ADVERTISEMENT

INSTITUTION: Institute of Geophysics, Polish Academy of Sciences

CITY: Warsaw

POSITION: Assistant Professor (Post-doc) at the Department of Magnetism.

SCIENTIFIC DISCIPLINE: Earth sciences, Physics, Applied Mathematics

NOTICE DATE: 01.03.2024.

DEADLINE FOR SUBMISSION OF BIDS: 31.03.2024

WEBSITE LINK: https://www.igf.edu.pl/kariera.php

KEY WORDS: Geomagnetic field, geomagnetic reversals/excursions, hydromagnetic dynamo, induction equation, Navier-Stokes equation, magnetohydrodynamics, non-equilibrium turbulence.

DESCRIPTION: The candidate will join the group carrying out the NCN OPUS project UMO-2023/49/B/ST10/03412 entitled 'Geodynamo from non-equilibrium turbulent wave field'.

Job Description.

Application of the fully three-dimensional open-source code Dedalus 3 for solving the hydro-magnetic dynamo problem under the anelastic approximation in spherical geometry, including the effects of differential rotation, gravity and density stratification, with different types of thermal boundary conditions; highly demanding numerical simulations with very high resolution in 3D; numerical modeling of theoretically obtained, reduced mean field equations within the scope of the renormalization approach.

Title of the NCN project

OPUS project UMO-2023/49/B/ST10/03412 entitled 'Geodynamo from non-equilibrium turbulent wave field'.

Requirements

1. Doctoral degree in physics, mathematics or engineering.
2. Programming skills, in particular knowledge of numerical methods used for solving partial differential equations.
3. Experience in numerical simulations and solving PDE's with numerical methods documented by at least one publication.
4. Good knowledge of electromagnetism and fluid dynamics.
5. Good knowledge of English.

* In accordance with NCN requirements, only a person who has obtained a doctoral degree from an entity other than the one where the position is planned to be filled no earlier than 7 years prior to the year of employment in the project may be accepted for a post-doc position. This period may be extended by the time of being on long-term (more than 90 days) documented sickness benefits or

rehabilitation benefits due to incapacity for work during this period. In addition, the number of months spent on leave for the care and upbringing of children granted under the terms of the Labor Code may be added to this period, and in the case of women - 18 months for each child born or adopted.

In addition, in accordance with the requirements of NCN, an employed person shall not, during the period of drawing this remuneration, draw other remuneration from funds granted as direct costs from research projects financed under NCN competitions, and shall not, during the period of drawing this remuneration, draw remuneration from another employer under an employment contract, including from an employer based outside the territory of Poland.

Conditions of employment:

1. the amount of employment funds is 11 667 PLN gross/month.
2. stage dimension: full time
3. period of employment – 42 months
4. employment is planned from 01.07.2024
5. In accordance with the terms and conditions of NCN, during the period of employment, the post-doc may not receive any other remuneration in any form from NCN funds and remuneration from any other employer under an employment contract, including an employer based outside the territory of Poland.

Additional information

The project is financed within the framework of the NCN OPUS project No. UMO-2023/49/B/ST10/03412, entitled ‘Geodynamo from non-equilibrium turbulent wave field’.

It is well known that a field of random waves in a fluid of non-zero resistivity is capable of exciting a large-scale magnetic field through creation of an electromotive force which leads to exponential growth of magnetic energy until the growing Lorentz force reacts back upon the wave field, leading to a saturated state. It is generally found that in the limit of vanishing resistivity of the fluid the fast-dynamos with finite growth rate have a pathological structure, non-differentiable wherever they are non-zero; the applicability of fast-dynamo theory to natural physical systems is then questionable.

The aim of this project is to relax standard simplifying assumptions of stationarity and homogeneity of turbulence and apply recently identified by the PI fast-dynamo mechanisms to the geodynamo theory. These mechanisms are fully dynamic, i.e. incorporate the effect of the Lorentz force on the flow (hitherto scarcely considered in theoretical approaches), for which the growing magnetic field remains smooth during the whole dynamo process. This results from a random superposition of distinct waves, such as the so-called MAC (Magnetic-Archimedean-Coriolis) and Rossby waves known to be dynamically very important in the Earth's core, and from co-existence of the kinetic and cross-helicities in developed non-equilibrium turbulence. Particularly effective is the wave-beating effect or non-stationarity of the turbulence wave field, which leads to very fast amplification of the mean magnetic field. Such mechanisms not only efficiently amplify the magnetic field, but also lead to slow time dependence of the large scale electromotive force and turbulent magnetic diffusivity and through that provide an interesting and potentially promising explanation of the well-known

dynamical process of geomagnetic excursions/reversals. The results of the project can therefore provide highly desired picture of a turbulent process, which could be responsible for the observed long-term behaviour of the geomagnetic field.

The theory is based on nonlinear analysis of the Navier-Stokes and electromagnetic induction equations, under some simplifying assumptions e.g. regarding the statistical properties of turbulent stirring or stochastic evolution of velocity streamlines. Sophisticated methods are necessary, such as renormalization and path integrals, weakly nonlinear and asymptotic approaches, supplied by numerical modelling of magnetohydrodynamic turbulence.

The work will be carried out under the supervision of:

Dr hab. Krzysztof Mizerski

Emal: kamiz@igf.edu.pl

Institute of Geophysics, Polish Academy of Sciences

Ksiecia Janusza 64, 01-452 Warsaw, Poland

Required documents:

- cover letter
- a scan or photocopy of a university degree
- a scan or a photocopy of the diploma of the Ph.D. degree
- a resumé with particular reference to information on numerical modelling of partial differential equations and research in fluid mechanics
- information on scientific achievements (including a list of publications), awards and scientific internships
- electronic versions of the two most important publications (or typescripts of unpublished works) that the candidate considers representative of his/her scientific achievements
- other relevant documents (at the candidate's discretion)

Applications for the Competition should be sent by 31.03.2024 to: kariera@igf.edu.pl with the subject of the message stating: "OPUS G74 Assistant Professor".

Selected candidates may be invited for an interview via electronic means of audio and video communication.

The Institute of Geophysics PAS reserves the right to close the competition without selecting a candidate.

For additional information, please contact:

Dr. hab. Krzysztof Mizerski, Institute of Geophysics PAS,

Księcia Janusza 64, phone: +48 22 6915904

e-mail: kamiz@igf.edu.pl

Please include the following clause in your documents:

I consent to the processing of my personal data by the Institute of Geophysics Polish Academy of Sciences Księcia Janusza 64, 01-452 Warsaw, for recruitment purposes. Personal data will be processed on the basis of Article 6(1)(a) of the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation on data protection OJ. EU.L.2016.119.1 of May 4, 2016). At the same time, I consent to the processing of my personal data for future recruitment.