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Magnetic brightening of "dark" excitons in carbon nanotubes S. ZARIC, J. KONO, Dept. of Elec. & Comp. Engineering, Rice Univ., X. WEI, NHMFL, Florida State Univ., R. H. HAUGE, R. E. SMALLEY, Chemistry Dept., Rice Univ. — We have measured polarized-excitation photoluminescence (PL) on micelle-suspended single-walled carbon nanotubes (SWNTs) in aqueous solution in external magnetic fields (B) up to 45 T at room temperature. Each PL peak, corresponding to a specific chirality, splits into two in a B and the amount of splitting increases with B. The magnetic field dependence of the relative intensities of the two peaks reveals that the lower-energy peak increases in intensity (or "brightens") with increasing B. These results can be understood in terms of "magnetic brightening" of an excitonic state that is "dark" at 0 T. Namely, recent calculations taking into account intervalley Coulomb mixing in semiconducting SWNTs predict the existence of a dark excitonic state at an energy Δ_X below the lowest optically active (bright) excitonic state. On the other hand, magnetic flux ϕ threading a nanotube removes the intervalley degeneracy which is seen in absorption measurements as peak splittings by an amount Δ_{AB} proportional to ϕ (when $\phi/\phi_0 \leq 1/6$, ϕ_0: magnetic flux quantum). While two equally-bright excitonic peaks are predicted and observed at high fields ($\Delta_{AB} >> \Delta_X$),[1] magnetic brightening is expected at lower fields ($\Delta_{AB} \sim \Delta_X$), which is consistent with our observations. [1] S. Zaric *et al*, Phys. Rev. Lett., to appear (see also cond-mat/0509429)

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