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Phenomenology of compact objects from a first order phase transition in the dark sector

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The study of first order phase transitions (FOPT) in the early Universe provides a window into fundamental physics. One possible observational signature can come in the form of low frequency stochastic gravitational waves, which may explain the NANOGrav observation. FOPT dynamics may be realized in certain BSM scenarios, which can also accommodate particle species in the dark sector. In this talk, we will discuss the formation of compact objects, formed from trapped dark matter particles in the false vacuum, that may subsequently collapse into primordial black holes (PBHs). We propose the use of pulsar timing to search for Doppler shifts in the pulsar timing signal, induced by these transiting PBHs. By also taking stochastic GWs as a complementary probe, we show that an SKA-like facility will be sensitive to transiting PBHs of masses 10^{-8} to 10 solar masses, and FOPT scenarios with critical temperatures lying in the 0.1-10 keV range. Furthermore, motivated by the result that black holes are characterized by their mass and spin, I will present some preliminary results on the spins of false vacuum bubbles, induced by cosmological perturbations during the FOPT. This may serve as a first step in determining the initial spins of PBHs produced from this mechanism.

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