**BCS-BEC crossover in an optical lattice**[1] PARAG GHOSH, University of Illinois, Urbana Champaign, ROBERTO DIENER, MOHIT RANDERIA, Ohio State University — We model fermions with an attractive interaction in an optical lattice with a single-band Hubbard model away from half-filling with on-site attraction $U$ and nearest neighbor hopping $t$. We use a large $N$ theory with $\mathrm{Sp}(2N)$ symmetry to study the fluctuations beyond mean field theory. At $T = 0$, we calculate across the crossover various observables, including chemical potential, gap, ground state energy, speed of sound and compressibility. The superfluid density $\rho_s$ is found to have non-trivial $U/t$ dependence in this lattice system. We show that the transition temperature $T_c$ scales with the energy gap in the weak coupling limit but crosses over to a $t^2/U$ scaling in the BEC limit, where phase fluctuations controlled by $\rho_s$ determine $T_c$.

Parag Ghosh
University of Illinois, Urbana Champaign