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Casimir-polder interaction of an atom with a cavity wall made of phase-change material out of thermal equilibrium

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Abstract

We consider the out-of-thermal-equilibrium Casimir-Polder interaction between atoms of He∗, Na, Cs, and Rb and a cavity wall made of sapphire coated with a vanadium dioxide film which undergoes the dielectric-to-metal phase transition with increasing wall temperature. Numerical computations of the Casimir-Polder force and its gradient as the functions of atom-wall separation and wall temperature are made when the latter exceeds the temperature of the environment. The obtained results are compared with those in experiment on measuring the gradient of the Casimir-Polder force between87Rb atoms and a silica glass wall out of thermal equilibrium. It is shown that the use of phase-change wall material significantly increases the force magnitude and especially the force gradient, as opposed to the case of a dielectric wall.

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Keywords

Atom-wall interaction, Atomic polarizability, Dielectric-to-metal phase transition, Nonequilibrium Casimir-Polder force, Phase-change material

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