

**PhD Scholarship at the Observatoire astronomique de Strasbourg  
High-resolution modelling of the Milky Way centre and its  
Black Hole**

**Application deadline: 15 May 2008  
Start date: 1 October 2008 (three-year programme)**

**Project description:**

The PhD candidate will focus his or her research on the issue of discovering the origin of the stellar spatial distribution and kinematics about the Milky Way centre, both in terms of light profiling and stellar population. Both analytical and numerical aspects will be investigated. The candidate will first get acquainted with the stability analysis of Poisson-Boltzmann equations (distribution functions, moments, perturbations). Growth rates of perturbation modes stemming from a non-static black hole mass will allow to map out the response of stars in phase-space and derive observables in relation to the characteristics of the black hole mass. The kinematics of massive stars will be explored and mapped out for comparison with RAVE data. These analytical predictions will be validated with numerical N-body rendering of a self-gravitating system to determine whether the black hole may have undergone a recent episode of mass accretion.

The evolution of rich stellar populations (including binary stars and a full stellar mass spectrum) with star-by-star N-body models will be put to task in order to assess the role of the migration of massive stars toward the centre, down to the break off radius  $\sim 0.2$  pc. Colour indices recovered from available stellar spectral libraries and evolutionary tracks will be compared with observational constraints to determine whether stars were more likely formed in situ. The public-domain codes Phi-Grape and Nbody6++ running on a parallel-platform Grape/GPU computer cluster will be dedicated to this task.

**Logistics:**

The Observatoire has secured a four-node 8-processor computer cluster equipped with Grape6-BLX64 cards and Nvidia 8600GTX graphics cards for dedicated computing of gravitational dynamics with direct-summation and particle-mesh codes. The SIMPSON cluster of four Pentium D950 dual-processor computers was acquired in the Autumn of 2007 as part of the SING research programme funded by the University of Strasbourg. The Observatoire also has proprietary access to eight dual-processor general purpose computers at the University's Centre for Computing and Visualisation facilities, which provides access to a still-growing computer cluster of eighty dual-processor machines on a shared-time basis. The candidate will be given full access to these facilities. Computing time on national supercomputing facilities such as IDRIS will be sought as required.

Candidates whose native language is not French will be able to submit a PhD thesis written in English. No course work will be required, however enrollment to specialised courses or schools (Master's or Doctoral level) will be encouraged. The International Space University or the European Doctoral College offer courses of general interest to space sciences in the English medium (see urls [HTTP://WWW.ISUNET.EDU/](http://www.isunet.edu/) and [HTTP://EDC.U-STRASBG.FR/EDC/ABOUT/INDEX\\_ENG.HTML](http://EDC.U-STRASBG.FR/EDC/ABOUT/INDEX_ENG.HTML)).

**The Observatoire astronomique:**

The Observatoire Astronomique is an independent faculty federated to the University of Strasbourg since 1973. Research at the Observatoire astronomique covers three broad areas, namely High Energy astrophysics; Galaxies; and Stellar populations, with theoretical and observational astronomy given equal weight; the url [HTTP://ASTRO.U-STRASBG.FR/OBSERVATOIRE/](http://ASTRO.U-STRASBG.FR/OBSERVATOIRE/) provides some basic information about its history and general setup. The group Galaxies (team-leader R. Ibata) was setup in 2000 with a view to spear-head research programmes in the fields of galactic and extra-galactic astronomy. The team members have since motored a broad range of scientific activities which led to 198 refereed articles totalling over 4600 citations (65 first-author papers accounting for 1575 citations). Today the group consists of 10 permanent staff (among whom Aubert, Bienaymé, Boily, Halbwachs, Ibata and Lançon work on some aspect of the PhD project) incremented by regular in-house research collaborations (Allen, Cambresy, Siebert, Vollmer). There are currently 4 students pursuing a PhD degree within the group; recent PhD awardees include

J.-J.Fleck, N.Martin, M.Mouhcine, P.Ocvirk and L.Veltz. Master's degree-level assistantships as well as summer traineeships are commonly offered to students from all across Europe. A RAVE post-doctoral fellow will join the group for an initial period of two years starting in the Autumn. The expertise developed in the team includes observational campaigns regularly awarded observing time on world-class telescopes (Keck, VLT, HST...) as well as theoretical astrophysics with a focus on gravitational dynamics and stellar populations. An international conference recently took place in Strasbourg on the topic of galactic and stellar dynamics (see URL [HTTP://ASTRO.U-STRASBG.FR/SCYON/GSD2008.HTML](http://ASTRO.U-STRASBG.FR/SCYON/GSD2008.HTML)).

**How to apply:**

Candidates should hold a Master's degree in Astrophysics or Computational Sciences, or equivalent experience. Application material include a letter of motivation, a full C.V., copies of degrees obtained or expected, as well as two letters of recommendation to be sent under separate cover to

Christian Boily, Observatoire astronomique, 11 rue de l'Université, Strasbourg F-67000, France.

Scanned material in pdf or ps format and informal inquiries can be forwarded by email (see addresses below). The deadline to receive all application material is 15 May 2008. Applications received after that date may not be given full consideration.

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