BIOMAC–BP Seminar Series

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3 PM CET

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Bio:
Deepak Kumar is an experimental soft matter physicist at IIT Delhi, India. He earned his PhD at TIFR Mumbai under Prof. Shankar Ghosh and conducted postdoctoral research at the University of Massachusetts Amherst with Prof. Narayanan Menon and Prof. Thomas Russell, where he developed techniques to encapsulate liquid drops with thin polymer films. His research interests include elastocapillary phenomena, liquid drop impact dynamics, and driven granular materials.

Geometrical Incompatibility Induced Friction at a Soft Interface

Soft and biological matter come in a variety of shapes and geometries. When soft surfaces that do not fit into each other due to a mismatch in Gaussian curvatures form an interface, beautiful geometry-induced patterns emerge, which has been the subject of many interesting recent studies. In this presentation, I will talk about our study of the effect of geometry on the dynamical response of soft surfaces moving relative to each other. Using a novel experimental scheme, we measure friction between a highly bendable thin polymer sheet and a hydrogel substrate. At this soft and low-friction interface, we find a strong dependence of friction on the relative geometry of the two surfaces. We show that the stress developed in the sheet due to its geometrically incompatible confinement is responsible for the enhanced friction. Our finding reveals a novel non-specific mechanism of purely geometrical origin that may influence friction significantly in soft, biological, and nano-scale systems. In particular, it provokes us to re-examine our understanding of phenomena such as the curvature dependence of biological cell mobility.

References

1. A. Chawla, & D. Kumar, Geometry-induced friction at a soft interface, Proc. Natl. Acad. Sci. U.S.A. 121 (30) e2320068121, https://doi.org/10.1073/pnas.2320068121 (2024).