

ICTS Seminar

- Title** : Vorticity generation in rotating cylindrical shear flows
- Speaker** : Sutirtha Sengupta, University of California Santa Cruz, USA
- Date** : Tuesday, July 9, 2019
- Time** : 3:30 PM
- Venue** : Emmy Noether Seminar Room, ICTS Campus, Bangalore
- Abstract** : We propose a mechanism for generation of vorticity in a rotating cylindrical shear flow and predict the effect of background rotation through three-dimensional linear stability analysis and direct numerical simulations (DNSs). Our linear theory predicts a positive feedback of angular momentum for moderate rotation rates that agree well with early time evolution of DNSs with weak rotation. These runs show the growth of low azimuthal wavenumber ($m \sim 1$) modes of instability (see left panel of 1) at early times with subsequent onset of centrifugal instabilities that arrests the initial spin-up of the core of the cylinder.
- For stronger background rotation, we observe the emergence of helical ($m \sim 2$) modes of instability from very early times (see left panel of 1) which drain angular momentum out of the core of the cylinder, and is consistent the linear theory predictions at high rotation rates. We discuss possible implications of this study for understanding the emergence and growth of large-scale vortices as commonly observed in DNSs of turbulent convection as well as natural flows in astrophysical and geophysical contexts.