Międzynarodowa Środowiskowa Szkoła Doktorska
przy Centrum Studiów Polarnych
w Uniwersytecie Śląskim w Katowicach

ul. Będzińska 60
41-200 Sosnowiec
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Title of PhD project: Analysis of the occurrence of the Alfvén ionospheric resonance in ground-based magnetic observations in connection with thunderstorm activity

Providing institute: Institute of Geophysics Polish Academy of Sciences

Requirements:

- Master's degree in Physics, Geophysics, Geography with the background in meteorology and climatology, in Electrical engineering or a related field
- Efficient use of mathematics e.g. for basic statistical analysis and for elementary vector analysis
- Some programming skills in order to visualize and analyse data collected in time series
- Proficiency in English sufficient to effective self-study from scientific literature, to communicate and write research publications
- Ability to work independently and in a team
- Scientific curiosity and commitment to research

Additional assets:

- Knowledge of methods of spectral analysis
- Knowledge of data sources on thunderstorm activity and lightning discharges
- Interdisciplinary research interests within Physics and Earth sciences

Description of the tasks:

- Processing of data from magnetic measurements conducted at ground stations
- Searching and processing existing meteorological datasets or data from lightning detection networks indicating thunderstorm and lightning activity in the region
- Developing advanced methods for analysis of these data and the potential relationship of studied phenomena
- Expanding knowledge in the field of conducted research through literature studies and participation in scientific meetings and workshops
- Preparing progress reports and the doctoral dissertation
- Participating in scientific cooperation at national and international level
- Presenting research results at national and international conferences
- Writing scientific papers
- Assistance in the tasks of the Department and the Institute, e.g. educational or didactic activity

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Summary of the doctoral project:

Thunderstorm or lightning activity is assumed to be one of the generators for the ionospheric Alfvén resosnance (IAR) occurring at middle latitudes in favourable ionospheric conditions. The signatures of IAR can be observed in ground-level magnetic field measured in the ultra and extremely low frequency (ULF/ELF) range. Preliminary data analysis confirmed IAR signatures in the magnetic field in Poland measured at the IGF PAS Suwałki station and the Hylaty station of the Jagiellonian University. This doctoral projects aims to investigate the assumed relationship between the source (thunderstorm/lightining) and effects (IAR) in greater detail on the example of IAR events discovered in the magnetic measurements from the Institute's stations and available meteorological and lightning detection network data indicating regional thunderstorm and lightning activity. The connection between the IAR events and the thunderstorm activity will be investigated in terms of correlation in time, the distance and direction from the source, as well as the intensity of the source, in order to determine the most important parameters that impact the generation of IAR at middle latitudes.

Other information:

The work will be carried out under the supervision of:
dr hab. Anna Odzimek, aodzimek@igf.edu.pl, Institute of Geophysics Polish Academy of Sciences
dr hab. Anne Neska, anne@igf.edu.pl, Institute of Geophysics Polish Academy of Sciences

28.04.2025 Anne Odzimek
28.04.2025 Anne Neska