Joint seminar

Army Research Laboratory – Stony Brook University

July 7, Friday, 11AM, Room 250, Lt. Eng. bldg

S. P. Svensson, W. L. Sarney, US Army Research Laboratory, Adelphi, MD

InAsSb and related alloys grown on GaSb and GaAs

Abstract

InAsSb with bandgap as small as 0.1 eV has been grown on GaSb using the virtual substrate (VS) technique and on GaAs using a combination of the interface misfit (IMF) dislocation array- and VS-method. Control (elimination) of localized charge accumulation can be achieved with careful alloying that opens up the bandgap, while maintaining the lattice constant. The prospects for using these materials in long-wavelength IR detectors and for studies of topological phenomena will be discussed.

D. Donetski, Dept. of ECE, Stony Brook University

Vertical and lateral carrier transport in InAsSb-based superlattices

Abstract

Vertical hole transport in long-wave infrared barrier detectors with InAsSb-based Strained Layer Superlattice (SLS) absorbers and lateral electron transport in similar materials will be discussed. Experimental data on quantum efficiency, dark current of barrier detectors and minority hole lifetime in the absorbers will be presented. A decrease of lateral conductivity of InAsSb-based SLS with excitation or negative photoconductivity (NPC) was observed experimentally at T = 77 K. Analysis showed that the NPC is a fundamental property of narrow-gap semiconductors at low temperatures which results from decrease of electron mobility in spite of increase of electron concentration.

S. Suchalkin, Dept. of ECE, Stony Brook University

Electronic properties of short period metamorphic $InAsSb_x/InAsSb_y$ superlattices

Abstract

We present experimental study of carrier dispersion, bandgap and carrier concentration in short period metamorphic strain compensated $InSb_xAs_{1-x}/InSb_yAs_{1-y}$ SLS. Cyclotron resonance and interband magneto-absorption peak energy in SLs with the $E_g \approx 0$ show square root dependence on the magnetic field in the range from 0 to 16 T. This manifests a linear character of the electron dispersion, so the SLS belong to a new class of Dirac materials. The Dirac velocity, determined by the electron and hole wave function overlap in the SL is $v_F \approx 7 \cdot 10^5 \frac{m}{s}$. We present a picture of the modification of the energy spectrum caused by variation of the layer thicknesses, strain and composition in short period SLS. Metamorphic $InSb_xAs_{1-x}/InSb_yAs_{1-y}$ superlattices as new platform for optoelectronic devices and for observation of topologically nontrivial states of matter will be discussed.