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标题: Dynamics of accelerated electron beams and X rays in solar flares with sub-THz radiation

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摘要: Unique measurements by a solar submillimeter radio telescope (SST) have been carried out in the sub-THz radiation at 212 and 405 THz over the past decade. The spectrum of RF radiation in this region increased with frequency for the three flares of November 2 and 4, 2003, and December 6, 2006, and the flux value reached 5 x 10(3)-2 x 10(4) sfu at 405 GHz (Kaufman et al., 2009).

In this work, we consider a set of nonlinear equations for an accelerated electrons beam and the Langmuir wave energy density. The distribution functions of the accelerated electron beam and wave energy density are calculated taking into account Coulomb collisions, electron scattering by waves, and wave scattering by plasma ions. In addition, the source of accelerated particles and the heat level of the Langmuir turbulence are specified. The beam and plasma parameters are chosen based on the aims of a problem. The plasma concentration varies from n = 10(13) to 10(15) cm(-3), the electron plasma frequency f (p) = (3 x 10(10)-3 x 10(11)) Hz in this case. The ratio of plasma and beam concentrations, sufficient to explain the value of the radio flux at a frequency of 300 GHz, is n (b)/n = 10(-3). The Langmuir turbulence is excited due to the instability of the accelerated electron beam with an initial distribution function of the "bump-in-tail" type. Then, the parameters of radiowaves are calculated in the sub-THz range under the assumption of coalescence of two plasma waves. The calculation results show that a sub-THz radio flux can be obtained under the condition of injection of accelerated electrons. The fine time structure of radio flux observed is easily simulated based on this statement by the pulsed time structure of electron beams and their dynamics in overdense plasma.

X-ray and gamma radiation was recorded during the events under study. Hard X-ray radiation is bremsstrahlung radiation from accelerated electron beams.

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