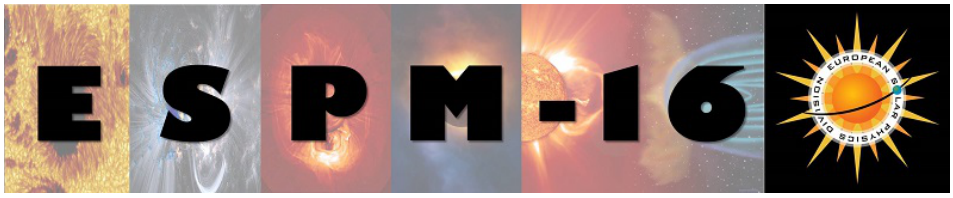

Contribution ID: **561** Type: **Invited talk**

Advances in mean-field dynamo theory

Monday, 6 September 2021 09:25 (20 minutes)

Mean-field dynamo theory is a rich field that tries to reproduce and often predict the large-scale behavior of a turbulent system. Numerical simulations play the same role as astronomical observations, except that the former ones can be done under controlled conditions while the latter ones have the advantage of being more in the asymptotic regime of large magnetic and fluid Reynolds numbers. Unfortunately, we do not yet understand much about the turbulence in the real Sun. Especially the extreme stratification in the uppermost layers is impossible to simulate properly.

Three-dimensional numerical simulations of the Sun are still far from the actual Sun, but they do produce features that are in agreement with appropriately tailored mean-field calculations. This has been achieved by measuring their mean-field transport coefficients using the test-field method, a reliable procedure whose accuracy enables us to pinpoint some previously unexpected phenomena.

Additional diagnostics concerning the measurement of magnetic helicity both at the solar surface and in the solar wind have widened the horizon of our understanding. In particular, it is now possible to solve mean-field models that encompass both dynamo and its wind emanating from it. In my talk, I will connect various aspects of solar wind physics with related aspects of solar magnetic activity. Looking around at other stars helps us further to put the Sun and our models into context and to appreciate to what extent our Sun might be special.

Student poster?

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Session Classification: Plenary 1

Track Classification: Session 1 - Solar Interior, Dynamo, Large-Scale Flows and the Solar Cycle