University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Doctor of Philosophy

of

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MSc (University of Victoria, 2014)
BSc (University of Washington, 2012)

“Understanding the Liveliness and Volatility of Debris Disks: from the Microscopic Properties to Causal Mechanisms.”

Department of Physics and Astronomy

Friday, July 13, 2018
11:00 A.M.
Clearihue Building
Room B017

Supervisory Committee:
Dr. Brenda Matthews, Department of Physics and Astronomy, University of Victoria (Co-Supervisor)
Dr. Kim Venn, Department of Physics and Astronomy, UVic (Co-Supervisor)
Dr. Christian Marois, Department of Physics and Astronomy, UVic (Member)
Dr. Colin Bradley, Department of Mechanical Engineering, UVic (Outside Member)

External Examiner:
Dr. Christopher C. Stark, Instruments Division, Space Telescope Science Institute

Chair of Oral Examination:
Dr. Kenneth Stewart, Department of Economics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Debris disks are a fundamental component of exoplanetary systems. Understanding their relationship and roles with their host stars and neighboring planets can help contextualize the evolution of exoplanetary systems. In order to further that goal, this thesis addresses some extreme outlier examples of debris disk systems. First, the highly asymmetric debris disk around HD 111520 is resolved and analyzed at multiple wavelengths to create a self-consistent model of the disk thermal emission and scattered light. The best-fit model is proposed to be an asymmetric disk from a recent collision of large, icy bodies on one side of the disk. In contrast, most debris disks are in a steady collisional cascade and this disk model could represent a relatively rare event in the creation of debris disks. Secondly, an optical spectroscopic survey of stars is conducted on stars where far-infrared observations exist to rule out or confirm the presence of debris disks. Specifically, AF-type stars are targeted in order to provide context around the Lambda Boo phenomenon, where stars are found to be specifically refractory metal-poor. One mechanism for this was hypothesized to be from a planetary scattering of debris disks, causing the accretion of volatiles from comets. The findings were that over the entire unbiased sample, stars which were refractory metal poor tended to be the stars with brightest debris disks. This supports a planet-disk hypothesis for accretion given that debris disks which are undergoing active planetary stirring are brighter. If true, this would mean about 13% of stars with debris disk are undergoing strong planetary scattering based on the occurrence rate of Lambda Boo stars relative to debris disk stars. All in all, these two tacks in our observational understanding of these extreme examples of debris disks provide constraints on the dynamics at work.