Probabilistic Radiation Belt Modelling

Code: 21/57

Company: British Antarctic Survey

Location: Cambridge

Company Description: Institute of the Natural Environment Research Council

Project Description:

The Earth is surrounded by regions of changed particles, known as the radiation belts. Satellites reside or traverse through these belts and can be damaged by the particles, leading to anomalous behaviour and outages. Predicting the radiation environment is therefore imperative for protecting the satellites. The project aim is prototyping a probabilistic radiation belt model based on the BAS radiation belt model which currently gives a 'most likely' prediction.

The applicant will develop a probabilistic electron radiation belt model using the Kalman Filter technique that is widely used in meteorology but has only recently been applied to radiation belt physics. The method allows for the uncertainty in the system to be included to give a prediction and an associated probability.

Electrons in the radiation belts are lost via interactions with magnetospheric waves, collisions with the Earth's atmosphere and at the outer edge. Ultra-low frequency waves diffuse the particles towards and away from the Earth. The applicant will write a 1D diffusion model that captures the radial transport with the losses included as sink terms. There is a great deal of uncertainty in radial diffusion and the loss processes. The candidate will estimate the uncertainty based on existing analytic and empirical models. The candidate will develop the Kalman Filter model around the 1D diffusion model incorporating the uncertainty in the diffusion and losses processes. The results of the model will be compared against satellite observations.

The applicant will be working closely with members of the Space Weather and Atmospheres Team at BAS. The applicate will develop the code in Python and manage the version control using Git.

Applicant Specification:

The applicant either has attained, or is in the process of attaining an undergraduate degree in one of the following or closely related areas: Physics; Engineering; Mathematics.

Minimum Requirements:

High attention to detail and ability to work well with a team. The applicant must have experience writing code in Python or a closely related language.

Preferred Additional Requirements:

Knowledge of finite difference methods and working knowledge of C or Fortran.

Further details:

8 weeks minimum fixed term contract to be agreed with successful candidate. Virtual Induction Event to be held on 21 June 2021. Ideally to complete before the start of the next academic year. Salary is £1,336.50 per calendar month gross.

Closing Date for Applications: 5pm Monday 14 June 2021

Applications should be made through the online form on the Satellite Applications Catapult website before the closing date.

https://sa.catapult.org.uk/work-with-us/space-placements-industry-spin/

Please note that elements of the form left incomplete will be deemed to render the application ineligible. They will be checked for eligibility and forwarded to the employer. Email applications made to the Satellite Applications Catapult, UK Space Agency, or host organisations will not be processed.