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White light parametric instabilities in plasmas LUIS O. SILVA, J. SANTOS, GoLP/CFP, Instituto Superior Tecnico, Portugal, R. BINGHAM, Rutherford Appleton Laboratory, UK — Parametric instabilities are pervasive in many fields of science, its importance stemming from their close connection to the onset of nonlinear and collective effects such as solitons, vortices, self-organization, and spontaneous ordering. Developments in light sources and laser technology, continue to reveal novel features of the parametric instabilities in plasmas, and have revived many questions associated with parametric instabilities driven by partially coherent radiation sources. These instabilities are critical in many problems, and have eluded a self-consistent treatment because of the lack of the appropriate theoretical framework. We employ a formalism, directly inspired in the Wigner-Moyal formalism for Quantum Mechanics, to establish the general dispersion relation for parametric instabilities driven by electromagnetic radiation, with arbitrary statistics, coupled to the electron collective dynamics in a unmagnetized plasma. The one-dimensional analysis for Stimulated Raman Scattering reveals a growth rate dependence with the coherence width σ of the radiation field scaling as $1/\sigma$ for backscattering, and $1/\sigma^{1/2}$ for forward scattering, and a significant dependence of the instability growth rate on the shape of the power spectrum of the radiation. The results open the way to a full multi-dimensional description of parametric instabilities driven by intense radiation sources, with arbitrary statistics, interacting with plasmas.

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