

MHRD Scheme on Global Initiative on Academic Network (GIAN)

Convection Instabilities and Natural Dynamos - Hydrodynamic Stability and Dynamo Theory Revisited

Course Dates: 09-01-2023 to 19-01-2023 (Offline)

Overview

Topics of this course are related to recent astrophysical and geophysical problems strongly progressing in the last decades due to common interaction of four parts, namely, theory supported by physical principles, observations with measurements from space and ground, and computational simulations and laboratory experiments. The topics can be attractive also to applied mathematicians due to sophisticated mathematical approaches applying wide spectra of numerical as well as analytic and asymptotic methods which are necessary for successful and effective solutions of the attractive physical problems.

The first goal of the course is to motivate mathematicians to solve complex physical problems. Therefore, the course indicates an attractiveness and practical usefulness of topics related to the magnetic field generation of cosmic bodies, in particular of the Earth and Sun. Understanding and the ability to predict the time behavior of the last two fields has also enormous practical significance, and it is not yet solved. The second goal is to show how various branches of mathematics are indispensable in solving the problems of Convection and Dynamo Theory in astro- and geophysics. The 3rd goal is to introduce the basic physical background for the topics with emphasis on mathematical expression of this physics, i.e. to underline the correspondence between the physics and mathematics of the topics. The attention will be focused on two bases, (1) the Study of Convection Instabilities (in rotating fluids permeated by magnetic fields) with some models of Rotating Magnetoconvection, and (2) the Foundations of Magnetohydrodynamics with Dynamo Theory applied on Natural Dynamos. The mathematical approaches with convenient approximations based on physical understanding of details in Dynamo mechanisms will be presented. Significant advancement in comparison with 2016-course is planned.

Objectives

The primary objectives of the course are as follows: (i) to motivate mathematicians to solve complex physical problems, (ii) to show how various branches of mathematics are indispensable in solving real problems, (iii) to introduce the basic physical background for the topics, (iv) to strengthen participants' ability to see correspondence between the physics and mathematics and (v) to enhance the ability of participants to choose crucial parameters and estimate their values.

Modules	Magnetohydrodynamics (MHD), Magnetism in Universe and Dynamos, Foundations of MHD and Dynamo Theory, Natural Dynamos and Dynamics of Rotating Fluids, Rotating Magnetoconvection (RMC), Convection in Spherical and Spherical shell geometry, Waves in Rotating MHD Systems, Dynamo Theory, Numerical methods and approaches (NMA) in RMC and Dynamos, Numerical Simulations of Dynamos.
You Should Attend If you are...	<ul style="list-style-type: none">▪ Student at all levels (BTech / MSc / MTech / PhD/Post Doc),▪ Faculty from reputed academic institutions and technical institutions.▪ Executives, engineers and researchers from government organizations including R&D laboratories and industry.
Selection and Fees	Candidates registering early will be given preference in short listing process. Selected participants will be intimated through email. They have to remit the necessary course fee to the bank as per the details given below (inclusive of GST) . Students Participants without/with Grading Rs. 1000/Rs. 2000 Faculty (Internal & External) & Scientists Rs. 4,000 Persons from Industry / Consultancy firms Rs. 8,000 Foreign Students USD 100 Other Foreign Participants USD 200
REGISTRATION PROCESS:	Stage-1: Web Portal Registration : Visit http://www.gian.iitkgp.ac.in/GREGN/index and create login User ID and Password. Fill up the registration form and do web registration by paying Rs. 500/- online through Net Banking/Debit/Credit card. This provides the user with life time registration to enroll in any number of GIAN courses offered. (If you have already registered in GIAN portal you can skip this step.) Stage-2: Course Registration: Login to the GiAN portal with the user ID and Password already created in Step 1. Click on Course Registration option at the top of Registration form. Select the course titled " Convection Instabilities and Natural Dynamos - Hydrodynamic Stability and Dynamo Theory Revisited " from the list and click on Save option. Confirm your registration by clicking on Confirm Course.

The Faculty



Prof. Brestenský Jozef is from Faculty of Maths, Physics and Informatics (FMPHI) in Comenius University (CU), Bratislava, Slovakia. He contributed his research knowledge in different departments of

CU such as Astronomy, Physics of the Earth and Meteorology, General Physics, Geomagnetism and Magnetohydrodynamics, and Natural Sciences. His research interests include Geophysics, Geophysical Fluid Dynamics, Planetary Magnetic Fields, Rotating Magnetoconvection, Cosmic Magnetohydrodynamics, Solar Physics, Physics of everyday life and Applied Mathematics. He contributed his vast knowledge in the prestigious Scientific committees in different positions. He has been invited by the different prestigious universities, to name a few, Cambridge University, University of Hyderabad and NIT Warangal. He published his research work in high impact factor SCI journals which has a large number of citations.



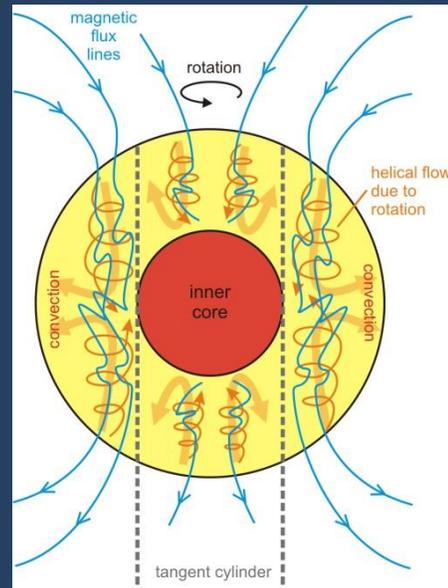
Dr. Y. Rameshwar is working as an Associate Professor in the Department of Mathematics, University College of Engineering, Osmania University. He visited Comenius university, Slovakia as a visiting guest to do research work on Geophysical Models. He did collaborate research work (Research Associate) on chaotic dynamics with Prof. M. K. Verma, IIT Kanpur. He

published his research work in Int. J. Heat and Mass Trans, J. Physical Society of Japan, Meccanica, Astrophysics space science journal, ASME J. Heat Transfer etc. His areas of research includes: Hydrodynamics and Hydromagnetic Stability, Ferrohydrodynamics, Pattern formation, Solitons.



Dr. HP Rani, Professor of Mathematics from NIT Warangal obtained her doctorate degree from Anna University, Chennai and has vast experience as an academician and researcher by working in prestigious National Taiwan University, Taiwan and Kyung Hee University, South Korea. She has introduced a new concept of boundary layer flow

visualisation through heatlines and masslines. Her work in flow assisted corrosion problems has gained currency in the nuclear industry. The detailed analysis of microcirculatory blood flow in hepatic lobule has got much appreciation from the medical community. Her area of interest includes Computational Fluid Dynamics, Heat and Mass Transfer, Biomechanics, MHD, Geodynamo and Corrosion problems.



Course Co-Ordinator

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<http://www.gjan.iitkgp.ac.in/GREGN>