



Indian Institute of Technology Kanpur



INSTITUTE LECTURE SERIES

July 24, 2023 (Monday) | 6.00 pm | L- 17

Speaker: Professor Edgar Knobloch

Talk Title: Geostrophic Turbulence and the Formation of Large Scale Structure

About the Speaker



Edgar Knobloch is a Professor of Physics at the University of California at Berkeley. He was born in Prague, and received his B.A. degree from the University of Cambridge in Mathematics and his PhD degree from Harvard University in Astronomy. He was a research fellow at St John's College, Cambridge, and a Junior Fellow of the Harvard Society of Fellows prior to joining the Berkeley physics department. Professor Knobloch is the recipient of honorary doctorates from Universite Paul Sabatier, Toulouse, France and Universidad Politecnica de Madrid, Madrid, Spain. His research interests range from bifurcation theory and nonlinear dynamics to pattern formation, fluid dynamics and astrophysics.

Abstract of the Talk

Rotating convection is studied using an asymptotically reduced system of equations valid in the limit of strong rotation. The equations describe four regimes as the Rayleigh number Ra increases: a disordered cellular regime near threshold, a regime of weakly interacting convective Taylor columns at larger Ra , followed for yet larger Ra by a breakdown of the convective Taylor columns into a disordered plume regime characterized by reduced heat transport efficiency, and finally by a new type of turbulence called geostrophic turbulence. Properties of this state will be described and illustrated using direct numerical simulations of the reduced equations. These simulations reveal that geostrophic turbulence is unstable to the formation of large scale barotropic vortices or jets, via a process known as spectral condensation. The details of this process will be quantified and its implications explored. The results are corroborated via direct numerical simulations of the Navier-Stokes equations; in the presence of boundaries, robust boundary zonal flows resembling topologically protected edge states in chiral systems are present.

All are cordially invited to attend

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