

## The exploration into U(1) hidden sectors using gravitational waves

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**Abstract:** A variety of supergravity and string-based models feature hidden sectors with U(1) gauge groups, playing significant roles in particle physics and cosmology. As constraints on dark matter tighten, exploration into these hidden sectors intensifies. These hidden sectors can engage in feeble interactions with the visible sector and vary between feeble and normal strength with each other. In scenarios where all hidden sector particles are produced via the freeze-in mechanism, they do not reach thermal equilibrium with standard model particles in the thermal bath. Consequently, the hidden sector sustains a distinct temperature from the visible universe, posing challenges in calculating the evolution of these particles. We have devised a general method to compute the complete evolution of hidden sector particles in this model class. My discussion will cover the U(1) extension of the standard model, focusing on various dark matter candidates. The detection of gravitational waves offer an alternative way to explore the details of hidden sectors. Gravitational wave originated from a weakly coupled U(1) hidden sector will be discussed.

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