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Double quantum dots in carbon nanotubes[1] JAVIER VON STECHER, JILA and Department of Physics, University of Colorado, Boulder, Colorado, BERNHARD WUNSCH, Physics Department, Harvard University, Cambridge-MA, 20138., MIKAHIL LUKIN , EUGENE DEMLER, Physics Department, Harvard University, Cambridge-MA, 20138, ANA MARIA REY, JILA and Department of Physics, University of Colorado, Boulder, Colorado — We study the behavior of few-electrons confined in a double-well quantum dot in semiconducting carbon nanotubes. These carbon nanostructures exhibit richer physics than GaAs ones due to the additional valley degree of freedom. We calculate and characterize the low energy eigenstates in the presence of a magnetic field and double-well detuning. Spin-orbit coupling lifts the spin and valley degeneracy and, in the presence of exchange interactions, leads, at small detunings and weak magnetic fields, to a spin-valley antisymmetric two-electron ground state which is not a pure spin-singlet state. At large detuning, the strong Coulomb interactions accessible in carbon nanotubes can substantially modify the non-interacting eigenstates via higher orbital-level mixing. The latter manifest in current transport experiments by the disappearance of the Pauli blockade.

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