

Syllabus for ASTR 734: Solar & Stellar Magnetism (2 credits)

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Semester: Fall 2010

Time: TBA

Duration: Aug 23–Dec 9, 2010

Course Description:

Magnetic fields are involved in many aspects of solar and stellar physics, and they play crucial role in fundamental physical processes, such as accretion, mass-loss, diffusion, convection, rotation. In other words, magnetic fields deeply influence the solar and stellar evolution. Thanks to combined breakthroughs in observing techniques and numerical simulations, our understanding of the origin and impact of magnetic fields in solar-type stars has greatly improved during the last decade. Many open issues related to solar and stellar magnetism, however, still remain, and they are subject to active research and debate by scientists in this exciting field.

This specialized course on Solar and Stellar Magnetic Activity is intended to provide graduate students with basic knowledge and understanding of magnetic fields of the Sun and other Sun-like stars of late spectral type. It discusses all of the fundamental topics defining the solar and stellar magnetism, namely: (i) creation of magnetic fields by dynamo processes in the solar and stellar interiors; (ii) emergence of magnetic fields from the convection zone; (iii) evolution of magnetic fields in the solar and stellar coronae, (iv) diffusion and annihilation of the magnetic fields; and (v) transport of the magnetic fields by solar and stellar winds, among other processes.

The course reviews the most recent advances in this field in regard to the Sun and Sun-like stars in great length and depth, and it presents the underlying physics in a systematic and comprehensive manner. The course attempts to connect the various phenomena resulting from the solar and stellar magnetic activity – by first presenting state-of-the art observations of these phenomena and then discussing their physical interpretation based on recent theories and numerical simulations – and it attempts to make the solar-stellar connection whenever possible.

Topics to be covered:

1. Stellar structure;
2. Differential rotation;
3. Solar magnetic structure;
4. Solar magnetic configurations;
5. Properties of the magnetic field;
6. Solar Dynamo;
7. Solar outer atmosphere;
8. Stellar outer atmosphere;
9. Coronal heating;
10. Activity and stellar properties; and,
11. Stellar magnetic phenomena.

12. Activity and rotation on evolutionary time scales
13. Activity in binary stars

Examination: Scientific report on a topic chosen by the student.

Textbook: Carolus Schrijver and Cornelius Zwaan, *Solar and Stellar Magnetic Activity*, ISBN: 978-0-521-58286-5, Cambridge University Press.