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Astrophysical signatures of dark matter (DM): probing DM through AGNs

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Active Galactic Nuclei (AGNs) are among the most powerful multi-messenger sources in the universe, emitting high-energy neutrinos and electromagnetic radiation. Recent observations from IceCube and complementary gamma-ray and X-ray telescopes aid in precise modeling of these extreme environments. In this talk, I will discuss how AGNs—natural sites of intense particle acceleration—can also serve as laboratories for probing DM. In the dense DM environments surrounding supermassive black holes, DM can scatter with AGN-accelerated cosmic rays (CRs), leading to rapid CR cooling. This can suppress or modify the expected high-energy neutrino and gamma-ray fluxes. These signatures reveal how AGN multi-messenger observations can probe dark-matter interactions.

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