An optically trapped microparticle as plasma probe

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The idea to use microparticles for plasma diagnostic purposes was implemented during the last decades by several experiments as electrostatic or thermal probes [1]-[5]. Because of their small size (μm to nm) microparticles can be used in studies of dynamic processes [6] as well as single probes in plasma sheath diagnostics [7, 8]. In contrast to common plasma diagnostic tools (e.g. Langmuir probes, calorimetric probes, mass spectrometers etc.), the µPLASMA (microparticles in a discharge with laser assisted manipulation) experiment [9] uses optically trapped microparticles (SiO2) as noninvasive single probes. The displacement of the particle in the laser trap is observed to measure a force while it is moving relatively to the plasma, either deeper into the sheath or into the plasma bulk. In addition, information about the neutral gas damping of the particles is presented. Systematic measurements of the residual charges [10] on the particle after switching off the plasma are performed, depending on the position of the particle in the plasma or the sheath, respectively. Furthermore, charging of the spheres by UV radiation is investigated and discussed.

References

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