Plasma Wave Coupling in Inhomogeneous Space: A New Approach

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Plasma waves in inhomogeneous space become complicated owing to existence of local cutoff and coupling as well as mode conversion. Previous theoretical methods such as the WKB and Bremmer approximations are invalid around the cutoff and singularities, where we can not obtain exact energy transport among the different wave modes. By adopting the concept of the invariant imbedding method, we have newly developed a powerful technique, which allows us to calculate the exact coefficients of reflection and transmission as well as the resonant absorption. We have derived a set of equations for fully coupled plasma waves in both unmagnetized and magnetized plasmas, which give correct results to the approximated solutions in previously published literature. We also introduce and discuss the time-dependent 3-D simulation results, which are compared with the theoretical approach.