1051-81-141 **Lev Kaplan*** (lkaplan@tulane.edu), Department of Physics, Tulane University, New Orleans, LA 70118. *Quantum Vacuum Energy in Graphs and Billiards.*

The Vacuum (Casimir) energy in quantum field theory is a problem relevant both to new nanotechnology devices and to dark energy in cosmology. The crucial question is the dependence of the energy on the system geometry under study. Despite much progress since the first prediction of the Casimir effect in 1948 and its subsequent experimental verification in simple geometries, even the sign of the force in nontrivial situations is still a matter of controversy. Mathematically, vacuum energy fits squarely into the spectral theory of second-order self-adjoint elliptic linear differential operators. Specifically, one promising approach is based on the small-t asymptotics of the cylinder kernel $e^{-t\sqrt{H}}$, H being the self-adjoint operator in question. In contrast with the well-studied heat kernel e^{-tH}, the cylinder kernel depends in a non-local way on the geometry of the problem. We discuss some recent results by the Louisiana-Texas-Oklahoma collaboration on vacuum energy in model systems, including quantum graphs and two-dimensional manifolds with boundary. The results may shed light on general questions, including the relationship between vacuum energy and periodic or closed classical orbits, and the contribution to vacuum energy of boundaries, edges, and corners. (Received August 22, 2009)