Opportunity Title: Artificial Intelligence modelling of Europa's Space Environment and Ionosphere
Opportunity Reference Code: 0267-NPP-NOV25-JPL-PlanetSci

Organization National Aeronautics and Space Administration (NASA)

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How to Apply All applications must be submitted in Zintellect

Please visit the NASA Postdoctoral Program website for application instructions and requirements: How to Apply | NASA Postdoctoral Program (orau.org)

A complete application to the NASA Postdoctoral Program includes:

1. Research proposal
2. Three letters of recommendation
3. Official doctoral transcript documents

Application Deadline 11/1/2025 6:00:59 PM Eastern Time Zone

Description **About the NASA Postdoctoral Program**

The NASA Postdoctoral Program (NPP) offers unique research opportunities to highly-talented scientists to engage in ongoing NASA research projects at a NASA Center, NASA Headquarters, or at a NASA-affiliated research institute. These one- to three-year fellowships are competitive and are designed to advance NASA's missions in space science, Earth science, aeronautics, space operations, exploration systems, and astrobiology.

Description:

Jupiter's moon Europa is a prime candidate in the search for life beyond Earth. NASA's Europa Clipper mission aims to investigate the habitability of this icy world with a suite of 10 science instruments when it arrives at the moon in the early 2030's. Of particular interest is the characterization of Europa's subsurface ocean by using its magnetic induction response measured by the Europa Clipper Magnetometer [1]. The largest source of noise in this measurement is by far the obscuring interaction field created by the interaction of Jupiter's corotating magnetospheric plasma with Europa's atmosphere and therefore need to be accounted for [2]. These fields are typically simulated with Magnetohydrodynamic Modelling (MHD); however, these simulations require significant computation time (e.g. supercomputers) and are therefore extremely resource intensive.

The aim of this project is to use advanced Artificial Intelligence (AI) techniques, trained on outputs from already developed MHD simulations, to emulate the space environment and ionosphere of Europa and other moons in the solar system [3]. By doing so, we will be able to approximate the functionality of dedicated MHD simulations using parameterized models at a fraction of the computing cost. This will be extremely useful to generate simulations on the fly, thus enabling Monte Carlo error analyses where the plasma parameter space is not entirely certain [4]. These simulations will be very valuable for determining how well the induction response from

ocean worlds can be extracted in the presence of plasma interactions at Europa and other icy worlds in the solar system in which NASA intends to visit. Additionally, we hope to incorporate existing physical models, such as magnetospheric particle bombardment, into the AI models, thus enhancing their applicability. The project will utilize in-situ data from Voyager, Galileo, and Juno, in preparation for the upcoming Europa Clipper and JUICE missions. Not only will this work have a significant impact on the ability to model the space environment at the Jovian moons, but could also be adapted to the large moons of Uranus and Neptune where the space environment is essentially unknown, thus providing use for potential future Discovery and Flagship missions to those environments.

The postdoctoral fellow will work with Dr. Corey Cochrane to build the AI models, couple them with the existing physical models, analyze results and disseminate findings to the relevant communities. The fellow will collaborate with members of the Europa Clipper Science Team to apply the AI models in preparation for Clipper's arrival at Europa.

1. Kivelson, M.G., Jia, X., Lee, K.A. et al. The Europa Clipper Magnetometer. Space Sci Rev 219, 48 (2023). https://doi.org/10.1007/s11214-023-00989-5 2. Westlake, J.H., McNutt, R.L., Grey, M. et al. The Plasma Instrument for Magnetic Sounding (PIMS) on the Europa Clipper Mission. Space Sci Rev 219, 62 (2023). https://doi.org/10.1007/s11214-023-01002-9 3. Kataoka, R., Nakano, S. & Fujita, S. Machine learning emulator for physics-based prediction of ionospheric potential response to solar wind variations. Earth Planets Space 75, 139 (2023). https://doi.org/10.1186/s40623-023-01896-3 4. Cochrane, C. J. et al. Single- and multi-pass magnetometric subsurface ocean detection and characterization in icy worlds using principal component analysis (PCA): application to Triton. Earth Space Sci. 9, e2021EA002034 (2022).

Field of Science:

- Planetary Science

Advisors:

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Applications with citizens from Designated Countries will not be accepted at this time, unless they are Legal Permanent Residents of the United States. A complete list of Designated Countries can be found

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at: https://www.nasa.gov/oiir/export-control.

Eligibility is currently open to:

- U.S. Citizens;
- U.S. Lawful Permanent Residents (LPR);
- Foreign Nationals eligible for an Exchange Visitor J-1 visa status; and,
- Applicants for LPR, asylees, or refugees in the U.S. at the time of application with 1) a valid EAD card and 2) I-485 or I-589 forms in pending status

Questions about this opportunity? Please email npp@orau.org

Point of Contact Mikeala

Eligibility Requirements

- **Degree:** Doctoral Degree.