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Eigenmode Structure in Solar Wind Langmuir Waves

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We show that observed spatial- and frequency-domain signatures of the most intense solar wind Langmuir waves can be described as localized, discrete-frequency eigenmodes trapped in a parabolic density fluctuation. Electric field waveforms from spacecraft in the solar wind are compared with one-dimensional solutions and, in many cases, can be represented by 1-3 of the lowest order eigenmodes. The spatial scale of the wave packets is on the order tens of wavelengths so the eigenmodes are able to draw energy directly from electron distributions associated with a solar type III radio bursts, which implies that Langmuir waves can grow in a strongly inhomogenous medium. The nonlinear evolution of the most intense Langmuir waves, critical for producing the Solar Type II and Type III radio bursts, can be strongly influenced by the quantized frequency structure and localization of the trapped eigenmodes.