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Photocapacitance measurements on GaP alloys for high efficiency solar cells[1] DAN HAMPTON, TIM GFROERER, Davidson College, MARK WANLASS COLLABORATION[2] — Large bandgap materials are an essential component of ultra-high efficiency solar cells. While multi-junction devices harness more of the solar spectrum for electricity production, challenges in the construction of a lattice-mismatched system lead to defects that trap charge carriers and inhibit overall efficiency. This work uses photocapacitance measurements to obtain optical escape energies from defect levels in high-bandgap GaInP and GaAsP alloys. We combine these optical results with previous thermal measurements to construct a working model that incorporates a lattice configuration-dependent energy structure. The model explains why the optical escape energy is significantly larger than the thermal capture and escape energies, and in the GaAsP device, it helps explain why the number of escaping carriers depends on the energy of the incident light. We also observe persistent photocapacitance in the GaAsP device after a large capacitance change with illumination. The magnitude of the trap signal is comparable to that of the dopants, which suggests the presence of AX complexes in the p-doped region of the device.

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