Chair in biogeochemical sensors and advanced signal processing for environmental sensing

For more information:
http://www.andra.fr/international/
http://www.otelo.univ-lorraine.fr/

Deadline for project submission:
31/08/2013

Frédéric VILLIÉRAS
Christian MUSTIN
Patrick LEBON
A) General Framework / Actors

This industrial research Chair is based on a scientific partnership between the National Radioactive Waste Management Agency (Andra) and the University of Lorraine in the framework of the LABEX RESSOURCES21 Priority Research Action-PRA n°6 the objective of which is to develop new sensors for field experiments that permit analysis of the response of ecosystems to anthropogenic perturbations, acquisition of observational data and development of the theoretical tools needed to treat the large data flux generated by an operational observation system.

The National Radioactive Waste Management Agency (Andra)

Established by the December 1991 Waste Act, the Andra is the public body in charge of the long-term management of all radioactive waste and is under the supervision of the Ministry of Ecology, Energy, Sustainable Development and the Sea and the Ministry of Research. Its three basic missions are:

- **a R&D mission** to propose safe definitive solutions for the radioactive waste categories not covered by current disposal facilities; in particular long-term deep geological storage for high and intermediate level, long half-life wastes;
- **an industrial mission** concerning, on one hand, waste acceptance criteria and control and, on the other hand, siting, construction, operation, closure and monitoring of repositories. This mission also includes a public service mission dedicated to (1) collection of waste produced by “small-scale nuclear activities” and (2) clean-up and rehabilitation of orphan polluted sites;
- **an information mission**, notably through the regular updating and publication of the National Inventory of radioactive materials and waste. This mission includes as well an active policy of dialogue with stakeholders both at national and local levels.

LABEX RESSOURCES21

The LABEX RESSOURCES21 was selected by the French Ministry of Research and Education in the framework of the "Laboratoires d'Excellence" initiative. RESSOURCES21 proposes an integrated scientific and educational approach to the understanding, exploitation and environmental management of strategic metal resources for the 21th century. It is supported by 4 research laboratories of OTELo and the teaching departments in Geoscience and Environment of the University of Lorraine.

The Lorraine Earth and Environment Observatory (Observatoire Terre et Environnement de Lorraine; OTELo)

OTELo is an Observatory of Sciences of the Universe (OSU) CNRS-University of Lorraine established in 2010. OTELo is also the scientific pole of the University of Lorraine gathering research units in Earth Sciences in a broad sense around issues such as the dynamics of the Earth, the chemistry of the Earth's mineral and energy resources, the cycle of resources and waste disposal in deep geological environment, hydro, land soil and sub-soil, environmental management of land resources, water, ecotoxicology and biodiversity. As an Observatory of Sciences of the Universe, OTELo’s mission is to contribute to the advancement of knowledge through:

- acquisition of observational data
- the development and operation of means of observation : experimental and monitoring infrastructures as GISFI (French Scientific Interest Group - Industrial & Wasteland soils), Long-term environmental research monitoring and testing system (OPE), testing river system (ZAM), analytical platform
- the development of theoretical tools
  The observatory is also responsible for:
- providing services related to their research
Since January 2013, OTELo brings together four research units and two joint and national services units:

- **CRPG**: Petrographic and Geochemical Research Centre
- **Georesources**: the laboratory results from the combination of staff from laboratories G2R, CRPG, LAEGO and LEM;
- the **LIEC: Interdisciplinary Laboratory of Continental Environments** from the merger of LIEBE, LIMOS and half of the LEM;
- **LSE: Soils and Environment Laboratory**;
- The **Service d’Analyse des Roches et des Minéraux (SARM)** which is the CNRS Analytical Research facility and part of the CRPG
- **Ion probes**

**B) The chair**

The chair is focused primarily on research concerning methods for sustainable observation, experimentation, archiving and data processing in the context of environmental research to be carried out within Andra’s project for deep geological disposal of radioactive waste. Chair activities will therefore be closely linked to a 900 km² national environment observatory in the eastern region of France dedicated to long-term environmental monitoring. The overall objective of the observation system is to furnish a dynamic view of the zone’s ecosystem services and the quality of the functions offered by continental surfaces over the long term (up to a hundred years). The chair aims at increasing the observation system monitoring capacity based on a variety of innovative experimental approaches and a wide range of redundant sensors designed to supply spatially resolved and real-time information about hydric, mechanical, thermal, biological and chemical behaviour of all environmental compartments (soils, sediments, rivers…) in a diversity of ecosystems (forest, prairie…). In many cases, functional rather than analytical information is ultimately desired. In this framework, the development of statistical methods will aim at giving insights into the experimental sensor network design and data interpretation.

The chair will be involved in the work of RESOURCES21 and will reinforce the research competences of OTELo (the Lorraine Earth and Environment Observatory) on environmental issues linked to major innovation and research projects. The chair holder will coordinate, or be tightly associated with, the **SOERE OPE** (the ANDRA Perennial Observatory of the Environment) missions and could, if the person’s experience fits, become the chairman of the Scientific Council.

**C) Position**

**Missions**

The Chair’s scientific and technical programme is associated with the process of achieving project information integration within a regional observatory and to furthering knowledge progress through:

- the acquisition of observation data,
- the development and exploitation of appropriate sensors or through the elaboration of required theoretical tools.

The chair holder will be responsible for:

i. conducting and animating the “Biogeochemical sensors” issue within Otel (the Lorraine Earth and Environment Observatory), being involved in implementing observation missions mainly in association with the SOERE OPE (the ANDRA Perennial Observatory of the Environment) at the site of Meuse/Haute-Marne.
ii. developing scientific research aiming at qualifying mineral, organic or biological agents which can be a point of departure for environmental sensors (due to their sensitivity to various physical-chemical local variations). It will focus on considering integration conditions of those agents in measuring instruments that must show some characteristics such as: ready integration within studied systems, non-invasive (do not impact the functioning of the system), stable and long operating life.

iii. animating a research topic on the development of innovative physical-chemical, optical and electrochemical methods to obtain functional information on subsurface environments (i.e. information about the effect of a disturbance on ecosystem health). Possible perspectives are: application of microsensor technologies and signal/data processing routines to environmental diagnostics and monitoring (benchmarking)*, validation of measurement devices or systems in which a biological, organic and mineral component will be used as the recognition element, development (with industrial partners if necessary) of new scalable and non-invasive environmental sensors or sensor networks, hard sensors, remote sensing and teledetection.

iv. participating in training programs provided by the University of Lorraine on a basis of 64 hours/year (Master degree, engineering school and PhD). Teaching subjects should be linked to observation topics and environmental data acquisition or signal processing.

Workplace:
Observatoire Terre et Environnement de Lorraine (OTERLO), Université de Lorraine - CNRS
Vandœuvre-lès-Nancy (France)

Duration: 5 years

D) Eligibility criteria

- Applicants must hold a PhD (or equivalent) as at the date of application (i.e. dissertation successfully defended).
- The candidate must justify recognised skills in the field of Biogeochemistry (environmental physicochemistry, physics of condensed environment, mineralogy and/or biology) and/or of environmental sensing and signal processing (optical and electrochemical measurements, spectrometry, multi-functional sensors, micro-fluidics, multivariate statistical signal processing, chemometrics ...)
- Applicants must be fluent in one of the working languages of the host laboratories; fluency in French or English.

E) Eligible Costs and available means

- Salary for the invited researcher: between 3000 € and 4000 € net/month (The remuneration will depend on qualifications and experiences of the chair holder)
- Professional travel expenses (national or international)
- PhD grant at the start of the chair and/or credits for experimental programme
- Access to technical and scientific means of OTERLO
- Expenses of documentation and publicationPublication expenses

F) Application procedure

Applications are to be sent per mail to Application@biogeochemicalsensorschair Each file must include:

1. the information sheet (appendix)
2. a curriculum vitae
3. a cover letter
4. a list of publications
5. A detailed research project proposal in English or in French: describe the program in detail (5 to 10 pages) including objectives, context, methodology, and calendar of actions.
6. An estimation of necessary technical and human means

G) Monitoring Committee and contact details:

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<tr>
<th>Name</th>
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<td><a href="mailto:andre.mariotti@upmc.fr">andre.mariotti@upmc.fr</a></td>
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H) Evaluation and selection process

Selection criteria (Incomplete or late applications will not be accepted):

1. Experience and quality of the candidate: demonstrate that you distinguish yourself as a world-class researcher or as a leader in your field
2. Quality of the project / Research programme proposal
3. Complementary skills and competences in metrology, programming and data processing system will be appreciated

Criteria to take into consideration:
- Only one project will be selected among the applications
- A permanent position as a(n associate) professor in the university of Lorraine may be open after the chair

Applications/proposals will be reviewed and selected by the monitoring (see G) and steering committee of the chair

- 31/08/2013: Deadline for application
- between the 14th and 18th of October in Paris: Interviews
- beginning of November 2013: communication of results
- Opening of position: January 2014
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