

# Sum rules and semiclassical limits for quantum Hamiltonians on surfaces, periodic structures, and graphs

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**Abstract:** I will discuss “sum rule” identities that can be derived using traces of commutators of operators. One use of these identities is to derive tight universal constraints on the spectra of periodic Schrödinger operators, quantum Hamiltonians on surfaces, and quantum graphs. Another is a short, efficient derivation of sharp semiclassical estimates of Lieb-Thirring type in the same situations.