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Suprathermal vs thermal spontaneous emissions in space plasmas

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Quasi-thermal motions of plasma particles trigger multiple physical processes via spontaneous emission and reabsorption (or induced emission) of random electromagnetic field fluctuations. Spontaneous fluctuations are detected in the quasi-stationary solar wind far from the influence of induced emissions, e.g., temperature anisotropies instabilities, and are fully determined by the velocity distributions of plasma particles, making it possible to unveil their properties.
We present recent progress on the evaluation of spontaneously emitted fluctuations in magnetized suprathermal plasmas and discuss possible applications in the low- and high-frequency regimes. Spontaneous spectra predicted by the theory are confirmed by the particle-in-cell simulations, and may be employed in spectroscopic techniques of in situ or remote diagnosis of the very hot and dense plasmas, e.g., close to the Sun, where direct measurements of plasma particles and their properties are technically impossible. Depicted from the new data expected from the current (Parker Solar Probe) and forthcoming missions (Solar Orbiter), contrasting patterns of suprathermal emissions may provide answers to a series of essential questions pertaining to coronal origin of the suprathermal populations or solar wind particles acceleration.