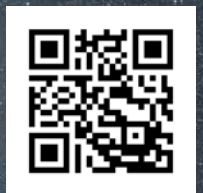# COSMIC-DANCE:
A comprehensive census of nearby star forming regions

Star Formation in Ophiuchus

Photograph: ESO

ERC-funded PhD Thesis

Contact

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Location

University of Bordeaux

Important dates

- Application deadline: 31/05/2017
- PhD Start: early/mid September 2017

Keywords

Astronomy - Astrophysics - Star formation - Astronomical Observations - Astro-Statistics

Description

Despite the tremendous progress achieved over the past decade, the study of stellar formation is far from complete. A number of important questions remain open: what is the minimum mass for star formation? how are stellar masses distributed in a star cluster (Fig. 1)? Is it universal? Although star clusters are the building blocks of galaxies, little is known about their early dynamical evolution and dispersal into the field. The main culprit for this state of affairs is the high level of contamination and incompleteness in the sub-stellar regime (brown dwarf), even for the best photometric and astrometric surveys.
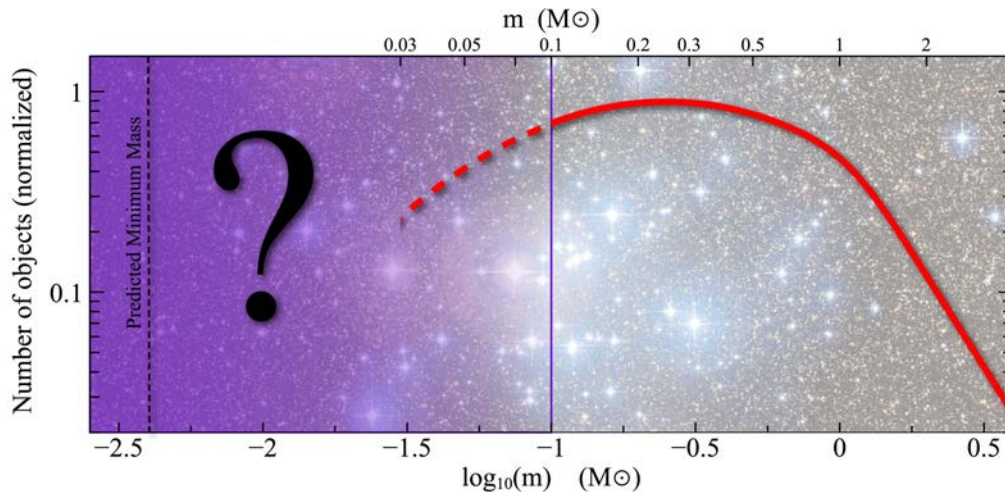

Fig. 1: The initial mass function, a measurement of the distribution of stellar masses at birth in a cluster, is one of the most fundamental and informative product of star formation. It remains largely unknown at the very low mass end, where stellar and planetary formation overlap.

In 2016, the COSMIC-DANCE project has been awarded a Consolidator Grant from the European Research Council and an Initiative of Excellence grant from the University of Bordeaux to overcome these drawbacks and reveal the content of young nearby clusters with a precision and completeness surpassing current and foreseeable surveys of the next 15 years.
COSMIC-DANCE will:
1) **Measure** proper motions with an accuracy comparable to the ESA Gaia mission but 5 magnitudes deeper, reaching the planetary mass domain, and, critically, piercing through the dust obscured young clusters inaccessible to Gaia's optical sensors.
2) **Discover**: feeding these proper motions and the multi-wavelength photometry to innovative hyper-dimensional data mining techniques, we will securely identify cluster members within the millions of sources of the COSMIC-DANCE database, complemented by Gaia at the bright end, to obtain the final census over the entire mass spectrum for 20 young nearby clusters, the end of a 60-year quest.
3) **Understand**: by providing conclusive empirical constraints over a broad parameter space unaccessible to current state-of-the-art surveys on the much debated respective contributions of evolutionary effects (dynamics, feedback and competitive accretion) and initial conditions (core properties) to the star formation process, with essential bearings on many areas of general astrophysics.

The successful candidate will be in charge of the study of several young clusters, from the acquisition of the data to the publication of the results on the mass function and the internal dynamics.
The candidate will be trained to:
• understand the astrophysical processes involved in star formation, and in particular in the study of the initial mass function and internal dynamics of young clusters
• prepare and perform astronomical observations, from proposal writing to the execution at the telescope. We have access to all major facilities around the globe, including in particular the ESO observatories, CTIO, La Palma, CFHT and Subaru observatories

- astronomical image processing and analysis: using the state-of-the-art softwares developed by members of the COSMIC-DANCE team
- modern statistical and data mining methods: developed for the project to identify members and interpret the observational results
- High Performance Computing: using our private and brand new HPC cluster at the University of Bordeaux

The COSMIC-DANCE team includes experts in stellar and planetary formation, astronomical observations, image processing, machine learning, data mining, and statistics, ensuring a versatile, stimulating and high quality training in all the fields required for the completion of the PhD project. Team members work at recognised international institutions in France, Spain, the USA, Germany, Japan, Austria, UK and Chile. The successful candidates will join the P.I. ERC-funded local group at the Laboratoire d'Astrophysique de Bordeaux (LAB) of the University of Bordeaux, that will include two post-doctoral fellows, another PhD student, and an engineer.

Visit the project webpage (http://www.project-dance.com) to learn more about COSMIC-DANCE.

LAB at the University of Bordeaux offers a very stimulating research environment with staff working in various areas of astrophysics, and in particular on various aspects of star and planet formation. The beautiful city of Bordeaux offers one of the highest quality of living and a vibrant cultural life, near the Atlantic coast.
Funding (stipend and travel grant) is fully secured for the 3 years of the PhD through the P.I. ERC Consolidator and Idex grants at the University of Bordeaux.
Large volumes of high quality data are already at hand, ensuring that the candidate can start immediately to work on the scientific analysis.

Requirements, skills, qualifications

- **Degree**: Aspiring candidates must hold a degree equivalent to a European Master (5 years of Higher Education) in either physics, astrophysics, statistics, or related fields.

- **Computing/Programming**: Familiar with Linux/UNIX environment. Experience with Python and/or Julia is a plus

- **Experience** in statistics (especially Bayesian techniques) and/or observational astronomy are a plus, although all excellent applicants will be considered

- **Language**: Proficiency in English

- **Nationality**: All nationalities are welcome to apply (subject to visa restrictions)

Creativeness, motivation, and independence are especially welcome.
Review of applications and interviews will start May 15, 2017, for a start early/mid September 2017. The french doctoral studies require no more than three years.

Salary & Benefits

The gross monthly stipend is 1,680 euros.
French doctoral contracts are true employment contracts to the extent that they are enforceable by law and carry all of the benefits attached to such contracts under French law.
In particular, **the contract carries medical insurance and other social benefits (e.g. unemployment, pension)** in addition to the stipend. Contracts are awarded and administered by the university of Bordeaux doctoral department.

Application

Applications should include a CV, a cover letter describing the applicant's background and motivation and a brief description of past research and future plans, as well as 2 or 3 letters of reference. These documents must be submitted by email as a PDF file to Hervé Bouy (herve.bouy@u-bordeaux.fr)