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Doped Mott insulators in (111) bilayers of perovskite transition-metal oxides with the strong spin-orbit coupling[1] SATOSHI OKAMOTO, Oak Ridge National Laboratory — We study the electronic properties of Mott insulators realized in bilayers of perovskite transition-metal oxides grown along the [111] crystallographic axis. The low-energy effective Hamiltonians for such Mott insulators are derived in the presence of the strong spin-orbit coupling. These models are characterized by the antiferromagnetic Kitaev interaction and the antiferromagnetic or ferromagnetic Heisenberg interaction depending on the d orbital occupancy. From exact diagonalization analyses on finite clusters, Kitaev spin liquid phases are shown to be confined in narrow parameter regimes. Slave-boson mean-field analyses indicate the possibility of non-trivial superconducting states induced by carrier doping into the Mott-insulating parent systems. We also discuss the possible experimental realization of these systems in $4d$ and $5d$ transition-metal oxides.

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