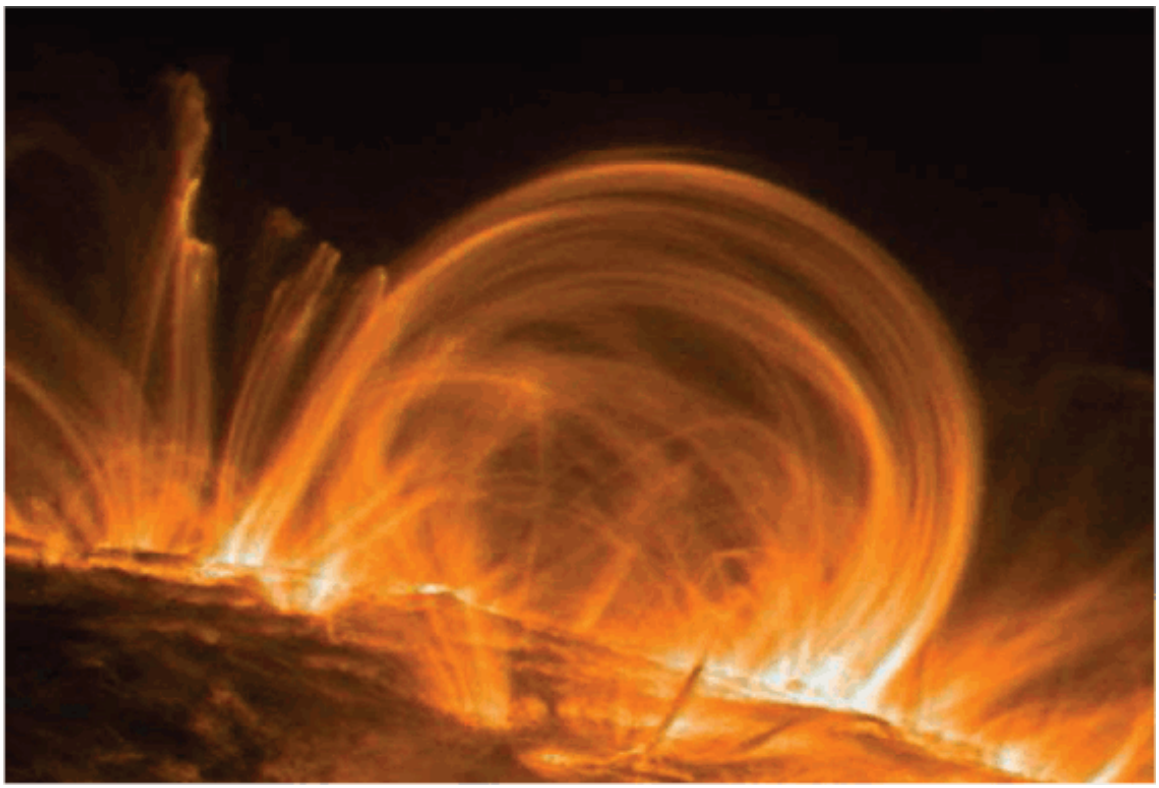
ENGS 152/PHYS 115. Magnetohydrodynamics



Overview

The fluid description of plasmas and electrically conducting fluids including magnetohydrodynamics and two-fluid fluid theory. Applications to laboratory and space plasmas including magnetostatics, stationary flows, waves, instabilities, and shocks.

Prerequisite: PHYS 68 or equivalent, or permission of instructor.

Instructor

William Lotko

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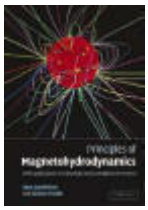
Office Hours:	Open, anytime or by appointment

Classes

Tuesdays and Thursdays, 2:00-4:00 pm, plus Wednesday (X-hour) from 4:15-5:30 pm. The x-hour may be used occasionally. An alternative class time will be discussed at the first class meeting on January 6.

Textbook



Principles of Magnetohydrodynamics: With Applications to Laboratory and Astrophysical Plasmas

Authors: J. P. Hans Goedbloed and Stefaan Poedts
Published by Cambridge University Press, 2004

ISBN-13: 9780521626071| ISBN-10: 0521626072

Evaluation

The course grade is based on performance on homework and examinations with the following weights:

Weekly Homework	55%
Midterm Exam	20%
Final Exam	25%

Additional information about the course objectives is available at http://thayer.dartmouth.edu/courses/09winter/engs152/Objectives.html.

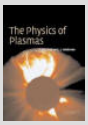
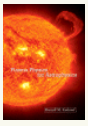
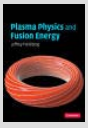
Blackboard

More information about this course, including lecture notes, handouts, and links to useful information, is available at the ENGS/PHYS 100 Blackboard site. You can login to Blackboard using your DND username and password. If you have registered for ENGS 100 or PHYS 100, you will see a link in your "My Courses" list.

Schedule

The Winter 2009 schedule of lectures by topic is available at http://engineering.dartmouth.edu/courses/09winter/engs152/Schedule.html

References: Additional references on various aspects of magnetohydrodynamics are listed below. They range from general treatments of plasma physics, including MHD, to topical treatments of magnetic reconnection and MHD turbulence, and applications to space, fusion and engineering MHD. You will find all of these books in the Dartmouth library.

	Boyd and Sanderson, "The Physics of Plasmas" 2003	"a comprehensive introduction to the subject, illustrating the basic theory with examples drawn from fusion, space and astrophysical plasmas"
	Bellan, "Fundamentals of Plasma Physics" 2008	"rigorous explanation of plasmas relevant to … controlled fusion, astrophysical plasmas, solar physics, magnetospheric plasmas, and plasma thrusters"
	Polovin and Demutskii "Fundamentals of Magnetohydrodynamics" 1990	development of magnetohydrodynamics with collisional transport, magnetohydrostatics, stationary flows, shocks, waves, turbulence and dynamos
	Priest and Forbes, "Magnetic Reconnection: MHD Theory and Applications" 2007	"a pedagogical account of the basic theory and physical phenomena created by reconnection – from laboratory machines, Earth's magnetosphere, Sun's atmosphere …"
	Biskamp, "Magnetohydrodynamic Turbulence" 2008	"a brief outline of the magnetohydrodynamic theory and discussion of the macroscopic aspects of MHD turbulence, including the small-scale scaling properties"
	Kulsrud, "Plasma Physics for Astrophysics" 2004	"introduces plasma physics from the ground up, presenting it as a field that can be grasped largely on the basis of physical intuition and qualitative reasoning"
	Priest, "Solar Magnetohydrodynamics" 1984	"a comprehensive review of present magnetohydrodynamic models in solar physics ... also an excellent text for a graduate on magnetohydrodynamics"
	Schindler, "Physics of Space Plasma Activity" 2006	"a detailed treatment of the [physics] of large plasma eruptions in space ... employs both fluid and kinetic models, and discusses the applications"
	Schunk and Nagy, "Ionospheres: Physics, Plasma Physics, and Chemistry" 2004	"a description of the physical, plasma and chemical processes controlling the behavior of ionospheres. The relevant transport equations are derived in detail "
	Sutton and Sherman, "Engineering Magnetohydrodynamics" 1965	properties of ionized gases in magnetic and electric fields, … macroscopic motion of electrically conducting compressible fluids, and engineering applications
	Freidberg, "Plasma Physics and Fusion Energy", 2008	"covers energy issues such as the production of fusion power, power balance, the design of a simple fusion reactor, and the basic plasma physics issue "