Hubble Space Telescope

Cycle 16 AR Proposal

# Radiation-induced Grain Dynamics in Dust Disks: Radiation Pressure, Poynting-Robertson Drag, and Photophoresis

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Scientific Category: STAR FORMATION

Scientific Keywords: DUST, PROTO-PLANETARY DISKS, STAR FORMATION, YOUNG STARS AND PROTOSTELLAR OBJECTS, T TAURI STARS

Total Budget Amount: $55,205

Theory: Yes

## Abstract

We propose a theoretical program to rigorously calculate the radiation pressure and Poynting-Robertson drag parameters for both porous and compact grains in dust disks illuminated by stars of a wide range of spectral types, using the scattering parameters obtained from our HST Cycle 15 theory project. We also propose to study the rotational excitation of grains in gas-rich, optically thin disks (through collisions with neutrals, ions, "plasma drag" which may drive them to rotate suprathermally) to test the "photophoresis" hypothesis which was recently invoked to explain the central clearing and the formation of narrow rings in dust disks. This program will create a web-based library of radiation pressure and Poynting-Robertson drag parameters for both porous dust and compact dust (including nano-sized grains) as a function of size, composition, porosity (for porous dust), and stellar spectral type. This library will be made publicly available via the WWW at http://www.missouri.edu/~lia/. These parameters are essential (1) for modeling disk dynamics to interpret the un-smooth structures (e.g. asymmetry, warps, inner holes, clumps, rings) seen in scattered light images of disks obtained with HST, and (2) for reliably determining the dust removal and replenishment rates of debris disks as well as disk evolution.

## Investigators:

| | Investigator | Institution | Country |
|---|---|---|---|
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Number of investigators: 2

## Dataset Summary:

| Instrument | No. of Datasets | Retrieval Method | Retrieval Plan |
|---|---|---|---|
| | 0 | | It is a theory proposal! |