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Towards a "bottom-up"construction of qunatum kinetic theory with spin

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Quantum Kinetic Theory (QKT) is a versatile tool for studying quantum effects in various many-body systems, including Quark-Gluon Plasma in a weakly coupled regime. Such a theory is commonly obtained from a "top-down" approach, starting from a microscopic theory and deriving the equation of motion for the distribution function. In this talk, we propose a "bottom-up" effective theory approach to formulate kinetic theory with spin. The low-energy effective degrees of freedom in SKT are identified as the spin averaged and spin-dependent distribution function. In the spirit of effective theory, the kinetic theory includes the equation of motion for those distribution functions as well as the constitutive relation connection them to observables. We compare the resulting quantum kinetic theory with those constructed from the "top-down" approach. We also demonstrate the matching between our kinetic theory's description and that from the real-time field theory calculations.

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