Low temperature magneto-photoluminescence of SWCNTs

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We report a detailed study of the magneto photoluminescence (PL) of SWCNTs at low temperatures in fields perpendicular and parallel to the axis of the tubes using photoluminescence excitation (PLE) maps. We give findings on both PL emission intensity changes and band gap shifts. The PL intensities were found to be strongly enhanced by magnetic field at 4.2K, the magnitude of which was strongly diameter dependent with the largest enhancements (by factors of up to 2.5 in 19.5T) observed for tubes aligned perpendicular to the field. We attribute these enhancements to the lowering of the probability that excitons populate the dark states as we observe the opposite effect - a suppression of PL emission from tubes at zerofield. Red shifts of the band gap of tubes parallel to the applied field were observed at 4.2K and are consistent in magnitude with those predicted by the Aharanov-Bohm (A-B) effect. The use of PLE mapping also allows us to confirm the diameter^2 behaviour of these shifts. For tubes aligned perpendicular to the applied field we also observe distinct red shifts of the band gaps at 4.2K, which cannot be explained by the A-B effect.