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Electromagnetic induced transparency in strongly correlated quantum gases HSIANG-HUA JEN, DAW-WEI WANG, National Tsing Hua University, NATIONAL TSING HUA UNIVERSITY TEAM — We develop a very general theory for the electromagnetic induced transparency (EIT) in ultracold quantum gases, applicable for both Bose and Fermi gases with arbitrary inter-particle interaction strength. Different from the standard theory for a frozen atom without inter-atom interaction, we consider the full kinetics and interaction of atoms, and derive the exact probe field electric susceptibility (i.e. the EIT spectrum) within the linear response theory at zero temperature. We find that the EIT spectrum is directly related to the dynamical Green's function of the ground state, and therefore can be a direct measurement of the many-body physics. We apply our theory to analytically and numerically several strongly interacting cases: 1D Luttinger liquid, Mott insulator state in optical lattice, and the superfluid case of two-component Fermi gases. We discuss how the Luttinger exponent, single particle gap, and pairing mechanism can be observed from the EIT spectrum.

Hsiang-Hua Jen
National Tsing Hua University

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