Quantum mechanics as an asymptotic projection of statistical mechanics with infinite-dimensional phase space

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We show that QM can be represented as a natural projection of a classical statistical model on the phase space $\Omega = H \times H$, where H is the real Hilbert space. Statistical states are given by Gaussian measures on Ω having zero mean value and dispersion of very small magnitude α (which is considered as a small parameter of the model). Such statistical states can be interpreted as fluctuations of the background field, cf. with SED and Nelson's mechanics. Physical variables (e.g., energy) are given by maps $f : \Omega \to \mathbf{R}$ (functions of classical fields). The conventional quantum representation of our prequantum classical statistical model is constructed on the basis of the Taylor expansion (up to the terms of the second order at the vacuum field point $\psi_{\text{vacuum}} \equiv 0$) of variables $f : \Omega \to \mathbf{R}$ with respect to the small parameter $\sqrt{\alpha}$. The complex structure of QM is induced by the symplectic structure on the infinite-dimensional phase space Ω. A Gaussian measure (statistical state) is represented in QM by its covariation operator. Equations of Schrödinger, Heisenberg and von Neumann are images of Hamiltonian dynamics on Ω. The main experimental prediction of our prequantum model is that experimental statistical averages can deviate from ones given by QM. Some preliminary results on this model were published in [1].

[1] A. Yu. Khrennikov, A pre-quantum classical statistical model with infinite-dimensional phase space. *J. Phys. A: Math. Gen.*, **38**, 9051-9073 (2005).