Notre Dame Science
Department of Physics

LOW-DIMENSIONAL NANOSTRUCTURES WITH UNIQUE SPIN PROPERTIES: FROM TECHNOLOGY TO APPLICATIONS IN BASIC RESEARCH AND APPLIED SCIENCE

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Thursday, October 13, 2011
4:00 p.m. NSH 184

I will review recent progress in molecular beam epitaxy of telluride nanostructures achieved in the Institute of Physics in Warsaw, and will show several examples of their applications. This will cover two areas of nanostructures: (1) nanowires (NWs) produced with the use of vapor-liquid-solid (VLS) growth; and (2) modulation-doped quantum wells. Specifically, I will show that Mn-containing telluride nanowires can be successfully fabricated by the VLS approach, and can be characterized by the use of giant spin splitting effects, the crucial signature of Mn-based diluted magnetic semiconductors (DMSs). I will also present results which demonstrate the first single-photon emission from CdTe quantum dots (QDs) located inside NWs, which holds promise for photons-on-demand sources; also those made of QDs containing a single Mn ion.

As a second part of the talk I will show that, by careful optimization of structure design and growth procedures, CdTe-based quantum structures containing 2-dimensional electron gas (2DEG) with Hall mobilities as high as 500,000 cm^2/V-s can be achieved, leading to the observation of fractional quantum Hall effect (FQHE) not only in CdTe-QWs, but also in DMS $Cd_{1-x}Mn_xTe$-QWs, with effective electron g-factors as high as 350. This is the very first observation of FQHE in II-VI semiconductor materials. Finally, I will discuss preliminary result obtained in Quantum Point Contact (QPC) geometry and in hybrid structures made of 2DEG structures with nanomagnets deposited on their surface. In such hybrid devices, a new type of spin transistor action (other than the well-known Datta Das design) has already been demonstrated.

Condensed Matter Seminar

All interested persons are cordially invited to attend.