Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Entanglement induced interactions in binary mixtures[1] JIE CHEN, JOHANNES SCHURER, PETER SCHMELCHER, Zentrum fr Optische Quantentechnologien, Universitt Hamburg — We establish a conceptual framework for the identification and the characterization of induced interactions in binary mixtures and reveal their intricate relation to entanglement between the components or species of the mixture. Exploiting an expansion in terms of the strength of the entanglement among the two species, enables us to deduce an effective single-species description. In this way, we naturally incorporate the mutual feedback of the species and obtain induced interactions for both species which are effectively present among the particles of same type. Importantly, our approach incorporates few-body and inhomogeneous systems extending the scope of induced interactions where two particles interact via a bosonic bath-type environment. Employing the example of a one-dimensional spin-polarized ultracold Bose-Fermi mixture, we obtain induced Bose-Bose and Fermi-Fermi interactions with short-range attraction and long-range repulsion. With this, we show how beyond species mean-field physics visible in the two-body correlation functions can be understood via the induced interactions.

[1]SFB 925 Light induced dynamics and control of correlated quantum systems and The Hamburg Centre for Ultrafast Imaging-Structure, Dynamics and Control of Matter at the Atomic Scale

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Date submitted: 08 Jan 2018 Electronic form version 1.4