PPPL PRINCETON PLASMA PHYSICS LABORATORY

# Colloquium

## Magnetohydrodynamical Turbulence in Star and Planet Formation


### DR. MORDECAI-MARK MAC LOW

*Associate Curator and Chair, Department of Astrophysics, American Museum of Natural History, New York, NY*



The structure of both star-forming molecular clouds and protoplanetary accretion disks depends on the properties of compressible MHD turbulence. In molecular clouds, turbulence both forms the density enhancements that ultimately collapse gravitationally, and helps to support them against gravity, though gravity wins rather quickly in the absence of energy input from massive stars. I will consider in particular how turbulence behaves in mostly neutral regions where ion-neutral drift becomes important. In protostellar accretion disks, magnetorotational turbulence not only transports angular momentum, allowing accretion, but it also strongly influences planet formation. I will show that it forms density enhancements with mass large enough to cause random walk migration of planetoids, but that dead zones sufficiently neutral to prevent turbulence reduce, without eliminating its effect. Finally, I will consider the influence of turbulence on the formation of planetesimals from boulders, showing that even in its presence streaming instabilities can cause direct gravitational collapse of boulders.


## Wednesday, March 7, 2007

**4:15 P.M. (Refreshments at 4:00 P.M.)**

**Lyman Spitzer Building, M. B. Gottlieb Auditorium**