Modeling of the Soft, ^{4}He Droplet-mediated, Deposition of Metallic Nanoparticles: An Intermolecular Interaction Problem

María Pilar de Lara-Castells
Institute of Fundamental Physics (C.S.I.C.), Serrano 123, E-28006, Madrid, Spain

The ultra-cold ^{4}He droplet-assisted synthesis and soft-deposition of metallic nanoparticles attracts nowadays strong attention due to both the exciting fundamental physics behind, including quantum vorticity in superfluid ^{4}He droplets [1], and to the applications of the deposited metallic and bimetallic core-shell nanoparticles and nanowires [2−4]. This talk is aimed to present modeling and simulation to deal with this intermolecular interaction problem at the interface between quantum fluid droplets and solid surfaces of different nature [5−11]. The focus will be in recent ab-initio schemes combining dispersionless density functional [12], incremental post-Hartree-Fock [13], and symmetry-adapted perturbation theories [14] to describe He/surface, He/metal, and metal/surface van der Waals-dominated interactions, as well as the helium density functional approach [15] to account for the time-dependent evolution of the superfluid ^{4}He droplet motion. The upscaling problem to nanoscale metallic particles will also be discussed. Finally, very recent studies on the intermolecular interaction between ^{4}He droplets and carbon nanotubes will be underlined [16].

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