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Ion heating and velocity fluctuation measurements in a high-temperature laboratory plasma D.A. ENNIS, D. CRAIG, D.J. DEN HARTOG, G. FIKSEL, S. GANGADHARA, S.C. PRAGER, University of Wisconsin-Madison and the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas — In many astrophysical and laboratory plasmas the magnetic field and plasma temperature are affected by magnetic fluctuations. In the Madison Symmetric Torus we study the redistribution of magnetic field by correlated velocity and magnetic field fluctuations (the MHD dynamo, <v x b>) and ion heating during magnetic reconnection. Emission from neutral beam-induced charge exchange recombination is collected by a high-throughput spectrometer yielding localized measurements of impurity ion temperature and velocity with high time resolution. We find poloidal velocity fluctuations correlated with magnetic fluctuations for a range of wavenumbers and the phase implies a contribution to the MHD dynamo. The correlation is greatest near resonant surfaces, where the wavenumber parallel to the magnetic field vanishes. During reconnection events, fluctuation amplitudes increase, the stored magnetic energy decreases, and strong ion heating is observed. The heating mechanism is unclear, but the increase in ion energy is comparable to the decrease in stored magnetic energy. Measurements of both bulk and impurity ions suggest the impurities are more strongly heated than the bulk and the heating source is global. Work supported by U.S.D.O.E. and N.S.F.

David Ennis
University of Wisconsin-Madison

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