Casimir Free Energy of Metallic Films: New Way to Discriminate between Drude and Plasma Models

Galina Klimchitskaya

Pulkovo Observatory of the Russian Academy of Sciences and Peter the Great Saint Petersburg Polytechnic University, Russia

Email of Presenting Author: g_klimchitskaya@mail.ru

It is shown that for metallic films of several tens of nanometer thickness the Casimir free energy and pressure calculated with the Lifshitz theory using the Drude and plasma model approaches take significantly different values and can be easily discriminated. Both cases of a metallic film sandwiched between two dielectric plates and free-standing in vacuum are considered. When the plasma frequency of film metal goes to infinity, the Casimir free energy obtained using the Drude model approach goes to a nonzero limit in contradiction with physical intuition. If the plasma model approach is used, the free energy of metallic film goes to zero in the limit of infinitely large plasma frequency. The possibilities to observe the predicted effects discriminating between the Drude and plasma model approaches are discussed.