Announcing
2011 Spitzer Lecturer

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SURPRISES IN ASTROPHYSICAL GASDYNAMICS

About 30 years ago, Princeton University Press published a fascinating book by Sir Rudolf Peierls, entitled "Surprises in Theoretical Physics." In the inside cover description it is stated that "Problems in theoretical physics often lead to paradoxical answers; yet closer reasoning and a more complete analysis invariably lead to a resolution of the paradox and to a deeper understanding of the physics involved." I was much taken by this book as a student, and looking back now at my own ensuing efforts, I think that many problems from my own research in astrophysical gasdynamics have some of this character. In this series of lectures I will share what I hope will be some simple and revealing examples, taken from hydrodynamics, thermodynamics, and magnetohydrodynamics. They will be drawn mostly, but not exclusively, from my own work. All the problems surprised me for one reason or another--a few seemed genuinely paradoxical -- and forced me to shift my way of thinking about the astrophysical behavior of the system at hand.

LECTURE 1
Fri Apr 29, 2:00

Cold clouds in hot gas: the surprisingly subtle thermal behavior of conducting and cooling plasmas.

LECTURE 2
Mon May 16, 2:00

The endlessly surprising magnetorotational instability.

LECTURE 3
Wed May 18, 2:00

Thermal redux: the surprising obstinance of the cooling flow problem.

COLLOQUIUM
Tue May 3, 4:30

A surprisingly simple model for solar rotation

Helioseismology has become a precision tool that has allowed the inner rotation pattern of the Sun to be elucidated. While the radiative zone is well-modeled by solid body rotation, the turbulent convective zone shows a regular pattern of differential rotation. Surfaces of constant angular velocity are, roughly speaking, poleward-opening cones, coaxial with the rotation axis. In this talk, I will show how a few simple physical ideas and mathematical techniques are able to reproduce these observations with surprising fidelity. The inner and outer boundaries of the convective zone exhibit strong deviations from the conical pattern; these "anomalies" offer valuable clues to the stresses that are present in these regions. If correct, the principles of the theory should be applicable to a wide class of stars, including those with fully convective envelopes, and (more speculatively) to the internal rotational dynamics of convective planets.

All lectures in Peyton Hall Auditorium