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Some Quantum Effects in de Sitter Spacetime with Compact Dimensions

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We investigate the effects of background curvature, nontrivial topology and of a planar boundary on the properties of the vacuum state for a charged scalar field. The background geometry is locally dS with an arbitrary number of toroidally compact dimensions. The planar boundary is perpendicular to one of infinite dimensions and on it the charged scalar field obeys the Robin boundary condition. Along compact dimensions general quasiperiodicity conditions are imposed and, in addition, the presence of a constant gauge field is assumed. The latter induces Aharonov-Bohm-type effect on the vacuum expectation values (VEVs) of physical observables. The periodicity conditions imposed on fields along compact dimensions give rise to the modification of the spectrum for normal modes and, related to this, the expectation values of physical observables are changed. As important local characteristics of the vacuum state we consider the VEVs of the field squared, energy-momentum tensor and of the current density.

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