

## Detecting exceptions of thermal dark matter

We will discuss the remaining parameter space for WIMP-like dark matter with thermal relic density, focusing on two scenarios: the small interaction rate region and the small mass region. In the small interaction rate region, we reanalyze the prospects of detecting dark matter annihilation signals in the Galactic Center, particularly near the supermassive black hole (Sgr A\*), by examining three annihilation processes—p-wave, resonance, and forbidden annihilation—under semi-relativistic velocities, using gamma-ray data from the Fermi and DAMPE telescopes. In the small mass region, we explore a minimal renormalizable dark matter model involving sub-GeV Majorana dark matter and a singlet scalar particle.

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