Trace formula, which is one of richest topics in modern mathematics, in its simples form connects spectrum of Laplacian on compact Riemannian manifold and closed geodesics. Although it's directly related to bosonic quantum thermal partition function, so far complete physical understanding of such formula was not established. Here we outline a rigorous physical derivation of trace formulas using a new class of supersymmetric localization principle mainly focus on three representatives: Jacobi Inversion formula, heat kernel inversion formula and Selberg trace formula. This is a work in collaboration with Leon Takhtajan.