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**Phase diagram of the Bilayer Bose Hubbard Model** YANFEI TANG, VITO SCAROLA, Department of Physics, Virginia Tech, Blacksburg, Virginia 24061, USA — Optical lattices can be tailored to realized a variety of different geometries. We model bosons confined to a bilayer configuration to allow a pseudospin degree of freedom in the layer index. Specifically, we model the Bose-Hubbard model on a bilayer square lattice with variable inter-layer hopping. Without the presence of interlayer hopping, the phase diagram only presents well known superfluid or Mott insulating phases. But interlayer hopping allows coupling of these two states. We find that an interesting incompressible phase emerges at half filling as we increase the interlayer hopping strength. We study the low temperature physics of the new phase and address the nature of pseudospin correlations in observables. We pair our effective theory with a quantum Monte Carlo study.

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