Efficient spectral methods for solving Schrödinger-Vlasov system and their application on studying the dynamics of Bose-Fermi mixture at finite temperature

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In this talk, we present efficient numerical methods for studying the dynamics of quantum fluids composed of a mixture of Bose-Einstein condensate and a cloud of fermionic atoms in a mean-field approximation. At first, we propose an efficient time-splitting Fourier pseudospectral method for Schrödinger-Vlasov system. The numerical integration for the system is performed using the time-splitting method, coupled with Fourier pseudospectral method in the phase direction and space direction. The method has spectral accuracy in space and can be implemented efficiently with the fast Fourier transform. Next, we proposed an efficient semi-Lagrangian pseudospectral method for the Schrödinger-Vlasov system. The latter method was based on solving the Vlasov equation by the semi-Lagrangian method coupled by high-order spectral interpolation. Comparison on these two proposed numerical method are shown and found in agreement with the theory. Numerical results on the dynamics of Bose-Fermi mixture at finite temperature are also presented.