



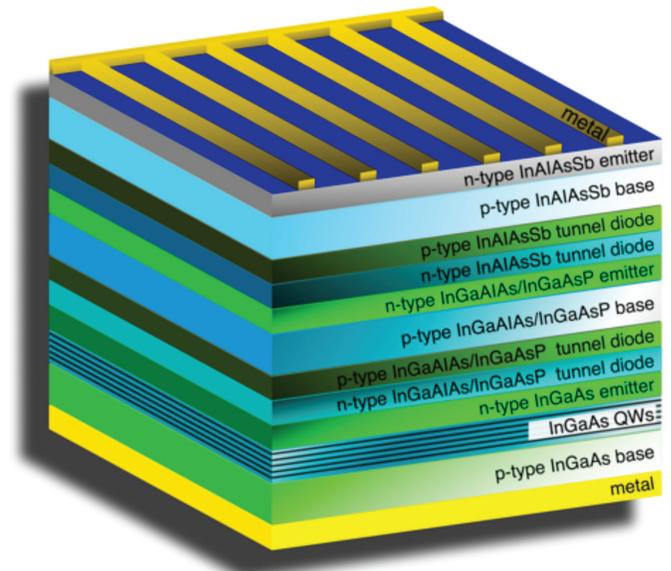
Multijunction Quantum Well Solar Cells for Remote and Portable Power

The Naval Research Laboratory and Imperial College London are collaborating to develop photovoltaics (solar cells) that are lattice matched to InP substrates and can be “tuned” for specific operational conditions, enabling extremely high power density energy sources for remote systems and portable power.

InP-based materials containing antimony (Sb) enable multijunction solar cells (MJSCs) with bandgaps ranging from 0.74 to 1.8 eV to be grown in a lattice-matched configuration. Moreover, nanostructures in the form of quantum wells (QWs) can be incorporated into the active regions of an MJSC to produce energy generation systems that can be tuned for specific operational conditions. The optoelectronic properties of QW-MJSCs can be precisely controlled through choice of material system, doping, and internal structure, so devices can be engineered to absorb light over a broad wavelength range. Maintaining lattice-matching enables the highest quality material.

QW-MJSCs will enable extremely high power density (W/kg) energy sources for remote systems and portable applications. Taking space as one of the most extreme and harsh remote environments, we are designing QW-MJSCs for radiation resistance and space performance that exhibit >35% efficiency and do not degrade after 15 years in geostationary Earth orbit (GEO). For portable, terrestrial power, we are engineering QW-MJSCs with efficiencies approaching 50% under concentrated terrestrial sunlight, to demonstrate a hand-held system capable of producing ~20 W/cm².

NRL has internationally recognized experts in theory, modeling, and growth of optoelectronic semiconductors, specifically for Sb-based materials. NRL leadership has also led to important advances in space photovoltaic technologies and radiation hardening. Similarly, Imperial College London has internationally recognized experts in theory, modeling, and characterization of QW solar cells, and it is their insight and ingenuity that will create designs that capitalize on the full capabilities of QW solar cells.



QW-MJSC developed by NRL and Imperial College London.