Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Probing the Casimir force with optical tweezers PAULO MAIA NETO, DINEY ETHER, LUIS PIRES, YARENI AYALA, FELIPE ROSA, UFRJ, STEFAN UMRATH, GERT INGOLD, U. Augsburg, NATHAN VIANA, MOYSES NUSSENZVEIG, UFRJ — Optical tweezers (OT) are single-beam laser traps for neutral particles, usually applied to dielectric microspheres immersed in a fluid. The stiffness is proportional to the trapping beam power, and hence can be tuned to very small values, allowing one to measure femtonewton forces, once the device is carefully calibrated. We employ OT to measure the Casimir (or retarded van der Waals) force between polystyrene beads in ethanol, for distances between 50 nanometers and 1 micrometer. The spherical beads have diameters ranging from 3 to 7 micrometers. We find a rather large correction to the widely employed Proximity Force approximation (PFA), since the ratio between distances and sphere radii is much larger than the typical values probed in recent experiments. For the comparison with experimental data, we compute the Casimir force using the scattering approach applied to the spherical geometry, including the contribution of double-layer forces. We also present experimental results for the total force between a mercury microdroplet and a polystyrene bead immersed in ethanol, with similar distances and diameters. In short, we probe the Casimir force with different materials in a regime far from the validity of PFA, such that the spherical geometry plays a non-trivial role.

Paulo Maia Neto
UFRJ

Date submitted: 11 Nov 2014 Electronic form version 1.4