The Classical Limit of Quantum Mechanics

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Abstract

Let $p_\hbar$ and $q_\hbar$ be the quantum mechanical momentum and position operators associated to a particle moving in one dimensional space. Klaus Hepp [CMP 1973[1]] gives a nice description of the classical limit ($\hbar \downarrow 0$ limit) and its quantum corrections for the quantum mechanical dynamics associated to the Schrödinger operator,

$$H_\hbar = -\frac{\hbar}{2m}\triangle + V\left(\sqrt{\hbar}x\right).$$

Hepp describes these limiting results in terms of bounded "observables" of the form $e^{i(rq_\hbar + sp_\hbar)}$ for $r, s \in \mathbb{R}$. In this talk, I will explain an extension of Hepp's method which allows one to use more standard unbounded observables, namely non-commutative polynomial functions of $p_\hbar$ and $q_\hbar$. Our results will hold for a general class of Hamiltonians which are themselves non-commutative polynomial functions $p_\hbar$ and $q_\hbar$.

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[1] "The classical limit for quantum mechanical correlation function."