# (As,Sb)In/GaInSb quantum well for infrared detection enhancement

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Infrared instruments measure mechanisms for radiant energy transfer in the universe providing insights into the formation and structure of planets, stars, galaxies and galactic clusters. Infrared (IR) detectors are widely used by astrophysics to scan these radiating sources at many different wavelengths. Moreover, the improvement in the last years of spatial and frequential resolution, optical sensitivity and speed of observations due to advances in materials and fabrication, has converted them in one of the main tools for astronomical observations.

Infrared range covers from 0.7um to 350um, what includes radiation from stars (0.1-10um), warm dust (1-80um), planets (10-200um) and interstellar dust (90-2000um). Wavelength regime of interest is in the atmospheric window at 2-5um and 8-13um. Wavelength outside of these bounds is strongly affected by absorption from molecules present in the atmosphere.

On one hand, HgCdTe detectors have been commonly used for this purpose, but they have some inherent problems. Short carrier lifetimes mean that to achieve high detectivity they must be cooled to low temperatures. Bandgap is sensitive to alloy concentration. These detectors are not easily reproducible due to the hard control of the alloy and they are expensive.

On the other hand, III-V semiconductors detectors present some advantages to be considered. They present high quantum efficiency while having low readout noise and low dark current. They have high electron mobility and saturation velocity, holding promise for ultra-fast and low power devices. Furthermore, they are cheap.

The main of this paper is to develop a new III-V semiconductor IR detector and evaluate its behavior, performance and application. This detector is a quantum well of (As,Sb)In/GaInSb on a GaAs substrate. Variations on the well depth produce changes in the detection cutoff wavelength, which is set near stars detection range limit. This variation is precisely controlled by the epitaxial growth in a MBE chamber. Thanks to the quantum well structure the responsivity is high for low optical power, allowing the detection of weak sources in the space.