Università di Roma
Tor Vergata

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Dipartimento di Scienze e Tecnologie Chimiche
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AVVISO DI SEMINARIO

Il Prof. Mark Borden,
University of Colorado, Boulder

Venerdì 26 maggio ore: 14:00

Nell'aula seminari del Dipartimento di Scienze e Tecnologie Chimiche

Terrà un seminario dal titolo:

Molecular Engineering of Microbubble Resonance

Proponente: Prof. G. Paradossi

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ABSTRACT

Is it possible to engineer the resonance frequency of a microbubble by manipulating the lipid shell? In this talk, a recent study will be discussed that attempts to answer this question for very small-amplitude oscillations. A molecular model for the lipid shell will be introduced that provides calculation of the shell elasticity directly from first-principle intermolecular pair potentials. This elasticity is strictly valid for very small intermolecular displacements, and was tested experimentally for microbubbles with different lipid shell compositions. Individual gold-nanoparticle-coated, plasmonic microbubbles of 2-6 μm radius were photothermally activated with a short laser pulse, and the subsequent nanometer-scale radial oscillations during ring-down were monitored by optical scatter. The method provided average dynamic response measurements of single microbubbles. Each microbubble was modeled as an underdamped, linear oscillator to determine the damping ratio and eigenfrequency, and thus the lipid monolayer viscosity and elasticity. As predicted by the model, a significant increase in surface elasticity was observed for lipid acyl chain length of 16 to 20 carbons. The surface viscosity was found to be equivalent for these lipid shells. We also observed an anomalous decrease in elasticity and increase in viscosity when increasing the acyl chain length from 20 to 22 carbons, indicating that microstructural effects may be important for such small displacements. The talk will conclude with insights gleaned from the molecular model on resonance effects for larger amplitude oscillations.