

Tomohiro Harada: Effect of Inhomogeneity on Primordial Black Hole Formation in the Matter Dominated Era

Wednesday, 4 December 2019 14:40 (20 minutes)

We investigate the effect of inhomogeneity on primordial black hole formation in the matter dominated era. In the gravitational collapse of an inhomogeneous density distribution, a black hole forms if the apparent horizon prevents information of the central region of the configuration from leaking. Since information cannot propagate faster than the speed of light, we identify the threshold of the black hole formation by considering the finite speed for propagation of information. We show that the production probability $\beta_{\text{inhom}}(\sigma)$ of primordial black holes, where σ is the density fluctuation at horizon entry, is significantly enhanced from that derived in previous work in which the speed of propagation was effectively regarded as infinite. For $\sigma \ll 1$, we obtain $\beta_{\text{inhom}} \approx 3.70 \sigma^{3/2}$, which is larger by about an order of magnitude than the probability derived in earlier work by assuming instantaneous propagation of information.