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Gravitational Wave Effects in Casimir Cavities

We analytically investigate the effects of gravitational waves on the Casimir force between two uncharged metallic plates. The gravitational contribution to the electromagnetic vacuum energy is computed using co-variant path integral quantization in a gravitational wave background. Our findings reveal that gravitons are absorbed by the cavity, inducing a repulsive correction to the Casimir force and a decrease in the von Neumann quantum entropy.

We demonstrate that the gravitational wave interaction induces a permanent modification of the vacuum polarization through the absorption of gravitons by confined photons. We establish a novel link between the Weinberg soft graviton theorem and the constant shift in the Casimir energy, further confirming the gravitational memory effect in Casimir cavities. Our results suggest that Casimir cavities serve as sensitive probes of quantum and classical gravity.

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