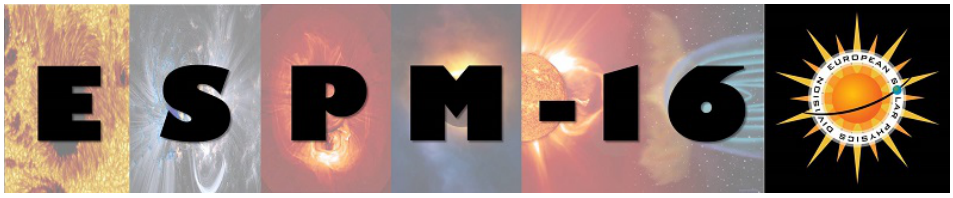

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Double plasma resonance instability as a source of solar radio zebra emission

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Radio zebras are detected as narrow-band stripes in radio observations from Sun, Jupiter, and Crab pulsar. They are Type IV radio fine structures and can help with diagnoses of local plasma properties in the active solar regions. The double plasma resonance model of solar radio zebra assumes dense and cold background isotropic plasma and rare hot component with an unstable loss-cone type of distribution function. The instability generates the Bernstein electrostatic waves that can transform into electromagnetic radiation. We used analytical theory and 3D electromagnetic relativistic Particle-in-Cell simulations and found that increasing the temperature shifts the growth-rate maxima to lower frequencies for the DGH velocity distribution function of hot electrons. Moreover, the maxima are not distinguishable for loss-cone thermal velocities $v_{\mathrm{t}} \geq 0.3\,c$. We estimated the brightness temperature, energy density, size of the zebra emission source, and conversion rates into electromagnetic waves.

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