SCIENCES & BIOENGINEERING SCIENCES

The Research Group
High Energy Physics

has the honor to invite you to the public defence of the PhD thesis of

Jethro Stoffels

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

Commissioning and First Data Analysis of the Radio Neutrino Observatory in Greenland (RNO-G)

Supervisors:
Prof. dr. Krijn de Vries (VUB)
Prof. dr. Nick van Eijndhoven (VUB)

The defence will take place on
Tuesday, September 22, 2026 at 4 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene,
In auditorium D.2.01

The defence can be followed through a live stream: N/A

Members of the jury

Prof. dr. Stijn Buitink (VUB, chair)
Prof. dr. Steven Lowette (VUB)
Prof. dr. Charlotte van Hulse (VUB)
Prof. dr. Dominique Maes (VUB)
Dr. Katharine Mulrey (Radboud Universiteit Nijmegen, NL)
Prof. dr. Christian Glaser (Technische Universität Dortmund, DE)

Curriculum vitae

Jethro Stoffels obtained the degree of master in Physics and astronomy in 2022 with a thesis about RNO-G. After this, he continued his research as a PhD candidate and performed initial data analysis, focusing on calibrating the surface antennas of the detector using Galactic radio emission. Furthermore, a semi analytical model to calculate the radio emission of secondary in-ice cascades was explored. He also fulfilled teaching duties for the “Introduction to astrophysics” and “Radio astronomy” courses.

Abstract of the PhD research

The research discipline of particle astrophysics is a rather novel and rapidly evolving one, full of unsolved cosmic mysteries in the grand scheme of scientific progress. One of these longstanding problems concerns the sources and physical processes involved in the production of cosmic rays. There exists a myriad of types of cosmic particles with different experiments dedicated specifically to each major group. One such subclass, and the main focus of this work, consists of the neutrinos. Neutrino astronomy was pioneered by the IceCube Neutrino Observatory at the South Pole in 2013 with the first measurement of a high-energy astrophysical neutrino flux, at TeV-PeV energies, but experimentally observed a sharply declining population of neutrinos at higher particle energies. To combat this extremely low neutrino flux, exponentially larger detection volumes using more cost-efficient equipment are required. One experiment that explores such an alternative is the Radio Neutrino Observatory in Greenland (RNO-G), located on top of the Greenland ice sheet. RNO-G uses the kilometer scale radio attenuation length to target the neutrino flux above 100 PeV and push forward into the terra incognita of the neutrino flux landscape. The work represented in this thesis is twofold. On the data driven side, it explores the use of the Galactic radio signal in the detector commissioning process and to also perform orientation calibration of the surface LPDA antennas of the detector, exploiting the strong directionality of these antennas. To this end, transit curves are constructed from data and subsequently compared to transit curves generated from simulation for differing antenna orientations. On the signal simulation side, an alternative to full Monte-Carlo simulations of cosmic-ray particle cascades initiated in the atmosphere and their propagation into the glacial ice is explored. This method replaces the computationally intensive in-ice component of the full simulation by a fully analytical solution to calculate the shower profile and resulting charge excess from the particle footprint at the surface. This is subsequently combined with a semi-analytical model for generating the resulting radio signal.