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Impurity bubbles in a BEC[1] EDDY TIMMERMANS, Los Alamos National Laboratory, ALINA BLINOVA, Rice University, MALCOLM BOSHIER, Los Alamos National Laboratory — Polarons (particles that interact with the self-consistent deformation of the host medium that contains them) self-localize when strongly coupled. Dilute Bose-Einstein condensates (BECs) doped with neutral distinguishable atoms (impurities) and armed with a Feshbach-tuned impurity-boson interaction provide a unique laboratory to study self-localized polarons. In nature, self-localized polarons come in two flavors that exhibit qualitatively different behavior: In lattice systems, the deformation is slight and the particle is accompanied by a cloud of collective excitations as in the case of the Landau-Pekar polarons of electrons in a dielectric lattice. In natural fluids and gases, the strongly coupled particle radically alters the medium, e.g. by expelling the host medium as in the case of the electron bubbles in superfluid helium. We show that BEC-impurities can self-localize in a bubble, as well as in a Landau-Pekar polaron state. The BEC-impurity system is fully characterized by only two dimensionless coupling constants. In the corresponding phase diagram the bubble and Landau-Pekar polaron limits correspond to large islands separated by a cross-over region. The same BEC-impurity species can be adiabatically Feshbach steered from the Landau-Pekar to the bubble regime.

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