XXIII. SPONTANEOUS RADIOFREQUENCY EMISSION FROM HOT-ELECTRON PLASMAS*

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RESEARCH OBJECTIVES AND SUMMARY OF RESEARCH

The production of a hot plasma usually results in an anisotropic velocity distribution function for the constituent particles. Such distribution functions are known to be unstable (velocity-space instabilities), and are often identified experimentally by the radio-frequency emissions that they produce. The pulsed electron-cyclotron discharge, which we have studied in the past, produces a hot-electron plasma. In the "afterglow" (in between the applied microwave pulses) we have observed strong emission near the electron-cyclotron frequency and its harmonics.

During the past year, we have carried out a theoretical stability analysis of plasmas with anisotropic velocity distributions. This includes a classification and description of such instabilities in terms of negative energy modes that we have proposed. Also, during the past year we have observed three types of enhanced RF emissions from a pulsed electron-cyclotron discharge, one that is accompanied by a loss of diamagnetic signal, one that is accompanied by an oscillatory variation in cold-plasma density, and one that is not accompanied by any appreciable plasma loss.

We plan to emphasize our experimental study of the proper identification and classification of the observed instabilities that occur in between the applied microwave pulses that form and maintain the plasma. Further supporting theoretical work on stability theory will be carried out as needed for interpreting experimental data.

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