ORIGIN OF PLASMA WAVE CLUMPING IN TYPE III RADIO BURST SOURCES

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It is hypothesized that the observed clumping of plasma waves in type III sources in the solar wind is due to suppression of the linear stream-plasma interaction by density inhomogeneities of scale size comparable to the characteristic amplification length. Criteria are given for when such suppression should be important. The magnitude and scaling of density inhomogeneities in the 50-200 km range near 0.5 AU is estimated from interplanetary scintillation data. This information is used to construct model sources in which plasma waves are traced and amplified with random inhomogeneities to test the hypothesis. Significant clumping occurs for inhomogeneity scales of 50 and 100 km with inhomogeneity expectation values of 4.8×10^{-3} and 6.0×10^{-4}, respectively, but not for 200 km scales. Further research is suggested to determine more completely the effects of density inhomogeneities in type III sources. Further details can be found in Smith, D.F., Sime, D. 1979, Astrophys. J., in press.

DISCUSSION

Papadopoulos: You have spikes which are not in equilibrium which means that they would be moving out with a group velocity homogeneized in space. Now the group velocity is about 10^6 and so you would expect hundred kilometer inhomogeneitiy spikes to homogeneize very quickly.

D.F. Smith: Finite group velocity effects are not explicityly taken into account, but these effects are small because the time required to amplify the plasma waves is quite short.

Melrose: As I understand the physics of the situation, the maximum wave growth occurs at the density minimum (or possibly the maximum) and then refraction impedes or prevents propagation of the Langmuir waves over significant distances.

Steinberg: To which extent are your results sensitive to the model of interplanetary electron density inhomogeneities. IPS measurements do imply integration over long lines of sight; but our (C.C. Harvey's)

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experiment on ISEE-1 and -2 shows that electron density inhomogeneities may be a factor of 2 off from the average. This is to be compared to average rms relative N_c deviations of 1% or less derived from IPS.

D.F. Smith: The results presented refer only to values of $\delta n/n$ deduced from interplanetary scintillations. If the actual values of $\delta n/n$ are larger, then the suppression of the instability would be even larger with correspondingly more extreme modulations.

R.A. Smith: It is misleading to say that Gurnett's observations preclude the existence of solitons. Gurnett's integration time constant is 50 msec, which is much greater than the time to cross the convecting soliton. Gurnett then divides the time-integrated RC response by his time constant of 50 ms, and deduces a field amplitude much smaller than the actual amplitude in the soliton.

D.F. Smith: I never said that the observations of Gurnett in no way rule out the possibility that there are solitons there. They just simply give no positive evidence that they are there.