When is the mode-summation method of calculating van der Waals force valid? ARVIND NARAYANASWAMY, Columbia University — Most calculations of van der Waals forces and Casimir forces can be categorized as variations of two "proto methods": (1) Lifshitz theory, and (2) mode summation method. In the Lifshitz theory, by which I include the subsequent generalization by Dzyaloshinskii, Lifshitz, and Pitaevskii [Adv. Phys. 10, 165 (1961); See also Zheng and Narayanaswamy, Phys. Rev. A 83, 042504 (2011)] the dispersion force is expressed in terms of the (dyadic) Green's function of the vector Helmholtz equation. In the mode summation method [see Casimir, Proc. Kon. Ned. Akad. Wetensch. 51, 793 (1948); Van Kampen, Nijboer, and Schram, Phys. Lett. A 26, 307 (1968)], the free energy of a configuration of objects is expressed in terms of the sum of the free energies of each of the possible electromagnetic modes. The derivative of this free energy with respect to variation of relative positions between the objects yields the force between two objects. However, we raised questions about the validity of the mode summation method when calculating van der Waals forces in dissipative media [see Narayanaswamy and Zheng, Phys. Rev. A 88, 012502 (2013) and Ninham, Parsegian, and Weiss, J. Stat. Phys. 2, 323 (1970)]. In this talk, I want to start a discussion about the validity of the mode summation method.

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