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Experimental evidence for a dynamical crossover in liquid metals

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Cooling a liquid and avoiding crystallization the viscosity will increase dramatically and finally the viscous liquid will arrest into the glass state. This process is accompanied by a slowing down of the structural relaxation process. However, it is unclear whether there exists a particular, universal temperature range at which the slowing down sets in.
We investigated the dynamics of liquid metals, ranging from rubidium over lead to aluminium, to scrutinize changes with temperature [1]. To this end we measured the temperature dependence of the collective particle dynamics at the structure factor maximum through inelastic neutron scattering. In addition, we investigated the intermediate scattering function, which becomes non-exponential towards the melting point. The Stokes-Einstein relation evidenced a change at the same temperature range where the collective dynamics showed a crossover [2]. Classical and ab initio simulations support these findings [2,3].
These results suggest a change in dynamics of the equilibrium liquid metal state well above the melting point and indicate a crossover from a fluid-like dynamics to a viscous liquid dynamics with decreasing temperature. The similarity of the changes in the studied monatomic metals is evidence for a universal character of this crossover.

References:
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