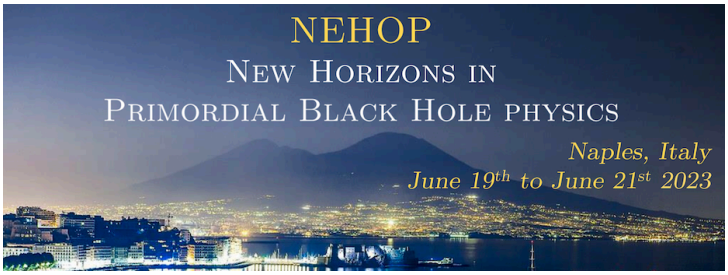

Contribution ID: **34** Type: **Highlight talk**

Supermassive Black Holes Directly from Inflation

Monday, 19 June 2023 17:10 (10 minutes)

It is generally thought that the supermassive black holes (SMBH) of mass $M \sim 10^8 - 10^{10} M_\odot$ ubiquitous in galactic nuclei grew from initially low mass seeds through the processes of accretion and mergers. Eddington-limited growth, however, is insufficient to explain the surplus of SMBH observed at high redshift $z \sim 6$, when the age of the universe was less than 1 Gyr. An alternative proposition is that these SMBH are primordial in origin, having been formed from the collapse of matter overdensities in the early universe.

In this talk, I explore the possibility of SMBH from the direct collapse of curvature perturbations generated during inflation. This generically requires a large enhancement of the primordial power spectrum on small scales, which could arise in single-field models with e.g. a transient period of ultra slow roll or local features like bumps or dips, as well as in a variety of multi-field models. SMBH are formed at late cosmological times, however, corresponding to scales where constraints from spectral distortions of the cosmic microwave background are relevant. In particular, the large enhancement of the power spectrum necessary for efficient black hole formation is naively in conflict with measurements of μ-type spectral distortions from COBE/FIRAS. However, this is assuming Gaussian statistics for the curvature perturbation; less amplification of the power spectrum is needed in the event that the statistics are sufficiently non-Gaussian. I quantify the extreme degree of non-Gaussianity needed to make the scenario of SMBH from direct collapse of inflationary perturbations work and explore the sorts of inflationary models that could give rise to such statistics.

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Session Classification: Session 4