Ph.D. Candidate

Samuel Kaare Kristoffersen

Graduate Academic Unit

Physics

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October 15, 2019

3:00 p.m.

Forestry/Geology Bldg.
Room 202

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Examining Board:
Dr. Dennis Tokaryk (Physics)
Dr. Jayachandran Thayyil (Physics)
Dr. Yun Zhang (Geodesy & Geomatics Eng.)
Dr. William Ward (Physics) Supervisor

External Examiner:
Dr. Jonathan Snively
Dept. of Physical Sciences
Embry-Riddle Aeronautical University
Daytona Beach, FL

The Oral Examination will be chaired by:
Dr. Kevin Englehart, Associate Dean of Graduate Studies

BIOGRAPHY

Universities attended (with dates & degrees obtained):

2012 – present	PhD candidate, University of New Brunswick
2008 – 2012	MSc in Physics, University of New Brunswick
2004 – 2008	BSc in Physics (Honours), University of New Brunswick

Publications:

Wu, Q., W. Ward, **S. Kristoffersen,** A. Maute, and J. Liu. *Simulation and observation of lunar tide effect on high-latitude, mesospheric and lower thermospheric winds during the 2013 sudden stratospheric warming event.* Journal of Geophysical Research: Space Physics, 124, 2019.

Lu. S., W.E. Ward, J.A. Langille, **S.K. Kristoffersen**, and C. Zhang, *Wind velocity measurement with wide angle divided mirror Michelson wind imaging interferometer*, Optoelectron. Adv. Mat. 11, 544-550, 2017.

Kristoffersen, S.K., W.E. Ward, S. Brown, and J.R. Drummond. *Calibration and validation of the advanced E-Region Wind Interferometer,* Atmos. Meas. Tech., 6, 1761-1776, 2013.

Conference Presentations:

"Polar Mesosphere Gravity Wave Observations," International Union of Geodesy and Geophysics (IUGG) General Assembly, Montreal, Quebec, Canada, July 2019.

"A Study of Gravity Waves with the ERIWN-II," Canadian Network for the Detection of Atmospheric Change (CANDAC) Workshop, Toronto, Ontario, Canada, May 2019.

"High Latitude Gravity Wave Observations," Division of Atmospheric Physics (DASP) Congress, Saskatoon, Canada, February 2019.

"Gravity Wave Observations and Characterization with the ERWIN-II," Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) 14th Quadrennial Solar-Terrestrial Physics Symposium, Toronto, Canada, July 2018.

"WaMI: The Waves Michelson Interferometer," Canadian Association of Physicists (CAP) Congress, Halifax, Nova Scotia, Canada, June 2018.

"Wind and Gravity Wave Observations with ERWIN-II," Canadian Network for the Detection of Atmospheric Change (CANDAC) Workshop, Toronto, Ontario, Canada, May 2018.

"Mesosphere Wind and Airglow Observations," Canadian Network for the Detection of Atmospheric Change (CANDAC) Workshop, Toronto, Ontario, Canada, May 2017.

"Mesosphere Wind and Airglow Irradiance Observations in Eureka, Nu," Canadian Meteorological and Oceanographic Society (CMOS) Congress, Fredericton, New Brunswick, Canada, June 2016.

"Mesosphere Wind and Airglow Observations," Canadian Network for the Detection of Atmospheric Change (CANDAC) Workshop, Toronto, Ontario, Canada, May 2016.

Several Other Conference Presentations

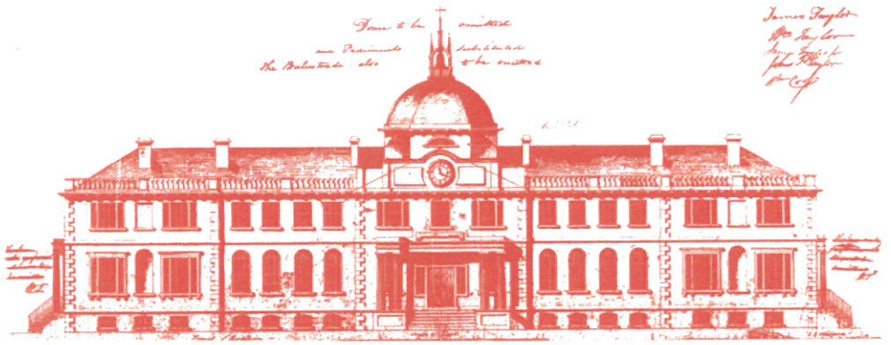
Doppler Michelson Interferometer Wind Observations and Interpretations

Abstract

The study of gravity waves is important for a complete understanding of the atmosphere as a whole, including the effects on large scale circulation patterns. Doppler shifts in the atmospheric airglow emissions (namely green line, O_2, and OH) are measured using Michelson interferometers to determine winds in the mesosphere at heights between about 87 and 97 km. The research of this thesis is sub-divided into two sections, one of the in lab testing of a novel monolithic Doppler Michelson interferometer design, and the second of wind and gravity wave observations in the polar mesosphere.

The first part of this research involves the in-lab testing of a multi-segmented mirror Michelson interferometer known as the Waves Michelson Interferometer (WaMI) designed as a monolithic wind imaging Doppler Michelson interferometer. This testing includes determination of the relative path differences of the four mirror segments and Doppler imaging of a retro-reflective rotating wheel. This acts as a proof of concept for this monolithic design, which was initially conceived for a satellite limb measurements of winds and rotational temperature measurements.

The wind and gravity wave observations are made with the E-Region Wind Interferometer (ERWIN-II) a Doppler Michelson interferometer located at the Polar Environment Atmospheric Research Laboratory (PEARL) in Eureka, Nu. (80 N, 86 W) since 2008. Observations of gravity waves in the winds and airglow brightness have allowed for the determination of the frequency and wave vectors of these gravity waves, in addition to demonstrating the vertical motion of the airglow layers by correlating the brightness with the vertical winds. Additional airglow height information was determined using correlations with a meteor radar co-located at PEARL. Observations of quasi-tidal frequency (between about 8 and 12 hour period) waves suggest that these waves may be inertia-gravity waves and not tides, with additional support provided by the enhancement of the gravity wave spectra at the inertial (Coriolis) frequency.



Home of the School of Graduate Studies, Sir Howard Douglas Hall was designed by J.E. Woolford in 1825 and is the oldest university building in Canada still in use.

The University of New Brunswick recognizes that the university sits on traditional Wolastoqey territory. The river that runs right by our university – the St. John River – is also known as Wolastoq, along which live the Wolastoqiyik -- the people of the beautiful and bountiful river.

UNIVERSITY OF NEW BRUNSWICK
SCHOOL OF GRADUATE STUDIES

ORAL EXAMINATION

Samuel Kristoffersen

IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY