

PITHIA-NRF TNA Success story: PRISMATIC (Can Polarisation Measurements of Auroral emissions Trace the Ionospheric Currents)

A group of researchers at the Royal Belgian Institute for Space Aeronomy (BIRA-IASB) led by Hervé Lamy developed an imaging polarimeter called PLIP (Polar Lights Imaging Polarimeter). It measures the linear polarisation (Degree of Linear Polarisation (DoLP) and the Angle of Linear Polarisation (AoLP)) of the three main auroral emissions (green, red and blue) on a large field of view on the sky. With this instrument, one goal is to check if there is a link between the AoLP of the auroral emission lines and the directions of field-aligned and/or ionospheric currents.

To achieve this objective, the BIRA-IASB team requested complementary observations to compute a 2-D reconstruction of field-aligned electron fluxes. This was possible using data from the ALIS_4D optical network and the measurements from the UHF antenna of EISCAT in Tromsø, Norway.

Thanks to the TNA of PITHIA-NRF, they obtained 8 hours of observations with EISCAT during a 10-day observation campaign with PLIP located at the Skibotn Observatory in Norway in November 2022. During this campaign, they received support from the EISCAT team who operated the necessary measurements with their infrastructure.

PLIP data are still being analysed, but the authors found an interesting case: a strong decrease of DOLP and a clear rotation of AOLP occurs during the main phase of a geomagnetic storm clearly identified by ground-based magnetometer data from Tromsø and UHF radar data from EISCAT. These observations tend to favour a scattering by electrons (possibly in the geomagnetic currents) as the source of polarization. Additional work must be done to confirm these results and see if AoLP of auroral emission lines can become a tracer of ionospheric currents and would have therefore a strong impact on space weather modelling and predictions. The results of this PITHIA-NRF TNA were also presented at the EGU and IUGG conferences:

- <https://meetingorganizer.copernicus.org/EGU23/EGU23-12835.html>
- https://c-in.flog.live/event/iugg2023berlin/daily_program_iaga?objectClass=timeslot&objectId=649483f764c73802ac74bf5b&type=detail



Left picture: PLIP instrument is visible on the right of the astronomical mount. It is made of 4 identical commercial sensitive cameras equipped with narrow interference filters and fixed polarizing filters at four different orientations.

Right picture: A part of the team with the PLIP instrument during the mission with from left to right, Jean Lilensten (Institut de Planétologie et d'Astrophysique de Grenoble), Gaël Cessateur, Hervé Lamy and Léo Bosse (BIRA-IASB).

