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Numerical vs. Semiclassical Evaluation of Casimir Forces in Piston Geometries[1] MARTIN SCHADEN, Rutgers University, LIVIU MATEESCU, New Jersey Institute of Technology — Using a modified wordline approach[1] for a massless scalar field satisfying Dirichlet boundary conditions, we numerically obtain the Casimir force on a piston in a cylindrical cavity with a cylinder head of different radius. There are no contributions from arbitrarily short paths and the Casimir *force* on the piston is finite for all systems considered. Our algorithm for Casimir forces in closed concave geometries is numerically stable, fast and accurate. For a hemispherical cylinder head, we analytically and numerically obtain an attractive contribution to the Casimir force that is inversely proportional to the elevation of the piston and does not depend on the radius of the cylinder. This attractive contribution to the Casimir energy cannot be distinguished from one due to the presence of a charge. It is of higher semiclassical order and was not observed in the leading description by periodic orbits [2]. By changing the radius of the cylinder head compared to that of the cylinder, we numerically verify the semiclassical estimate [2] that the Casimir force on the piston is drastically reduced by a hemispherical cylinder head. We also present preliminary numerical studies for a massless scalar field satisfying Neumann boundary conditions. [1] H. Gies, K. Langfeld and L. Moyaerts, JHEP 0306, 018 (2003); H. Gies and K. Klingmuller, Phys. Rev. D74, 045002 (2006). [2] L Mateescu and M. Schaden, [quant-ph/0705.3435].

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