

PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DEMR-2024-13**

(à rappeler dans toute correspondance)

Lieu : Toulouse

Département/Dir./Serv. : DEMR/PER

Tél. : 05.62.25.26.98 / 05.62.25.27.30

Responsable(s) du stage : X. Baumann, V. Fabbro

Email : xavier.baumann@onera.fr
vincent.fabbro@onera.fr

DESCRIPTION DU STAGE

Thématique(s) : PRORAD

Type de stage : Fin d'études bac+5 Master 2 Bac+2 à bac+4 Autres**Intitulé : Study of Solar and Space Weather Conditions impact on Ionosphere**

Sujet : Solar activity and space weather exert a profound influence on the ionosphere, the ionized upper layer of Earth's atmosphere. This, in turn, significantly affects radio frequency systems, especially within the HF band (3-30 MHz). To monitor the ionosphere state, an international network of radar sounding systems (or ionosondes), known as GIRO, has been established (<https://giro.uml.edu/>). The data from this network, which is available online, when combined, provides a spatio-temporal representation of the ionospheric layer. These large-scale measurements, in addition to GNSS measurements, make it possible to develop near-real-time maps of the integrated electron content (or TEC) and of the plasma frequency of the ionosphere.

On the other hand, the space weather community gives access to a whole series of satellite and ground measurements of the sun state and of the solar wind propagated between the sun and the Earth. For instance, the feature parameters that makes it possible the prediction of the ionosphere state can be extracted from the five-minute resolution HRO (High Resolution Omni) dataset provided by the National Aeronautics and Space Administration (NASA)'s Space Physics Data Facility available since 1995. (<https://spdf.gsfc.nasa.gov/>).

The work proposed in this internship aims at the study of the sensitivity of ionosphere radio-sounding measurements to solar and space weather conditions. The objective is twofold: first, to improve the understanding of the phenomena involved; second to make a prediction of the ionospheric state at various temporal horizons.

To carry out the correlation and prediction studies between space weather conditions and ionosphere, the candidate will have access to large databases and will use traditional correlation approaches such as methods based on deep learning. A characterization with occurrence statistics of events will be sought.

Throughout this internship, the candidate will acquire knowledge in different domains such as the ionosphere layer, electromagnetic wave propagation through the ionosphere, space weather, statistical analysis and machine learning algorithms.

Est-il possible d'envisager un travail en binôme ? **Non****Méthodes à mettre en oeuvre :**

- | | |
|---|--|
| <input type="checkbox"/> Recherche théorique | <input type="checkbox"/> Travail de synthèse |
| <input checked="" type="checkbox"/> Recherche appliquée | <input checked="" type="checkbox"/> Travail de documentation |
| <input type="checkbox"/> Recherche expérimentale | <input type="checkbox"/> Participation à une réalisation |

Possibilité de prolongation en thèse : **Oui**

Durée du stage : Minimum : 4

Maximum : 6

Période souhaitée : janvier-juin 2023

PROFIL DU STAGIAIRE

Connaissances et niveau requis :

signal processing, electromagnetism,
mathematics, deep learning

Ecoles ou établissements souhaités :

Master 2 or engineer school