



**University  
of Victoria**

Graduate Studies

Notice of the Final Oral Examination  
for the Degree of Master of Science

of

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BSc (University of British Columbia, 2012)

“Deriving Dust Properties in Star Forming Clumps: a Look Across the  
Perseus Molecular Cloud with Herschel and SCUBA-2.”

Department of Physics and Astronomy

Tuesday, April 7, 2015

2:00 P.M.

Elliott Building

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Supervisory Committee:

Dr. James Di Francesco, Department of Physics and Astronomy, University of Victoria (Supervisor)

Dr. Jon Willis, Department of Physics and Astronomy, UVic (Member)

Dr. Doug Johnstone, Department of Physics and Astronomy, UVic (Member)

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Dr. Lewis Knee, NRC Herzberg Institute of Astrophysics

Chair of Oral Examination:

Dr. Veronica Pacini-Ketchabaw, School of Child and Youth Care, UVic

## **Abstract**

Herschel and JCMT surveys of nearby star-forming regions have provided excellent images of cold dust emission across several wavelengths with unprecedented dynamic range and resolutions. Here we present spectral emissivity index and temperature maps of dust in the star-forming clumps of the Perseus molecular cloud determined from fitting SEDs to the combined Herschel and JCMT observations in the 160  $\mu\text{m}$ , 250  $\mu\text{m}$ , 350  $\mu\text{m}$ , 500  $\mu\text{m}$ , and 850  $\mu\text{m}$  bands, employing the technique developed by Sadavoy et al. (2013). In NGC1333, the most complex and active star-forming clump in Perseus, we demonstrate that CO line contamination in the JCMT SCUBA-2 850  $\mu\text{m}$  band is typically insignificant. The derived spectral emissivity index,  $\beta$ , and dust temperature,  $T_d$ , ranges between 0.8 - 3.0 and 7 - 50 K, respectively. Throughout Perseus, we see indications of heating from B stars and embedded protostars, and smooth  $\beta$  variations on the smaller scales. The distribution of  $\beta$  values seen in each clump differs from one clump to another, and is in general different from the diffusive ISM values (i.e.,  $\sim 2$ ), suggesting that dust grain evolution are significant in star-forming clumps. We also found coincidences between low  $\beta$  regions and local temperature peaks as well as locations of outflows, which may provide hints to the origins of these low  $\beta$  value grains, and dust grain evolution in star-forming clumps in general.