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Chiral superfluid states in hybrid graphene heterostructures ENRICO ROSSI, JUNHUA ZHANG, Department of Physics, College of William and Mary — We study the hybrid heterostructure formed by one sheet of single layer graphene (SLG) and one sheet of bilayer graphene (BLG) separated by a thin film of dielectric material. In general it is expected that interlayer interactions can drive the system to a spontaneously broken symmetry state characterized by interlayer phase coherence. The peculiarity of the SLG-BLG heterostructure is that the electrons in the layers (SLG and BLG) have different chiralities. We find that the difference of chirality between electrons in the two layers causes the spontaneously broken symmetry state to be N-fold degenerate. Moreover, we find that some of the degenerate states are chiral superfluid states, topologically distinct from the usual layer-ferromagnetism. The chiral nature of the ground state opens the possibility to realize topologically protected midgap states.

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