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Majorana Spin Liquids on a two-leg ladder[1] HSIN-HUA LAI, OLEXEI MOTRUNICH, California Institute of Technology — We realize a gapless Majorana Orbital Liquid (MOL) using orbital degrees of freedom and also an SU(2)-invariant Majorana Spin Liquid (MSL) using both spin and orbital degrees of freedom in Kitaev-type models on a 2-leg ladder. The models are exactly solvable by Kitaev's parton approach, and we obtain long-wavelength descriptions for both Majorana liquids. The MOL has one gapless mode and power law correlations in energy at incommensuare wavevectors, while the SU(2) MSL has three gapless modes and power law correlations in spin, spin-nematic, and local energy observables. We study the stability of such states to perturbations away from the exactly solvable points. We find that both MOL and MSL can be stable against allowed short-range parton interactions. We also argue that both states persist upon allowing Z_2 gauge field fluctuations, in that the number of gapless modes is retained, although with an expanded set of contributions to observables compared to the free parton mean field.

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