



ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 11 December 2014

17:00 -18:00

3rd Floor Seminar Room

"Research and applications that led to the 2014 Physics Nobel Prize"

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Abstract

A review of the critical research achievements of Hiroshi Amano and Isamu Akasaki at Nagoya University and Shuji Nakamura at Nichia Chemical Industries, in Japan, that led to the joint 2014 Nobel Prize in Physics award *"for the invention of efficient blue light-emitting diodes (LEDs) which has enabled bright and energy-saving white light sources"* [1], will be presented. The Nobel Laureates succeeded to overcome two major obstacles for the development of blue LEDs: (1) they improved the quality (crystal defects, surface smoothness and unintentional electron concentration) of heteroepitaxial GaN films grown on sapphire substrates and (2) solved the problem of realizing p-type GaN conductivity. Amano and Akasaki invented the low energy electron beam irradiation to activate Mg acceptors in Mg-doped GaN epilayers and Nakamura followed with the more practical method of annealing under nitrogen or vacuum conditions. The availability of pn diodes, combined with progress in the growth and design of InGaN/GaN and InGaN/AlGaN heterostructures, resulted to realization of high brightness blue LEDs and long lifetime laser diodes (LDs). White LEDs are currently developed in several sites in the world, using phosphors to covert part of the blue radiation to green-yellow-red wavelengths. Solid state lighting with white light GaN based LEDs is expected to reduce 4-5 times the amount of electrical energy that is currently consumed for lighting (20-30% of total electricity).

[1] http://www.nobelprize.org/nobel_prizes/physics/laureates/2014/