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Axions in plasmas: from active production to dark matter candidates

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Axions are hypothetical particles proposed as an elegant solution to the strong CP problem in the Standard Model. However, they were soon discovered to be very well-motivated dark matter candidates due to their low interaction with photons and ordinary matter. More recently, there has been a hype around axions in the context of Plasma physics. It was shown that their interaction with the quanta of plasma oscillations (plasmons) forms a new quasiparticle, the axion-plasmon-polariton, and together with the use of dynamical instabilities to excite electron waves in plasma, we can exploit this new mode to bring about new axion detection schemes that are highly competitive in comparison with current experiments. In this work, we will attempt to discover which dynamical instability yields the best axion-photon conversion rate while re-writing this semi-classical theory in a brand new formalism within the framework of Quantum plasma dynamics.

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