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Measurement of Magnetic-Field-Independent Thermal Diffusivity in Electron Plasmas (PhD Oral-24)[1] KURT A. THOMPSON, ANDREY A. KABANTSEV, C. FRED DRISCOLL, University of California, San Diego, NICOLA PANZERI, University of Milan, Italy — Studies of cross-magnetic-field heat transport are critical to further our understanding of astrophysical and fusion plasmas. Incisive heat transport experiments can be performed on nonneutral plasmas due to their quiescent nature and excellent confinement properties. Utilizing a cylindrical pure electron plasma confined in a Penning-Malmberg trap we present measurements of cross-field thermal diffusivity over a range of magnetic fields from B=1 kG to B=13 kG. The plasma has density $n \approx 10^7$ cm^{-3} and temperature T<1 eV resulting in $r_c << \lambda_D$. Heat transport in this regime is expected to be dominated by 1D long-range collisions with impact parameter $r_c < \rho < \lambda_D$, and the predicted long-range thermal diffusivity, χ_L, is notably independent of magnetic field, i.e. $\chi_L \propto n^0 B^0$. In contrast, classical 3D short-range collisions with impact parameter $\rho < r_c$, yield a classical thermal diffusivity, $\chi_C \propto n^1 B^{-2}$. Experimentally, the thermal diffusivity is calculated from the radial heat flux which is derived from measurements of the temporal evolution of the radial temperature and density profiles. Our measurements of thermal diffusivity are in excellent agreement with the long-range prediction and verify the magnetic-field independence of the heat transport. Furthermore, it is found that the measured diffusivity exceeds the classical prediction by four to six orders of magnitude over the range of tested magnetic fields.

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Kurt Thompson
University of California, San Diego

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