O 34: Invited Talk (Andre Schirmeisen)

Time: Tuesday 14:45–15:30 Location: TRE Phy

Invited Talk O 34.1 Tue 14:45 TRE Phy

A Bottom-up View of Sliding Friction: From Hopping Atoms to Superlubric Nanoparticles — •Andre Schirmeisen — Institute of Physics and Center for Nanotechnology (CeNTech), University of Muenster, Germany

Frictional motion plays a central role in diverse systems and phenomena that span vast ranges of scales, from the nanometer contacts in micromachines up to the geophysical scales of earthquakes. Despite the practical and fundamental importance of friction little progress has been made in finding an exact atomistic description. The advent of new experimental tools such as the friction force microscope enabled the investigation of frictional forces occurring on microscopic scales.

Our experiments show that at the molecular level friction is intimately connected to thermal activation of atomic jumps [1]. However, for slightly larger contact sizes, we found evidence for an inverse thermal activation effect, which is due to contact formation processes at the sliding interface [2]. Finally, by using the method of controlled nanoparticle manipulation, we reveal that metal particles can even coexist in two frictional states, exhibiting 'frictional duality': Some particles show linear scaling with contact area while others assume a state of virtually frictionless sliding [3]. This superlubricity phenomenon is based on the interlocking of interface atoms, exhibiting a characteristic sub-linear scaling of friction with contact area.

[1] Jansen et al., Phys. Rev. Lett. 104 (2010) 256101
[2] Barel et al., Phys. Rev. Lett. 104 (2010) 066104
[3] Dietzel et al., Phys. Rev. Lett. 101, 125505 (2008)