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Yield Transition and Controlled Fluidization of Soft-Glassy Materials

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Emulsions are soft-glassy materials made of non-coalescing droplets moving in a continuous component. Above the jamming point, they display unique properties that endow them with both solid and plastic features: when an external forcing is applied the system responds as an elastic solid until a threshold is overcome, the so-called yield stress, above which the system flows through a series of irreversible plastic events occurring as a sequence of topological changes in the droplets distribution. Emulsions stand as extremely interesting systems both from the technological (pharmaceutical and oil industry...) and the theoretical (out-of-equilibrium statistical mechanics) points of view. Leveraging the computational power of GPUs we developed a general tool for the prompt detection of plastic events and the tracking of droplets in Lattice Boltzmann model emulsions which allowed us to study with an unprecedented statistics micro-channel flows, crucial in technical applications, as well as emulsions microscopic dynamics at the onset of the yield-stress transition. In this talk we will briefly introduce the computational technique and show the results obtained in the control of the emulsion fluidization by means of rough micro-channels as well as the most recent ones regarding the onset of the yield-stress where we observed a reversible tunneling from the solid to the liquid phases along with long-ranged correlations. The author acknowledges the project "High performance data network: Convergenza di metodologie e integrazione di infrastrutture per il calcolo High Performance (HPC) e High Throughput (HTC)"(fondi CIPE) for support. [Computer Physics Communications, 2017, 213, 19 –28; Physical Review E, 2017, 95, 052602; arXiv:1710.00686 [cond-mat.soft]]

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