Contribution ID: **421** Type: **Parallel session talk**

ALP dark matter with non-periodic potentials: parametric resonance, halo formation and gravitational signatures

Monday 21 August 2023 18:18 (18 minutes)

Axion-like particles (ALPs) are leading candidates to explain the dark matter in the universe. Their production via the misalignment mechanism has been extensively studied for cosine potentials characteristic of pseudo-Nambu-Goldstone bosons. In this work we investigate ALPs with non-periodic potentials, which allow for large misalignment of the field from the minimum. As a result, the ALP can match the relic density of dark matter in a large part of the parameter space. Such potentials give rise to self-interactions which can trigger an exponential growth of fluctuations in the ALP field via parametric resonance, leading to the fragmentation of the field. We study these effects with both Floquet analysis and lattice simulations. Using the Press-Schechter formalism, we predict the halo mass function and halo spectrum arising from ALP dark matter. These halos can be dense enough to produce observable gravitational effects such as astrometric lensing, diffraction of gravitational wave signals from black hole mergers, photometric microlensing of highly magnified stars, perturbations of stars in the galactic disk or stellar streams. These effects would provide a probe of dark matter even if it does not couple to the Standard Model. They would not be observable for halos predicted for standard cold dark matter and for ALP dark matter in the standard misalignment mechanism. We determine the relevant regions of parameter space in the (ALP mass, decay constant)-plane and compare predictions in different axion fragmentation models.

Collaboration / Activity

Quantum Universe Cluster

Primary authors: CHATRCHYAN, Aleksandr (T (Cosmology)); ERÖNCEL, Cem (DESY); SERVANT, Geraldine (T (Cosmology)); KOSCHNITZKE, Matthias (T (Phenomenology))

Presenter: KOSCHNITZKE, Matthias (T (Phenomenology))

Session Classification: T03 Dark Matter

Track Classification: Dark Matter