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Los Alamos Astrophysics Distinguished Seminar Series

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Sustained Dust Asymmetries At Dead Zone Edges in Protoplanetary Disks

Thursday, July 21, 2016

2:00 PM - 3:00 PM

T-DO Conf Room
(TA-03, Building 123, Room 121)

Abstract. Protoplanetary disks, consisting of gas and dust in orbit around a newly formed star, are the birthplaces of planetary systems. Several observations of transition disks, a class of protoplanetary disks in which the first stages of planet formation have already occurred, exhibit strong asymmetries in thermal dust emission. These are thought to arise due to the trapping of dust in large-scale vortices, which form due to a shear instability occurring at locations in which mass accumulates into a "bump". A planet embedded in the disk may create a bump, but the resultant vortex is often quickly dissipated due to viscosity or dust drag. Since the vortex is a transient feature, it is unlikely to be observed. In an alternate scenario, the bump and vortex are formed at the interface between the magnetically active outer disk and the inactive inner disk ("dead zone"). Using hydrodynamic simulations of mutually coupled gas and dust, we show that vortices created at the dead zone edges are more robust than those created by embedded planets. Due to strong driving of the bump, multiple generations of vortices can be formed, which continually force the dust into sustained asymmetric configurations. The asymmetries can be maintained for a significant portion of the disk lifetime, making their observation possible.

For more information, or to meet with Ryan, contact the technical host, Hui Li, T-2, 665-3131, hli@lanl.gov

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