Primordial Black Holes & their Formation

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With the discovery of gravitational waves from merging pairs of massive black holes, the interest in the question of whether Primordial Black Holes (PBHs) could constitute the Dark Matter (DM) has recently been revived. In this talk, I will review the different mechanisms for (DM) PBHs formation with a focus on inflation which can source the required large density fluctuations for PBHs formation. I will also explain the excursion set theory as a new formalism for the formation of DM PBHs.

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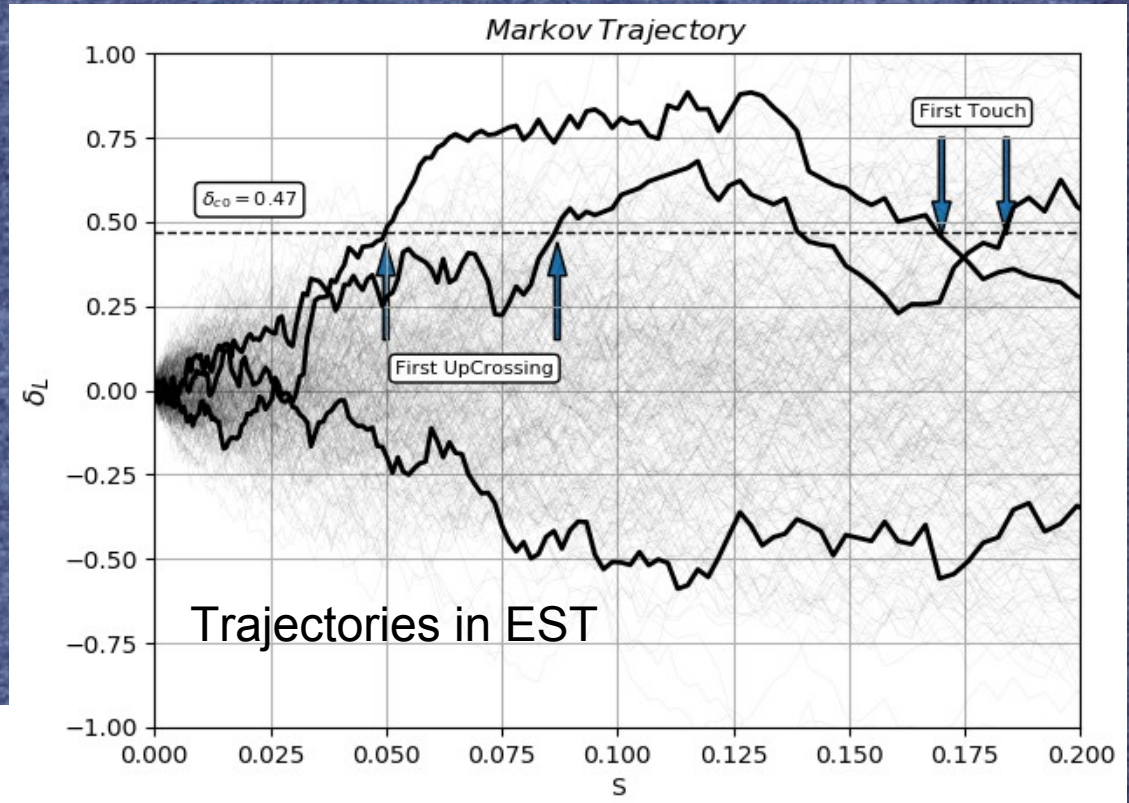
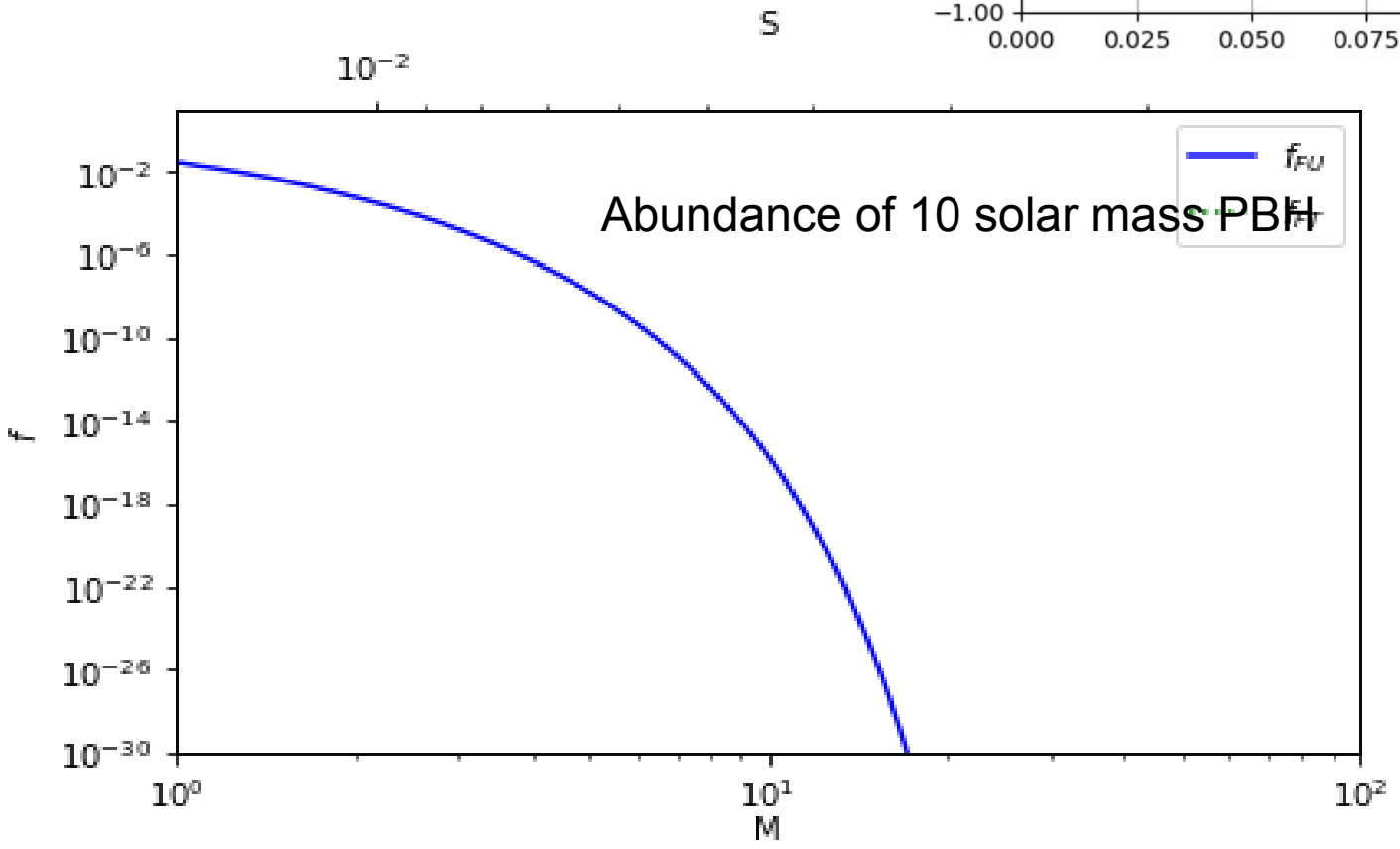
Main Questions

- Why are PBHs useful?
- Can PBHs be a candidate for dark matter?
- How can they form?
- What is the difference between different mechanisms?
- What are the observational constraints on PBHs?

$$\beta \simeq 3.7 \times 10^{-9} \gamma^{-1/2} \left(\frac{g_{*,i}}{10.75}\right)^{1/4} \left(\frac{M_{\rm PBH}}{M_\odot}\right)^{1/2} f_{\rm PBH}$$

$$\beta(M_{\rm PBH}) = \gamma \int_{\delta_c}^{1} \frac{d\delta}{\sqrt{2\pi\sigma_\delta(R)^2}} \exp\left(-\frac{\delta^2}{2\sigma_\delta^2(R)}\right) = \frac{1}{2}\,\mathrm{erfc}\left(\frac{\delta_c}{\sqrt{2\sigma^2}}\right),$$





arXiv: 0912.5297
arXiv: 1801.05235
arXiv: 2009.XXXXX