Physics AT QUEENS COLLEGE

Colloquium Notice

Igor Kuskovsky

Queens College, CUNY

Type-II CdTe/ZnCdSe quantum dot intermediate band solar cells with optimized broadband Bragg reflector

The intermediate band solar cell (IBSC) concept has been proposed to overcome the efficiency limits of single-junction devices. In IBSCs, mid-gap states in the host material create an additional intermediate absorption pathway for below-bandgap photons, increasing the short-circuit current without compromising the open-circuit voltage. We have shown that submonolayer CdTe QDs grown by MBE-MEE and embedded in ZnCdSe, latticed matched to InP, can be employed in IBSCs without the formation of a detrimental wetting layer be fabricated with near-optimal IBSC parameters. Hundreds of QD-containing layers can be grown, which is particularly important for addressing the inherently low absorption in IBSCs, and especially those using type-II QDs. We present results from recently grown CdTe/ZnCdSe type-II QDs that exhibit deeper PL emission, indicating the formation of larger QDs required for an optimized IB energy position.

In addition, we present theoretical considerations for increasing light absorption in these solar cells. Distributed Bragg reflectors (DBRs) are an attractive choice to recycle photons and enhance absorption. We demonstrate optimization techniques for the inverse design of broadband (1 to 1.8 μm) and wide-angle (0 to 70°) DBRs operating in this spectral range, specifically modeling a DBR using ZnCdSe/ZnCdMgSe lattice-matched to InP. The total photon absorption was chosen as the figure of merit for the optimized structures. We show that the proposed design offers excellent broadband reflectivity with strong robustness against fabrication errors.

Monday
November 16, 2026
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326
This talk is accessible via **Zoom** or use
meeting ID 829 2687 2594 and **passcode 866995** to join