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First order behaviour of Bose Fermi mixtures across a Feshbach resonance CHARLES MATHY, Department of Physics, Princeton University, FRANCESCA MARCHETTI, Rudolf Peierls Center for Theoretical Physics, University of Oxford, MEERA PARISH, DAVID HUSE, Department of Physics, Princeton University — We analyze the phase diagram of a mixture of bosonic and fermionic atoms, whose interaction is tuned by varying a magnetic field across a Feshbach resonance. To this end, we introduce a two-channel model and study it with a mean field approach. The phase diagram is found to contain both second order and first order phase transitions, which leads to a regime of densities where phase separation is predicted. We explain why our model is consistent with the experimental observation of collapse, which is usually captured by a single- channel model, and discuss in which systems one is most likely to encounter the physics we are describing.

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