The College of Graduate Studies and the College of Science Cordially Invite You to a

Master Thesis Defense

Entitled

CLOUD TRACKING WINDS ON MARS USING EMM-EXI IMAGING

by

Shaimaa Ahmed Abdulaziz Mohamed AlBlooki

Faculty Advisor

Dr. Roland Young, Physics Department

College of Science

Date & Venue

10:00 AM

Wednesday, 7 June 2023

Room 234, F3 Building

Abstract

The Martian atmospheric wind structure is a major unknown in our understanding of Mars' climate because it is difficult to measure wind remotely. The Emirates eXploration Imager (EXI) instrument on board the Emirates Mars Mission (EMM) takes visible and ultraviolet images of the whole hemisphere of the planet at a time, and can capture complete weather systems at once, along with their evolution over time. This project uses EXI 320 nm observations to measure winds on Mars using Correlation Imaging Velocimetry (CIV), a cloud tracking method based on software developed for laboratory fluid dynamics experiments, and with significant heritage in planetary imaging. We focused on observation sequences designed specifically to capture high-cadence imaging of Mars, with images separated by as little as five minutes. The experimental procedure was first to look for overlapping pairs of images that contain trackable features, but with an image separation large enough in time to see these features move, and then create cropped pairs of processed images projected on a $0.05^{\circ} \times 0.05^{\circ}$ degree longitude-latitude grid. We then optimized the CIV parameters for a representative pair of images, and finally applied the CIV method to as many EXI image pairs as possible. The results will be presented as wind field maps, latitudinal profiles, zonal and meridional analysis plots and will be compared to numerical models such as the Mars Climate Database.

Keywords: Mars, Atmosphere, Cloud Tracking, Correlation Imaging Velocimetry (CIV), Image processing, Wind Fields.