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Cooling a Band Insulator with a Metal: Fermionic Superfluid in a Dimerized Holographic Lattice[1] ARIJIT HALDAR, VIJAY B. SHENOY, Indian Institute of Science Bangalore — A cold atomic realization of a quantum correlated state of many fermions on a lattice, eg. superfluid, has eluded experimental realization due to the entropy problem. Here we propose a route to realize such a state using holographic lattice and confining potentials. The potentials are designed to produces a *band insulating* state (low heat capacity) at the trap center, and a metallic state (high heat capacity) at the periphery. The metal "cools" the central band insulator by extracting out the excess entropy. The central band insulator can be turned into a superfluid by tuning an attractive interaction between the fermions. Crucially, the holographic lattice allows the emergent superfluid to have a *high transition temperature* – even twice that of the effective trap temperature. The scheme provides a promising route to a laboratory realization of a fermionic lattice superfluid, even while being adaptable to simulate other many body states. Reference: Scientific Reports **4**, 6665 (2014).

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