Absorption and fluorescence spectroscopy of a nanodusty plasma

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Nanoparticles can be easily produced in typical low-pressure plasmas, either by injecting reactive gases or by sputtering materials deposited on the electrodes. In these cases, a dense nanoparticle cloud is obtained and fills most of the plasma volume. As nanoparticles attach plasma free electrons, a huge nanoparticle density induces a strong disturbance of the plasma properties and stability. It can give rise to a wide variety of low-frequency instabilities and to the appearance of a void region, usually located in the plasma center (Fig. 1), and characterized by an enhanced light emission [1].

In this contribution, laser absorption and laser induced fluorescence are used to evidence the effects of nanoparticle growth on argon metastable atoms. These non-intrusive laser techniques have recently shown their ability to reveal the strong plasma modification as nanoparticles are grown thanks to acetylene addition [2,3]. In the present work, nanoparticles are grown from the sputtering of a carbonaceous layer deposited on the electrodes. The obtained dense nanoparticle cloud can be easily observed with laser light scattering. Absorption and fluorescence profiles are analyzed with a particular attention on spatially dependent effects related to void formation and nanoparticle cloud instabilities.

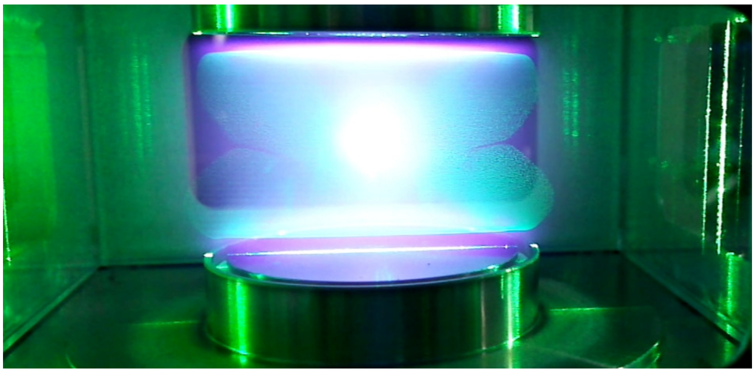

Fig. 1. Nanoparticle cloud illuminated by a green laser and trapped in the plasma volume. The central void is evidenced as a region of enhanced emission

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