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**Many-Body Dynamical Phase Separation and Pattern Formation in Ultracold Fermionic Mixtures**[1] SIMEON MISTAKIDIS, JENNIFER ERDMANN, PETER SCHMELCHER , University of Hamburg — We explore the correlated quench dynamics of ultracold fermionic mixtures consisting of a majority and an impurity atom being confined in a double-well. It is shown that quenching the interspecies repulsion towards the strongly interacting regime the two species phase separate within the Hartree-Fock approximation, while remaining miscible in the many-body treatment. Despite their miscible character on the one-body level the two species are found to be strongly correlated and exhibit a phase separation on the two-body level that suggests the anti-ferromagnetic behavior of the mixture. On the other hand, ramping down the barrier of the double-well induces a counterflow dynamics of the species which form strongly correlated dark-bright soliton like entities. By increasing the concentration of the impurities we showcase signatures of the induced interactions in several observables and the dynamical formation of bound states. Finally, we simulate in-situ single-shot measurements and showcase how our findings can be retrieved by averaging over a sample of single-shot images.

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