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Polarization of vacuum with nontrivial boundary conditions

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Abstract

In the framework of the zeta-regularization approach, we consider the polarization of the scalar field vacuum with nontrivial boundary conditions originating from electrodynamics in the presence of a conducting infinitely thin boundary layer. Boundary conditions of the first type correspond to the case where the field is continuous on the boundary while its derivative has a jump proportional to the boundary value of the field. Boundary conditions of the second type correspond to the case where the field derivative is continuous on the boundary but the field itself has a jump proportional to the field derivative on the boundary. We explicitly obtain the zeta function of the scalar field Laplace operator with the above boundary conditions and calculate all the heat kernel coefficients. We obtain an expression for the energy of the scalar field vacuum fluctuations. © 2011 MAIK/Nauka.

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Keywords

Casimir effect, polarization of vacuum, quantum field theory, zeta function