



COLLOQUIUM DI FISICA

Giovedì 27 Novembre 2014, ore 15.00
aula "A. Rostagni"

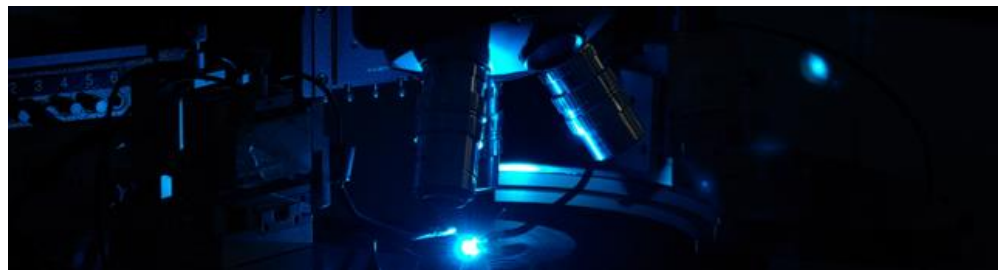
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Light-emitting diodes and applications: the era of solid-state lighting

ABSTRACT:

Over the last decade, the research in the field of optoelectronic devices has shown impressive advancements, thanks to the new possibilities offered by gallium nitride:



based on this compound semiconductor, it is possible to fabricate LEDs and lasers with visible and UV emission, as well as white light sources with incredibly high luminous efficacy (>200 lm/W).

White LEDs can completely outperform the conventional light sources used for general lighting, such as the 125 year old Edison bulb (efficacy ~ 15 lm/W), and the more recent fluorescent lamps (efficacy ~ 60 lm/W).

The ever-growing performance of white LEDs is driving a revolution in the lighting field, offering more compact, reliable and versatile light sources.

A massive penetration of LEDs in the lighting market will have a benefic environmental and economical impact: in fact, lighting accounts for 19% of the global electricity consumption.

The advancements in the field of LEDs have been possible only through basic and applied research in the fields of material science, physics and engineering: two recent Nobel Prizes (Herbert Kroemer, in 2000, and Nakamura/Amano/Akasaki, in 2014) have awarded researchers involved in the study of LEDs and semiconductor structures for applications in optoelectronics.

This seminar will introduce the basic operating principles of LEDs, and the specific properties of gallium nitride, the semiconductor which is used for the fabrication of high efficiency optoelectronic devices. Moreover, we will review the most critical steps which have led to the development of blue and white LEDs, and motivated the recent Nobel Prize to Nakamura/Amano/Akasaki. Finally, we will describe the open scientific challenges in the field of LEDs and solid-state lighting, with mention to the research activities carried out in our University in this field.