Appunti di Fisica '18
&
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The Photophysics of Carbon Dots

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The optical properties of nanomaterials are largely different from those of bulk materials. Their photophysics is characterized by the small size of the systems, which can give rise to quantum confinement effects, and by the large surface-volume ratio, which dramatically increases the number of surface states. These concepts are very common in the Science of semiconductor Quantum Dots, as they play a key role in the optical absorption and emission mechanisms of these nanomaterials.

Here, we discuss a very different type of nanomaterials: **Carbon Nanodots**. Carbon Nanodots are a new class of optically-active nanomaterials which consist in sub-10 nm nanoparticles composed by carbon, oxygen, nitrogen and hydrogen. The most important hallmark of carbon dots is their photoluminescence, which is intense, tunable and extremely sensitive to the external environment. Although the light emission properties of Carbon Nanodots are the topic of several scientific researches, the underlying mechanisms are still unclear and very debated. Some authors associate the fluorescence to a quantum confinement effect, related to the small size of the particles, whereas other authors attribute it to a radiative electron-hole recombination which takes place on surface states.

This presentation is focused on our recent studies on Carbon Dots, which led to propose a new model of the electronic transitions responsible of their absorption and emission, to the understanding of solvent-induced effects on their optical properties, and to clarify some of the fundamental interaction mechanisms between carbon dots and nearby ions in solution.