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# Seminar general

# Molecular Forces on Macroscopic Bodies


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Van der Waals-London and Casimir forces acting between macroscopic bodies are derived by introducing explicitly the polarization degrees of freedom and their interaction with the electromagnetic field. The Lorentz-Drude model of (non-magnetic) matter polarization provides an adequate tool for studying the dynamics of the mobile charges in polarizable bodies. Results are given for two electromagnetically-coupled semi-infinite solids (half-spaces) in vacuum, or with a third, polarizable body in-between. It is shown how to derive the force acting between two bodies of any shape. The force between a sphere and a half-space is derived explicitly, to meet the most interesting experimental situation. The polarizations of the two bodies are coupled through the electromagnetic field. The normal modes and the eigenfrequencies of the interacting ensemble of two polarizable bodies are calculated and the force is derived from the zero-point energy of the vacuum fluctuations. A historical overview is done, concerning quantum-mechanical calculations, vacuum fluctuations of the electromagnetic field, quantum-statistical theory of electromagnetic fluctuations and the theory of field propagators. So many theories led to a long-standing debate concerning "who is moving in there and brings the molecular forces". On the other hand, the experimental evidence in favour of all these results seems solid. It seems that we are in the uncomfortable position in this subject of knowing the correct results, without understanding them. The main aim of this Seminar is to bring some new insights in the problem, and to multiply the unclear things, by adding, for instance, another meaning of the vacuum for the macroscopic bodies.


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