

# JOB VACANCY ANNOUNCEMENT

## VAC-2024-53 – Inverse problems for deep geothermal energy forecasting: adaptive Markov chain Monte Carlo strategies (FPI 2023)

**Number of places:** 1

**Category:** PhD Student

**Workplace:** Barcelona, Campus Nord UPC

**Salary (gross):** 19.479,01 €<sup>1</sup>

**Weekly working hours:** 40h/week

**Contract type:** PhD

**Duration:** 4 years

**Planned start date:** February 1st 2025 as maximum<sup>2</sup>

### Functions to be developed:

A doctoral thesis in the framework of the research project entitled DeepGeo - Computational Engineering Supporting Future Clean Energy via Deep Geothermal Prospection, with reference PID2023-153082OB-I00. Principal investigators: Prof. Sergio Zlontik and Prof. Pedro Díez Mejía.

During the last 20 years the Solid Earth community pursues massive data-driven simulations and joint inversions for the physical state of the Earth's interior. In this thesis we want to explore model reduction techniques that seek low-dimensional representations of parameters. The goal is producing an adaptive parameterisation effectively reducing the number of parameters to be identified.

Tasks to be performed:

- Get familiar with the methods for deep geothermal forecasting, lithospheric structure and probabilistic inversions.
- Get familiar with lithospheric dynamics including thermal, mechanical, rheological behaviors; Bayesian methods, in particular Markov chain Metropolis-Hastings.

<sup>1</sup> The first annual salary is 19.479,01 € and the second, third and fourth annual salary will be 24.348,77 €.

<sup>2</sup> This date is subject to the adjustment of the final concession resolution.

- Understand model order reduction techniques and to integrate them within a Bayesian solver.
- Understand Reduced Basis; uncertainty quantification and error assessment; adaptive strategies (e.g. active subspaces);
- Propose a methodology to accelerate the probabilistic inversion algorithm and facilitate efficient sampling in the reduced parameter space. The result will be a tractable procedure for the solution of statistical inverse problems involving partial differential equations with high-dimensional parametric input spaces.

Additional information about the project is available at: CIMNE RTD Project: [DeepGeo](#)

The candidate will join the research group of Credible data-driven Models: Credible High Fidelity and Data Driven Models

This contract is financed by the announcement of Proyectos de Generación de Conocimiento 2023 of the Ministerio de Ciencia, Innovación y universidades: Proyectos de Generación de conocimiento 2023| Agencia Estatal de Investigación (aei.gob.es)

#### Required skills:

- The candidate must have a Master's degree (or equivalent) in Aeronautical, Civil, Industrial, or Mechanical Engineering, applied sciences or mathematics.; and to be in disposition to be enrolled in a PhD programme in the moment of the contract's formalitiation.
- Good written and oral communication skills in English.
- Good knowledge of numerical methods for the approximation of partial differential equations (in particular, the finite element method).
- Advanced programming skills (such as Python, Matlab, ...).
- Hard-working and enthusiastic attitude towards research and innovation.

#### Other valued skills (not mandatory):

- Knowledge of machine learning, reduced-order models, computational solid and structural mechanics and dynamics is not compulsory but will be considered an advantage.

#### Qualification system:

The evaluation process must comply with the following criteria and sub-criteria:

1. Academic and/or scientific-technical background of the candidate (up to 50 points).
  - Scientific-technical contributions (up to 45 points). The candidate's academic record and other curricular merits will be evaluated, as well as their suitability to the tasks to be performed based on the candidate's training and professional experience.

- Mobility and internationalization (up to 5 points). The relevance and impact of the candidate's stays in national and international centers and/or in the industrial sector on his/her research career will be assessed, taking into account the prestige of the entity receiving the stay and the activity carried out therein.
2. Criterion 2. Adequacy of the candidate to the research activities to be developed (up to 50 points). The suitability of the person to the program, project or research activities to be carried out will be assessed according to his/her previous training and experience. For this purpose, the added value that the completion of the project will represent for his/her research career will be taken into account, as well as the value contributed to the center and to the receiving team.

Candidates must complete the "*Application Form*" form on our website, indicating the reference of the vacancy and attaching the required documents.

The deadline for registration to the offer ends on November 22<sup>nd</sup>, 2024 at 12 noon.

The preselected candidates may be requested to send the documentation required in the "Requirements" and "Merits" sections, duly scanned, and may be called to go through selection tests (which might be of eliminatory nature) and / or personal interviews.

### **Commitment to inclusivity:**

At CIMNE, we champion workplace equity, diversity, and inclusion. We're committed to fostering a culture where everyone can thrive, leveraging diverse talents and backgrounds. We welcome all applicants regardless of color, religion, gender, origin, abilities, gender identity, sexual orientation, pregnancy or any other characteristic. Join us in building a community that values, celebrates, and respects every individual.

### **HR Excellence in Research:**

CIMNE welcomes and supports the principles of European Commission's *European Charter for Researchers* and the *Code of Conduct for the Recruitment of Researchers*, embracing a transparent, attractive, and open labour market in research. The centre's Human Resources Strategy for Researchers (HRS4R) includes an action plan with actionable short and long-term actions to support a high-quality working environment for all. Further information can be found [here](#).

(\*It is mandatory to provide the CV in the official form of the Spanish Ministry, which can be downloaded from the following link: <https://www.cimne.com/cvdata/cntr2/spc2/dtos/mdia/People/CV-abreujat.pdf>)

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