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Development of a non-contact method to measure soft matter viscoelasticity

Place of work/:
FCUL, Atomic Force Microscopy and Related Techniques (AFMaRT) Lab

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Mechanical properties of materials such as elasticity or viscosity, have long been the focus of intensive research towards the development of novel materials and applications. Recently these properties have also been associated with critical aspects of cell life in the human body, from cell division to the formation of metastasis and death and are regarded as potential therapeutic targets for diagnosis of several diseases.

However, the measurement and study of these properties is currently hindered by experimental challenges. Not only the traditional physical models underlying such experiments are often inaccurate, but also effects such as adhesion originate severe disturbances to the expected linear elasticity theories. In the AFMaRT Lab we are developing an innovative non-contact experimental method to probe the viscoelasticity of soft materials. In short, to avoid the detrimental effects of adhesion, we sense how soft and how viscous a material is without ever touching it, by oscillating nearby a colloidal probe, in a low Reynolds number regime.

This project is centered in the development of this experimental method. After first contacting with the current challenges in measuring viscoelasticity with atomic force microscopes (AFM), and depending on the student's interest, the proposed work plan, which includes learning how to use this instrument proficiently, can focus on the accurate modelling of the experimental setup and prediction of experimental results, and/or on the use of our lab AFMs to test and develop the proposed methodology on a large range of different test samples, from polymeric gel matrices to cells.

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Bibliography: (if applicable)