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**Superfluid-Insulator Transition of Fermions in Optical Lattices across a Feshbach Resonance** HUI ZHAI, TIN-LUN HO, Department of Physics, the Ohio-State University — We study superfluid-insulator (SI) transition of fermions in an optical lattice as a function of scattering length and fermion density. For systems with two fermions (hence one boson) per site, SI transition is the usual Mott transition between bosonic molecules on the BEC side of resonance. On the BCS side, the insulating phase is the band insulator. SI transition is caused by the energy gain in promoting two fermions in valance band to various valance bands to form Cooper pairs. This phenomena become even more intriguing at higher fermion densities. In this talk, we shall present the phase diagram for SI transition across a Feshbach resonance for different densities. Our results directly related to the recent MIT experiment on SI transition of lattice fermions with two fermion per site.

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