

Anatomy of astrophysical echoes from axion dark matter

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If the dark matter in the Universe is made of μeV axion-like particles (ALPs), then a rich phenomenology can emerge in connection to their stimulated decay into two photons. We discuss the ALP stimulated decay induced by astrophysical beams of Galactic radio sources. Three signatures, made by two echoes and one collinear emission, are associated with the decay, and can be simultaneously detected, offering a unique opportunity for a clear ALP identification. We derive the formalism associated with such signatures starting from first principles, and providing the relevant equations to be applied to study the ALP phenomenology. We then focus on the case of Galactic pulsars as stimulating sources and derive forecasts for future observations, which will be complementary to helioscopes and haloscopes results.

Primary authors: TODARELLO, Elisa (Turin University); Dr CALORE, Francesca (LAPTh); REGIS, Marco (Istituto Nazionale di Fisica Nucleare)

Presenter: TODARELLO, Elisa (Turin University)