

Quantum Gravity Origin of (Un)Stable PBHs and Gravitational Waves

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We explore the phenomenological consequences of breaking discrete global symmetries in quantum gravity (QG). We explore how quantum gravity effects, manifested through the breaking of discrete symmetry responsible for the production of primordial black holes (PBH) resulting from Domain Wall annihilations, can have observational effects through gravitational waves. While stable PBHs formed in this process can play the role of dark matter, an unstable PBH produced can result in the production of dark matter from its evaporation. Since such QG symmetry breaking leads to DW annihilation, this may generate the characteristic gravitational wave background that can be tested in the current and future gravitational wave detectors. On top of this for unstable (ultralight) PBHs, the dominant contribution to the gravitational wave spectrum comes from the PBH distribution that generates gravitational waves at the second order. This work therefore highlights a tantalizing possibility of probing the effective scale of QG from Gravitational Wave observations.

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