Quantum Physics

The cryptohermitian smeared-coordinate representation of wave functions

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The one-dimensional real line of coordinates is replaced, for simplification or approximation purposes, by an N-plet of the so called Gauss-Hermite grid points. These grid points are interpreted as the eigenvalues of a tridiagonal matrix $\mathfrak{q}_0$ which proves rather complicated. Via the "zeroth" Dyson-map Ω_0 the "operator of position" $\mathfrak{q}_0$ is then further simplified into an isospectral matrix Q_0 which is found optimal for the purpose. As long as the latter matrix appears non-Hermitian it is not an observable in the manifestly "false" Hilbert space ${\cal H}^{(F)}:=\mathbb{R}^N$. For this reason the optimal operator Q_0 is assigned the family of its isospectral avatars $\mathfrak{h}_\alpha$, $\alpha=(0,)\,1,2,...$. They are, by construction, selfadjoint in the respective $\alpha-$dependent image Hilbert spaces ${\cal H}^{(P)}_\alpha$ obtained from ${\cal H}^{(F)}$ by the respective "new" Dyson maps Ω_α. In the ultimate step of simplification, the inner product in the F-superscripted space is redefined in an {\it ad hoc}, $\alpha-$dependent manner. The resulting "simplest", S-superscripted representations ${\cal H}^{(S)}_\alpha$ of the eligible physical Hilbert spaces of states (offering different dynamics) then emerge as, by construction, unitary equivalent to the (i.e., indistinguishable from the) respective awkward, P-superscripted and $\alpha-$subscripted physical Hilbert spaces.

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