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Spin-valley blockade and electron valley resonance in carbon-based quantum dots GUIDO BURKARD, ANDRAS PALYI[1], University of Konstanz, Germany — The spin blockade effect in the electric conduction through two semiconductor quantum dots connected in series has allowed the monitoring of spin-breaking effects, notably single-spin rotations induced via external fields in electron spin resonance (ESR) and spin decoherence due to the hyperfine coupling to the nuclear spin environment. Electrons in double quantum dots in carbon nanotubes and graphene comprise a valley isospin in addition to their spin. We show that this can lead to a spin-valley blockade which is sensitive to both spin and valley breaking effects. The hyperfine interaction due to residual ^{13}C nuclear spins turns out to be both spin- and valley-breaking, while non-magnetic atomic impurities can lead to pure valley-breaking. We study the magnetic-field dependent leakage current in the spin-valley blockade, also taking into account the spin-orbit interaction in carbon nanotubes. In analogy to ESR, we propose a resonance effect for the valley isospin (electron valley resonance) driven by an oscillatory electric field in a graphene or carbon nanotube quantum dot. References: A. Palyi and G. Burkard, Phys. Rev. B 80, 201404 (2009); Phys. Rev. B 82, 155424 (2010); arXiv: 1010.4338 (2010).

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