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Gravitational memory of Casimir effect

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We investigate the influence of a time-varying spacetime background on the vacuum polarization of a massless quantum field confined to a Casimir cavity. The background is modelled as an anisotropic Bianchi-I spacetime, in which small time-dependent perturbations around the flat spacetime are vanishing in the far past and future. The spacetime admits asymptotic Minkowskian regions, thus allowing for an unambiguous definition of the in- and out-field vacua. Following Schwinger's proper-time approach, we evaluate the vacuum polarization inside the Casimir cavity. We show the presence of a small shift in the field vacuum energy, once the perturbation is over. The time-dependent background has distorted the field modes, causing a permanent change in the zero-point energy of the field confined to the Casimir apparatus. As an example, we briefly consider the case of a weak gravitational wave background, which can be locally identified with the previously employed Bianchi-I spacetime model. The present effect appears as a sort of gravitational memory of the Casimir effect

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