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Collision Rates of Axion Stars with astrophysical Objects

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Bose stars are gravitationally bound Bose-Einstein-Condensates in which the kinetic quantum pressure is stabilized by the self-gravitation and self-interaction of the scalar field.
In recent years, several interactions between these Condensates and astrophysical objects have been proposed: Bose star merger events could lead to supercritical soliton states, which can either shed a large fraction of their mass through relativistic Axion emission [1] or steadily emit radio photons given suitable Axion-Photon coupling $g_{a\gamma\gamma}$ [2, 3]. Similarly, the interaction of Bose stars with the strong magnetic fields of neutron stars could lead to enhanced photon emission [4, 5].
This talk gives a short overview about the fundamental properties of Bose stars - their condensation time scales, accretion rates and the mass-radius relation for QCD Axion stars. Considering these properties, we develop a formalism to precisely calculate collision rates for a broad range of Axion stars with the most abundant astrophysical objects in the milky way: ordinary stars, white dwarves, neutron stars, stellar black holes, planets and other Axion stars.
We re-evaluate from our results the likelihood of events and the possibility of future detection for several Axion star interactions and for different values of the Axion mass and coupling. We conclude by proposing physically motivated mass distributions for QCD Axion stars and demonstrate how this affects the likelihood of interactions.

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