Lower hybrid drift waves in the reconnection current sheet of laboratory and space plasmas

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Lower hybrid drift waves (LHDWs) inside the reconnection current sheet are studied by observations of the magnetospheric Multiscale (MMS), measurements in the Magnetic Reconnection Experiment (MRX), and a local, linear theoretical model. Both space and laboratory observations show that the type of LHDWs is determined by the value of the plasma beta. When the plasma beta is low (high guide-field case), the short-wavelength, quasi-electrostatic LHDW (ES-LHDW) that propagates perpendicular to the magnetic field is unstable. When the beta is high (low guide-field case), on the other hand, the long-wavelength, electromagnetic LHDW (EM-LHDW) has a positive growth rate. In particular, the ES-LHDW is capable of generating anomalous drag between electrons and ions [1]. Moreover, initial MRX measurements indicate that there is a positive correlation between the electron temperature and density fluctuations associated with the ES-LHDW. This means that the ES-LHDW can be generated in the electron diffusion region during reconnection with a guide field, potentially affecting the electron and reconnection dynamics. To quantify the effects of the ES-LHDW on electron heating and anomalous terms in the Ohm's law in MRX plasmas, we have developed a local, linear model that can be used for plasma with arbitrary collisions. Results from the model show that collisional effects decrease the growth rate of both types of LHDWs but their impacts are limited (<20 %) [2]. This model will be used to quantify the wave-associated electron heating and other anomalous terms via quasi-linear calculations with measured amplitudes of LHDWs.

[1] Yoo *et al.* Lower hybrid drift waves during guide field reconnection, *Geophys. Res. Lett.* **47**, e2020GL087192.
[2] Yoo *et al.* Effects of Coulomb collisions on lower hybrid drift waves inside laboratory reconnection current sheet, *submitted.*