



# 清华大学高等研究院

Institute for Advanced Study, Tsinghua University

## Astrophysics Seminar

**Title:** Planetesimal agglomeration and destruction in binary star systems

**Speaker:** Dr. Kedron Silsbee  
*Princeton University*

**Time:** 1:45pm, Friday, Oct. 27, 2017

**Venue:** Conference Hall 322, Science Building, Tsinghua University

### Abstract

Many planets have been discovered in tight binary star systems. Simple calculations indicate that while planets were forming inside these systems, the relative speed of collisions between planetesimals would be orders of magnitude above the escape velocity for a kilometer-sized planetesimal. Therefore, one would think that planetesimals of this size should be obliterated, rather than growing in mutual collisions. We analytically calculated the relative collision velocities between planetesimals as a function of their size in a model that takes into account secular gravitational perturbations from the companion star and an eccentric protoplanetary disk, as well as gas drag from the disk. We combined this with a model for the outcome of collisions (as a function of the size of the colliding bodies and their relative velocity) to predict system properties that could enable growth. We find that for particular values of the protoplanetary disk mass and eccentricity, the planetesimal collision velocities are greatly reduced from what would be expected from simple order of magnitude estimates. In general however, it is difficult to understand how kilometer-sized, or even tens of kilometer sized planetesimals could survive their mutual collisions in these systems. We also present some preliminary results from a coagulation-fragmentation code that tracks the evolution of the planetesimal size-distribution due to the combined effects of collisions and radial drift.