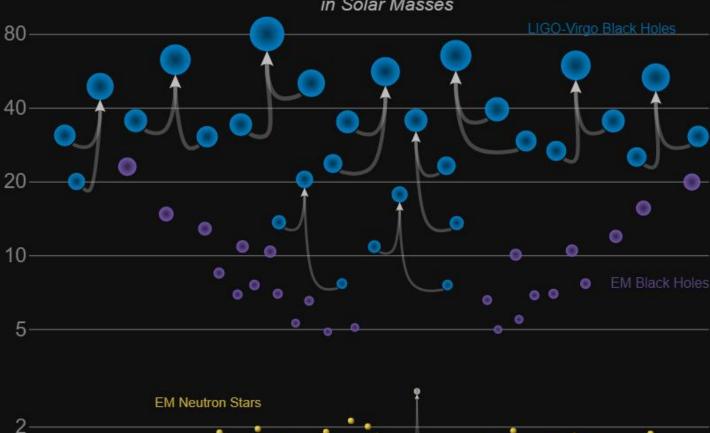
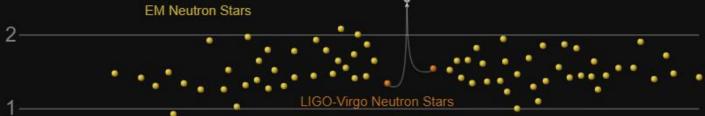
Astrophysics of gravitational wave sources

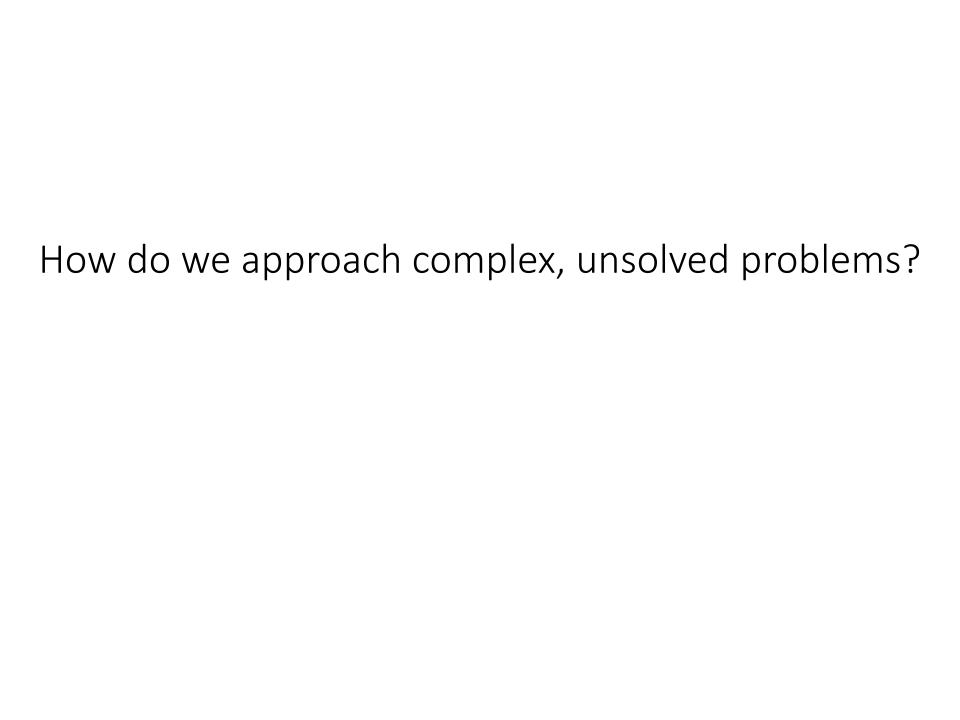
Lecture 2: Orbital decay due to gravitational wave emission

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Masses in the Stellar Graveyard in Solar Masses







Orbital decay timescale due to gravitational wave emission

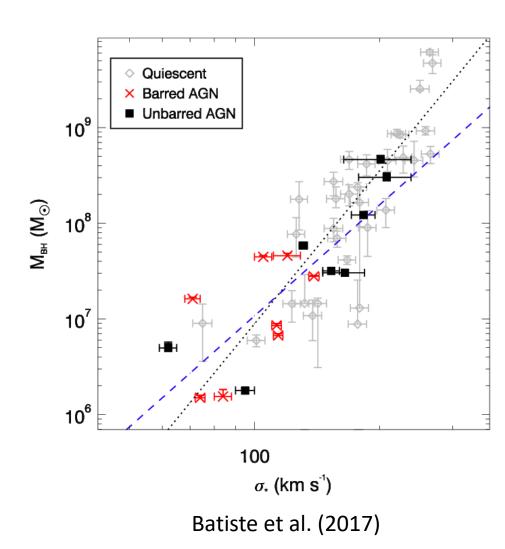
Gravitational wave strain

$$h_{ij}(t) = \frac{2G}{c^4r} \ddot{I}_{ij}^{TT}(t - r/c)$$

Order-of-magnitude problem

Most galaxies contain supermassive black hole in their center (10⁶-10⁹ Msun). Galaxies assemble by mergers with other galaxies and there is evidence that central BHs and galaxies grow together.

When two galaxies merge, the two BHs sink in the center by dynamical friction on stars and eventually they become bound while orbiting in the galaxy stellar population. Illustrate the "Final parsec problem" by estimating the asymptotic distance between the two BHs due to interactions with stars and comparing with GW merger time.



Virial theorem