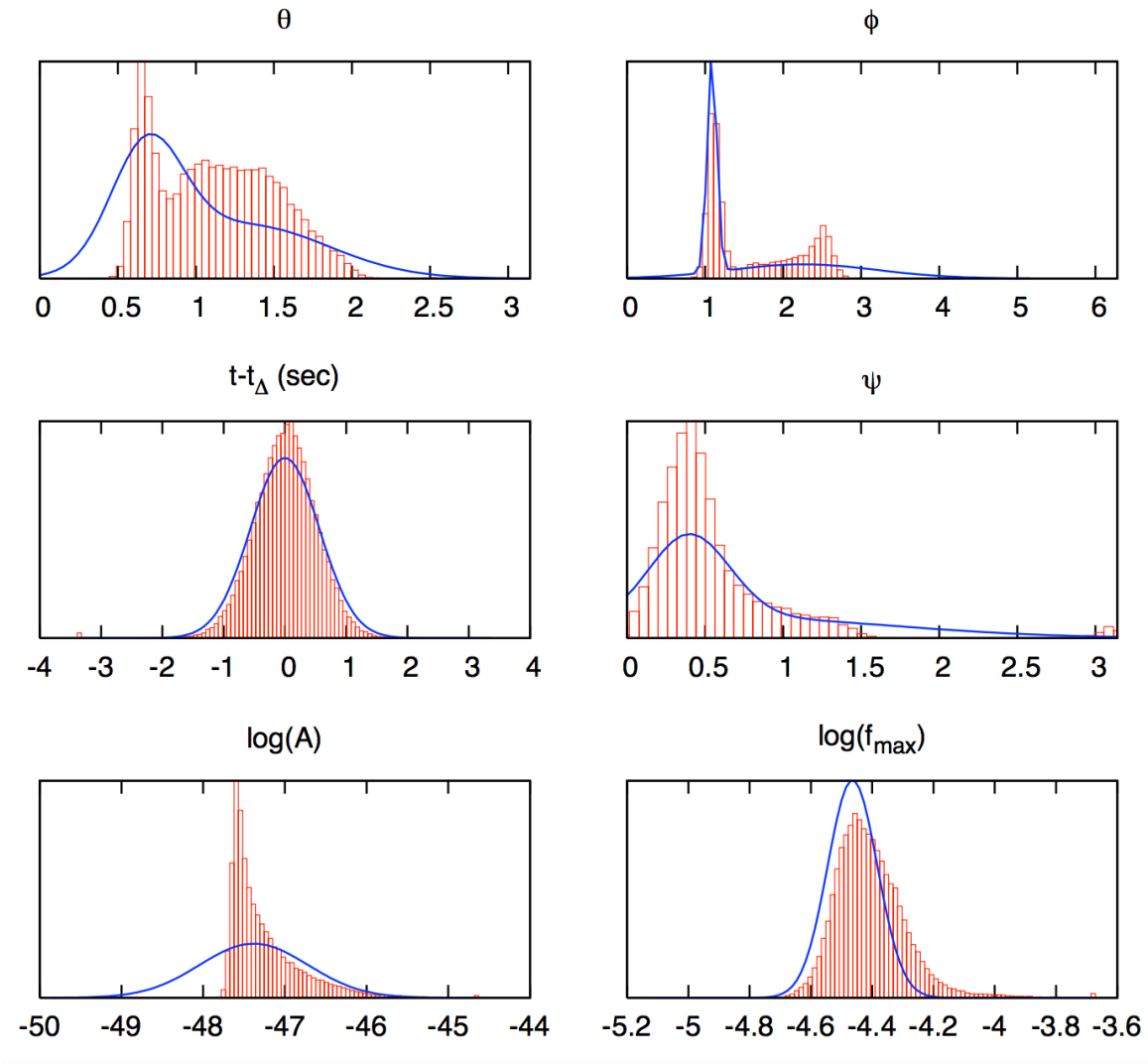




Key and Cornish, PRD 2011

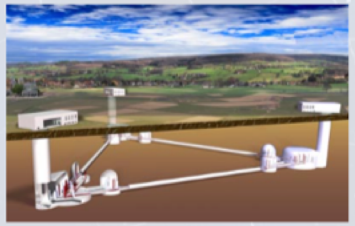
LISA Observations of Bursts from Cosmic String Cusps





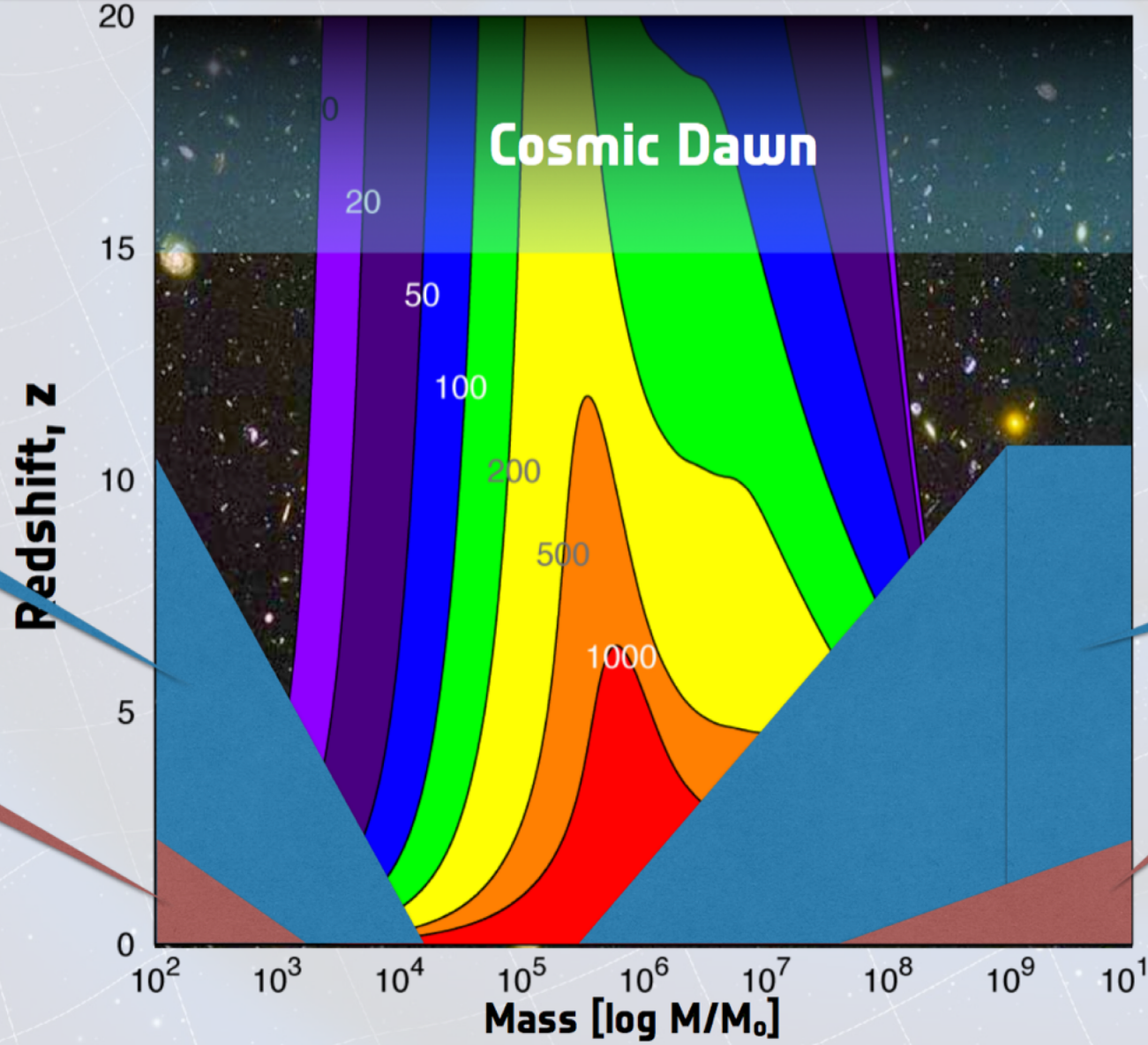
Key and Cornish, PRD 2009

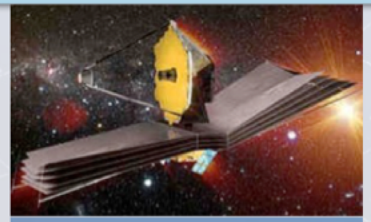
Black Hole Astronomy in the 2030s

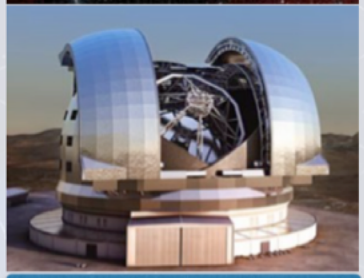


Future ground based detectors e.g. Einstein Telescope

Current ground based GW detectors







Future EM obs. e.g. LSST, JWST, EELT

SKA, Pulsar Timing