Incoming: The Disruption of Asteroids

K.T. Ramesh

Decker Professor of Science & Engineering
Hopkins Extreme Materials Institute
The Johns Hopkins University

ABSTRACT

Most asteroids are small rocky bodies. The structure and surface topography of these bodies is determined largely by impact and fracture processes that occur over an immense range of timescales. We examine the disruption and breakdown of asteroids by studying the multiscale mechanics of dynamic fracture and fragmentation, coupled with computational simulations of gravitational re-accumulation. We address these issues through fundamental high-strain-rate experiments, high-speed visualization, theoretical and computational modeling of failure processes, and computational simulations of asteroid damage and disruption. We compare our predictions with the observations of asteroidal surfaces by many space probes over the last twenty years or so. Our focus is on the relative roles of impact and thermal loading on the nature of near-Earth asteroids (NEAs) that may potentially impact the Earth.

Finally, we consider the implications of our work for the lifetimes of these asteroids, for asteroid mining operations, and for the potential disruption of incoming asteroids.

K. T. Ramesh is the Alonzo G. Decker Jr. Professor of Science & Engineering at Johns Hopkins University and the Director of the Hopkins Extreme Materials Institute. He is a Professor in the Departments of Mechanical Engineering (primary), Materials Science and Engineering, and Earth & Planetary Sciences. His research interests are the broad areas of impact and failure of materials under extreme conditions, currently with specific interests in protection materials, the massive failure of brittle solids, impact processes in planetary science, and impact biomechanics. His work has applications in protecting people, in avoiding concussions, and (perhaps) in protecting the Earth from incoming asteroids. He also has a particular interest in the ways in which creativity can be integrated into the sciences, arts and engineering.

For in the Mechanics of Materials Seminar Series organized by Sumit Basu, IIT-Kanpur, Nov. 11, 2020.