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Flush-mounted probes smaller than the ion gyroradius[1] ILON JOSEPH, RON COHEN, DMITRI RYUTOV, Lawrence Livermore National Lab — When an electrically conducting probe with a cross-section that is smaller than an ion gyro-radius but larger than an electron gyro-radius is placed within a magnetized plasma, the electrostatic perturbation that is produced develops an extremely long length scale parallel to field lines. For such small-scale disturbances, collisions play an important role in determining the response of the lowest-order distribution function. In the fluid picture, the ion viscous force dominates and the ions effectively become demagnetized. Kinetically, the dominant non-adiabatic response is generated by electron-ion friction rather than parallel streaming, because the parallel length scale is typically much longer than the mean free path. This study also has direct application to the linear dispersion relation of modes that are dominated by electron-scale physics. For example, divertor leg instabilities can be terminated near an X-point due to the development of fine scales through the action of magnetic shear. The non-adiabatic correction to the dispersion relation of these modes is determined.

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