**2018-00573 - POST-DOC IPL FRATRES**

**Contract type:** Public service fixed-term contract  
**Level of qualifications required:** PhD or equivalent  
**Fonction:** Post-Doctoral Research Visit  
**Level of experience:** Recently graduated

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**About the research centre or Inria department**

The Inria Rennes - Bretagne Atlantique Centre is one of Inria's eight centres and has more than thirty research teams. The Inria Center is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative PMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute, etc.

**Context**

Collaboration between 2 Inria teams: MINGuS Team in Rennes and TONUS Team in Strasbourg. Some regular travel between Rennes and Strasbourg. These travels will be in charge to IPL FRATRES.

Controlled nuclear fusion can be considered as an example of grand challenge in many fields of computational sciences from physical modeling, mathematical and numerical analysis to algorithmic and software development and several Inria teams and their partners are developing mathematical and numerical tools in these areas.

The goal of the Inria Project Lab FRATRES is to organize these developments on a collaborative basis in order to overcome the current limitations of today numerical methodologies. The ambition is to prepare the next generation of numerical modeling methodologies able to use in an optimal way the processing capabilities of modern massively parallel architectures.

This objective requires close collaboration between a) applied mathematicians and physicists that develop and study mathematical models of PDE; b) numerical analysts developing approximation schemes; c) specialists of algorithmic proposing solvers and libraries using the many levels of parallelism offered by the modern architecture and d) computer scientists. The project will contribute in close connection with National and European initiatives devoted to nuclear Fusion to the improvement and design of numerical simulation technologies applied to plasma physics and in particular to the ITER project for magnetic confinement fusion.

**Assignment**

The mathematical framework consists the numerical approximation of kinetic equations to describe charged particles systems. The typical model is the Vlasov equation satisfied by the distribution function $f(t, x, v)$ with $t$ the time, $x$, the space and $v$ the velocity variable. The preservation of equilibrium states is of major importance when one wants to approximate numerically the Vlasov equations. Indeed, most of the time, the initial condition is a perturbation of an equilibrium state and in order to validate the code, it is important to quantify the instability rate. If this equilibrium state is badly preserved by the numerical method, the instability rate can be polluted by the lack of preservation.

The main goal is to construct a numerical method able to preserve a family of stationary state of Vlasov type equations, in order to improve the approximation of the solution. In particular, the method will have to be adapted to the method of choice for the numerical approximation of Vlasov equations (semi-Lagrangian methods for instance). The numerical developments will be done within the framework of the library Selalib.

**Main activities**

The concrete outcomes of this project consist in

1- construct a numerical strategy able to preserve a family of stationary state
2- validate the strategy on 1d-1d Vlasov-Poisson equation

3- extend the strategy to more realistic problem (two-species Vlasov-Poisson model, boundary conditions, ...)

**Skills**

**Thème/Domaine :** Schémas et simulations numériques & Sciences de la planète de l'environnement et de l'énergie

**Ville :** Rennes (équipe MINGuS, laboratoire IRMAR) et Strasbourg (équipe TONUS, laboratoire IRMA).

**Centre Inria :** CRI Rennes-Bretagne Atlantique et CRI Nancy Grand Est

**Date de prise de fonction souhaitée :** 01/09/2018

**Durée du contrat :** 12 mois (6 mois à Rennes et 6 mois à Strasbourg)

**Date limite pour postuler :** 30/06/2018.

**Benefits package**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Sports facilities

**Remuneration**

Gross salary : 2653 euros