Department of Astrophysical & Planetary Sciences, University of Colorado, Boulder

ASTR 7500: Solar and Stellar Magnetism Instructor: Juri Toomre

Spring 2013: Tues/Thur 2:00pm/3:15pm MST (starts at UH 11am, NJIT 4pm)

Overview: This is the *inaugural web-enabled course* in the `George Ellery Hale Collaborative Graduate Education Program in Solar & Space Physics', in collaboration with the University of Hawaii (UH) and the New Jersey Institute of Technology (NJIT). This graduate program is established as a component of the planned move of the headquarters of the National Solar Observatory (NSO) to Boulder as one enters the Advanced Technology Solar Telescope (ATST) era. Other courses will be taught in turn by UH and NJIT, and we welcome other institutions to join in our attempts to offer a regular and frequent series of courses for graduate students considering research in solar and space physics, or related areas in astrophysics. We are planning for active participation in this inaugural course by scientists from both NSO and the High Altitude Observatory (HAO).

Course outline: The Sun is a magnetized star and one that we can study in great detail. It shows rich time dependent behavior that we are only just beginning to understand. This course will address the interior origins and photospheric properties of solar magnetism, and how these compare to what is known about magnetic activity on other stars. The course will focus on the interplay between observations and modeling. We begin by looking at helioseismic measurements of the solar interior and their constraints on dynamo models. We then consider current 3-D MHD models of global-scale convection coupled to rotation, and their ability to build magnetic fields through dynamo action. Next we turn to flux transport from the base of the solar convection zone into the surface layers, examining thin flux tube models, their limitations, and the interplay between finite size rising flux bundles and convection. The emergence of the flux through the solar photosphere will lead to study of turbulent dynamo processes and spectro-polarimetric measurements of small-scale photospheric fields. Finally, we will assess the capabilities and limitations of current instrumentation and modeling efforts, looking forward to the future promise of the ATST and terascale computing.