**Tata Institute of Fundamental Research**
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

# Colloquium

## Yielding in crystals towards the quasistatic limit: A slip-plane condensation transition

## Jürgen Horbach

### HHU Düsseldorf, Germany

When a crystalline solid is slowly deformed with a constant deformation rate, plastic flow initiates only at a limiting deformation called the yield point. In this talk, the yielding of a Lennard-Jones fcc crystal with periodic boundary conditions is studied using particle-based simulation techniques. We show that in the quasi-static limit the yielding can be described as a slip-plane condensation transition, a novel type of first-order phase transition that occurs in the limit of very large but finite linear dimension of the system. This transition shares similarities with the droplet condensation transition[1, 2] that is observed in the context of first-order phase transitions. It is associated with a jump of an intensive thermodynamic variable and strongly depends on the boundary conditions and the deformation protocol. For finite deformation rates, we present a theory for the deformation rate dependence of the yield strain which is in excellent agreement with the simulation data.

**References:**
[1] K. Binder, M. Kalos, J. Stat. Phys., 22, 363-396 (1980)
[2] K. Binder, Physica A: Statistical Mechanics and its Applications, 319, 99-114 (2003)

***Friday, Feb 23rd 2024***

***16:00 Hrs (Tea / Coffee 15:45 Hrs)***

***Auditorium, TIFR-H***