

Vita

Candidate's name: Mahith Madhanakumar

Universities
Attended: Mahatma Gandhi University (2016)
Bachelors of Science

Cochin University of Science & Tech (2018)
Masters of Science

University of New Brunswick (2021)
Masters of Science
Physics

Conferences Presentations/Publications:

On the Dependence of Amplitude and Phase Scintillation Indices on GPS Signal Propagation Geometry, Submitted to IEEE Geoscience and Remote Sensing Letters.

NASA Heliophysics Summer School (2021), run by NASA's Living With a Star program and UCAR/CPAESS (Virtual)

M. Madhanakumar, A. Kashcheyev, P.T. Jayachandran (2021), On the Dependence of Scintillation Indices on Magnetic Aspect Angle, Division of Atmospheric and Space Physics (DASP) Workshop, Calgary, Canada (Virtual)

Incoherent Scatter Radar Summer School (2020), Florida Space Institute, University of Central Florida (Virtual)

On the Dependence of Scintillation on GPS Signal Propagation Geometry

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Mahith Madhanakumar

in the Department of Physics

U.N.B., Fredericton, N.B.

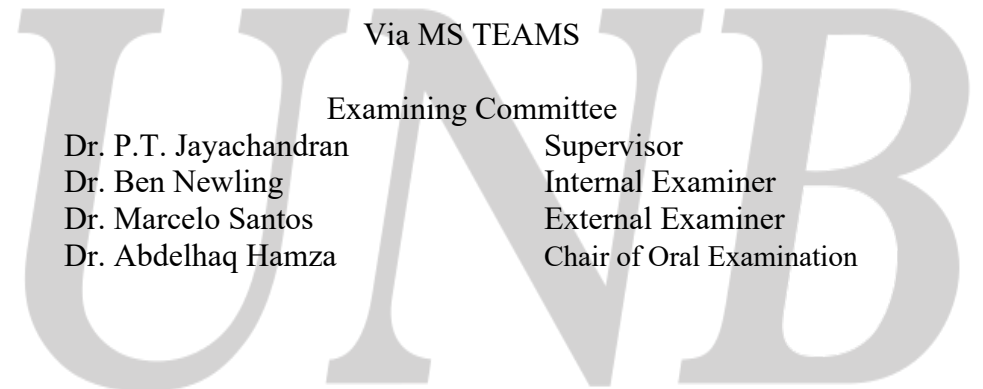
**Monday, August 23rd, 2021
2:30 p.m.**

Via MS TEAMS

Examining Committee

Dr. P.T. Jayachandran
Dr. Ben Newling
Dr. Marcelo Santos
Dr. Abdelhaq Hamza

Supervisor
Internal Examiner
External Examiner
Chair of Oral Examination



Abstract

A detailed investigation on the dependence of amplitude and phase scintillation indices on the Magnetic Field Aligned Angle (MFAA) is conducted using six years of data from ten stations of the Canadian High Arctic Network (CHAIN) distributed along a wide range of geographical latitudes ranging between 56.65° – 73.004° , making the study the first of its kind to look into the geometrical dependence of scintillation from a statistical point of view. The results indicate that both the scintillation indices show a gradual increase when the MFAA approaches zero. This happens when the satellite link is parallel to the magnetic field line vector and indicates the presence of field aligned irregularities which are elongated along the field vector. Comparison to previous studies on this subject were also conducted and is shown to contradict what other studies had previously found on the nature of dependence of scintillation indices with elevation and azimuth angles of the satellite. It is shown that the scintillation producing irregularities are field aligned, i.e. elongated in the direction of the magnetic field and

not perpendicular to the field as some previous studies had concluded. It is also observed that the higher variations of σ_{ϕ} as compared to the S_4 index with the propagation geometry of GPS satellites is nothing but a refractive artifact introduced due to the improper detrending of the carrier phase. It is shown that σ_{ϕ} never exceeds S_4 if one properly detrend the phase of the signal by taking into account the dynamic nature of the Fresnel frequency at high latitudes.