

## ICTS Astrophysics and Relativity seminar

**Title** : Mean Field Dynamo: Beyond MHD

**Speaker** : Vinod Krishan (Indian Institute of Astrophysics, Bengaluru)

**Date** : 13<sup>th</sup> March 2024, Wednesday

**Time** : 11:00 AM (IST)

**Abstract** : Magnetic fields pervade the entire universe, even in extremely weakly ionized regions. The generation and sustenance of the magnetic fields is an attendant important issue in such systems. In this 3-part talk, I shall set up a theoretical framework beyond MHD in which the magnetic induction is subjected to the ambipolar diffusion and the Hall effect in addition to the usual advective and resistive dissipation processes. The Hall effect arises from the treatment of the electrons and the ions as two separate fluids and the ambipolar diffusion due to the inclusion of neutrals as the third fluid. In the second part, the essentials of the mean field dynamo, one of the most acceptable mechanisms of the generation of large scale field from small scale field fluctuations, within MHD will be recapitulated. In the third part I shall discuss the mean field dynamo mechanism including beyond MHD effects considering a weakly ionized turbulent plasma. It is shown that these beyond MHD effects modify the so-called  $\alpha$  effect and the turbulent diffusion coefficient  $\beta$  in a rather substantial way. The Hall effect may enhance or quench the dynamo action altogether. The ambipolar diffusion brings in an  $\alpha$  which depends on the mean magnetic field. The new correlations embodying the coupling of the charged fluids and the neutral fluid appear in a decisive manner. The turbulence is necessarily magnetohydrodynamic with new spatial and time-scales. The nature of the new correlations is demonstrated by taking the Alfvénic turbulence as an example. The solar atmosphere may be a possible locale of the play of these effects.

**Venue** : **Offline:** Emmy Noether Seminar Room

**Online:** Please click the below link to join the seminar.

<https://icts-res-in.zoom.us/j/95718838882?pwd=ZnNwNk1lU0lRLzkYeHIwMdBjWEVozZ09>

Meeting ID: 957 1883 8882

Passcode: 131413