ΠΑΝΕΠΙΣΤΗΜΙΟ ΚΡΗΤΗΣ

ΤΜΗΜΑ ΦΥΣΙΚΗΣ

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 08 November 2012

17:00 -18:00

3rd Floor Seminar Room

"Novel Applications of III-Nitride Semiconductor Nanostructures"

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Abstract

Recent results in novel fields of III-Nitride hetero/nanostructures applications will be presented, concerning:

(i) GaN QDs embedded in SiO_2 for non-volatile memory (NVM) application.

Employing III-N quantum dots, with negative conduction band offset (NCBO) characteristics, with respect to silicon, can lead to a new generation of high speed/high retention time non-volatile memory devices. MOS capacitors with GaN QDs embedded in the dielectric layer, through a fully CMOS compatible methodology, were realized and they exhibited significant memory windows remaining after ten years extrapolation.

(ii) Hybrid III-N/PFO FRET structures.

Förster resonant energy transfer is a non-radiative mechanism with high transfer efficiency in case of close proximity donor-acceptor layers. Realization of hybrid structures, involving III-N SQWs and light emitting polymers, for advanced lighting applications, is particular challenging. Self consistent Schrödinger-Poisson (SCSP) investigations of the near-surface heterostructures led to the development of SQWs with emission characteristics well matched to the thin polyfluorene overlayers' dielectric function. Hybrid structures with FRET efficiencies up to 70% at room temperature were realized.

(iii) III-Nitride resonant tunneling diodes (RTDs).

Despite intensive efforts by many research groups, truly functional nitride RTD devices are yet to be demonstrated. Double barrier Al(Ga)N/GaN RTD heterostructure devices show complex dynamic behavior involving negative differential resistance, charge trapping and multistability phenomena. Realistic SQSP-quantum transport modeling was employed to clarify the role of strong polarization fields in resonant tunneling and an approach to overcome effects obstructing functional RTD device operation is proposed.