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Propagation of Type III radio emission through solar corona: numerical analysis

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In this work the emission of fast electron beam propagating through plasma of solar corona is investigated numerically. Frequency of registered electromagnetic wave is known to depend on local plasma density at the point of generation. In our model the beam crosses two levels of density, corresponding of measured frequencies on which we calculate frequency drift rate of Type III bursts. We divide the volume occupied by the electron beams into elementary volumes, and determine the contribution to intensity of each of them, taking into account that group velocity of electromagnetic wave grows with the distance from the Sun. Summing over signals from all elementary volumes gives the full profile of the intensity at each frequency.

The obtained duration and frequency drift rate of type III bursts correlate with existing observational data. For example, when the linear dimension of beam is the half of solar radius, duration of burst is some seconds. We analyze effect of the size and the shape of the original electron beam, and effect of the angle between the electron beam velocity and the direction to the observer. Speed of electron beam corresponding to infinite frequency drift rate is also calculated, therefore the presented model can explain fast type III bursts with extremely large value of frequency drift rate observed at UTR-2 radiotelescope during last decade.