DYNAMICS OF THE VERY EARLY UNIVERSE: TOWARDS DECODING ITS SIGNATURE THROUGH PRIMORDIAL BLACK HOLE ABUNDANCE, DARK MATTER, AND GRAVITATIONAL WAVES

SEMINAR

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Abstract

I will start my talk with a brief overview of the standard reheating scenario. Then, I will discuss reheating through the evaporation of primordial black holes (PBHs) if one assumes PBHs are formed during the phase of reheating. Depending on their initial mass, abundance, and inflaton coupling with the radiation, I discuss two physically distinct possibilities of reheating the universe. In one possibility, the thermal bath is solely obtained from the decay of PBHs, while inflaton plays the dominant energy component in the entire process. In the other possibility, PBHs dominate the total energy budget of the universe during evolution, and then their subsequent evaporation leads to a radiation-dominated universe. Furthermore, I will discuss the impact of both monochromatic and extended PBH mass functions and estimate the detailed parameter ranges for which those distinct reheating histories are realized. The evaporation of PBHs is also responsible for the production of DM. I will show its parameters in the background of reheating obtained from two chief systems in the early universe: the inflaton and the primordial black holes (PBHs). Then, I will move my discussion towards stable PBHs and discuss the effects of the parameters describing the epoch of reheating on the abundance of PBHs and the fraction of cold dark matter that can be composed of PBHs. If PBHs are produced due to the enhancement of the primordial scalar power spectrum on small scales, such primordial spectra also inevitably lead to strong amplification of the scalar-induced secondary gravitational waves (GWs) at higher frequencies. I will show how the recent detection of the stochastic gravitational wave background (SGWB) by the pulsar timing arrays (PTAs) has opened up the possibility of directly probing the very early universe through the scalar-induced secondary gravitational waves. Finally, I will conclude my talk by elaborating on the effect of quantum correction on the Hawking radiation for ultra-light PBHs and its observational signature through dark matter and gravitational waves.

THURSDAY, JUNE 20, 2024

03:00 PM

PAMU SEMINAR ROOM

Everyone is invited to attend