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Estimates from below for the spectral function  
and for the remainder in Weyl’s law on  
negatively-curved surfaces

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**Abstract**

We obtain asymptotic lower bounds for the spectral function of the Laplacian on compact manifolds. In the negatively curved case, thermodynamic formalism for hyperbolic flows is applied to improve the estimates. Our results can be considered pointwise versions (on a general manifold) of lower bounds (due to Hardy and Landau) for the error term in the Gauss circle problem. We next discuss lower bounds for the remainder in Weyl’s law on negatively-curved surfaces. Our approach works in variable negative curvature, and is based on wave trace asymptotics for long times, thermodynamic formalism for hyperbolic flows, and small-scale microlocalization.

**This is joint work with I. Polterovich and J. Toth.**