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Weak localization as a definitive test of diffusive models in the Casimir effect[1] ANDREW ALLOCCA, JUSTIN WILSON, VICTOR GALITSKI, Univ of Maryland-College Park — Results from many measurements of the Casimir effect suggest that the metallic plates in these experiments should be modeled with the plasma model of free electrons as opposed to the naive diffusive Drude model, while other experiments seem to indicate the exact opposite, with results more in line with a diffusive model. We study the Casimir effect at low temperatures between a thick disordered plate and purely two-dimensional disordered system where the Drude conductivity decreases logarithmically at low temperatures due to weak localization. This effect can be tuned with either temperature or applied magnetic field leading to a measurable change in the Casimir force. On the other hand, a ballistic model cannot experience such an effect and is only weakly dependent on temperature and magnetic field. As a result, we propose that an experiment would unambiguously differentiate between diffusive and ballistic models by measuring the effect at low temperatures with an applied magnetic field. Additionally, we calculate the impact that fluctuations in the disorder distribution have on the Casimir effect. Assuming the validity of a diffusive model, we find that the Drude model is a good approximation of a more exact treatment of disorder.

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