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Spin polarons, Molecules and Twin Peaks in rf spectra of Fermi gases at unitarity

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We examine pairing, molecule, and spin-polaron formation in strongly-interacting Fermi gases and discuss how radio-frequency (RF) spectroscopy can reveal these phenomena. For an unpolarized gas at unitarity, we show how the double-peak structures observed in recent experiments arise due to the inhomogeneity of the trapped gas. The emergence of stable molecules in the BEC regime results in a two-peak structure in the RF spectrum with clearly visible medium effects on the low-energy part of the molecular wavefunction. For the highly-imbalanced case, we show the existence of a well- defined quasiparticle (a spin polaron) on both sides of the Feshbach resonance, we evaluate its lifetime, and we illustrate how its energy may be measured by RF spectroscopy. The main experimental features observed above the critical temperature in the recent experiments are recovered with no fitting parameters.