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Magnetic Brightening of Dark Excitons in Individual Single-Walled Carbon Nanotubes[1] AJIT SRIVASTAVA, JUNICHIRO KONO, Rice University, HAN HTOON, VICTOR I. KLIMOV, Los Alamos National Laboratory — We have performed micro-photoluminescence (PL) studies on *individual* single-walled carbon nanotubes (SWNTs) at varying temperatures (T = 4 K – 100 K) in magnetic fields (B) up to 5 T, which provide direct evidence for the existence of dark excitons in SWNTs. Only when the B was parallel to the tube axis, we observed the appearance of a *secondary peak at a lower energy* with respect to the main emission peak. The secondary peak increased in intensity with increasing B at the expense of the main peak. At the lowest T, a complete reversal of emission intensity from the main peak to the side peak was seen as the B was increased. However, the main peak was recovered as the T was increased at a fixed B. These behaviors can be explained by assigning the main and secondary peaks to the lowest-energy bright and dark singlet exciton states, respectively. The absence of these behaviors in B perpendicular to the tube axis convincingly suggests that brightening is induced by the Aharonov-Bohm phase. The zero-field dark-bright splitting is found to be ∼1-2 meV, which is lower than most theoretical predictions.

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