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Recasting the 3D Wigner-Liouville equation with spectral components of the force MAARTEN VAN DE PUT, BART SORE, WIM MAGNUS, Univ of Antwerp, imec — The phasespace approach to many-body quantum mechanics, by means of the Wigner-function is interesting through its connection to classical mechanics. Time-evolution of any statistical distribution of states under influence of a (time-dependent) Hamiltonian is obtained through use of the Wigner-Liouville equation. The standard form of this equation contains two 3D integrals, over the entire phase space. As a result, this form emphasizes the non-locality of the interaction of the potential, but lacks simplicity and ease of understanding. Furthermore, the integrals make numerical solution of the Wigner-Liouville equation challenging. We present an alternative form to the Wigner-Liouville equation based on the force rather than the potential, in alignment with the classical Boltzmann equation. Decomposition of the force in its spectral components yields a simpler form of the Wigner-Liouville equation. This new form has only one 3D integral over the spectral force components, and is local in position, simplifying both interpretation and numerical implementation. Because of its use of the force, it straightforwardly reduces to the Boltzmann equation under classical conditions.

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