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Angular momentum and pseudospin in graphene B.C. REGAN, MATTHEW MECKLENBURG, UCLA Department of Physics and Astronomy, and CNSI — Any quantum mechanical problem with two levels can be treated by analogy with the spin 1/2 system. For instance, treating the proton and neutron as 'up' and 'down' states of the same particle leads to the fruitful concept of nuclear isospin. Because the honeycomb structure of graphene has two inequivalent atoms per unit cell, a pseudospin variable arises in the solution of the graphene Hamiltonian. This variable is commonly thought to be analogous to a spin 1/2 angular momentum. Unlike isospin, however, pseudospin is intimately connected to rotations in real space. Furthermore, graphene electrons couple to the electromagnetic field through their pseudospin: the pseudospin flip seen in electron-hole recombination creates a spin-1 photon. The natural conclusion is that the pseudospin is a real angular momentum. Implications of this identification for condensed matter and particle physics will be discussed.

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