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【415】Diverging exchange force for ultracold fermionic atoms

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The Pauli exclusion principle $0 \leq n_k \leq 1$ is a kinematical constraint on fermionic occupation numbers which strongly shapes fermionic quantum systems on all length scales. We demonstrate that this fundamental restriction can also be interpreted dynamically: the fermionic exchange symmetry manifests itself in the one-fermion picture in the form of an "exchange force" which repulsively diverges on the boundary of the allowed region, preventing fermionic occupation numbers n_k from leaving their domain $0 \leq n_k \leq 1$. Moreover, for translationally invariant one-band lattice models, we exploit the knowledge of the natural orbitals (momentum states) and discover the form of the exact one-particle reduced density matrix functional $\mathcal{F}(\vec{n})$. Remarkably, $\mathcal{F}(\vec{n})$ turns out to be strongly shaped by Pauli's exclusion principle.

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