

*DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING FRAME  
INFORMATION CALL 2022*

**PhD POSITION OFFER FORM**

**Position**

1. Project Title/ Job Position title: **Mathematical Physics**
2. Area of Knowledge: **Physical Sciences, Mathematics and Engineering**
3. Group of disciplines: **Theoretical and Applied Mathematics, Computer Sciences**
4. Research project/ Research Group description (max. 2.000 characters)

The Mathematical Physics group at BCAM consists of the research lines in Quantum Mechanics, Statistical Physics and Singularity Theory & Algebraic Geometry.

Specific project thesis:

- **Singularities in Algebraic Geometry**. Advisor: **Ilya Smirnov**. We are offering projects on the algebraic side of the study of singularities: algebraic geometry and local algebra. The choice of a specific topic is up to the applicant's preferences. Among potential options are multiplicity theory and various aspects of positive characteristic methods in commutative algebra and algebraic geometry. More information about advisor's interests can be found at <https://people.kth.se/~ismirnov/>.

A background in algebraic geometry is not necessary for this project. However, an interest in geometry will be helpful since the applicant will be part of a diverse group of PhD students and postdocs that studies singularities using different, such as algebraic, topological, symplectic or Hodge-theoretical, methods.

- **Study of Many-Fermion Systems with Long Range Interactions**. Advisor: **Jean-Bernard Bru**. Description: The first goal is to use cluster expansions techniques and the structural stability of the catastrophes in catastrophe theory to show the stability of phase diagrams of many-fermion systems with long-range interactions. The second goal is to relax the mean-field limit used to study fermionic systems in [1] by taking the so-called "Kac limit". Such analysis requires further work, but it is a natural continuation of the first objective which allows to study mean-field fermionic models in details. Beside this plan, there is a possibility of proving a large deviation principle for the convergence of electric current densities in fermionic systems and in presence of interactions, with rate function given via current quantum fluctuations.

[1] J.-B. Bru and W. de Siqueira Pedra. *Memoirs of the American Mathematical Society*, 224 (2013).

## 5. Job position description (max. 2.000 characters)

The candidate will be part of one of the research groups of the **Mathematical Physics** research area at BCAM.

- Quantum Mechanics, Group Leader: Jean-Bernard BRU  
<http://www.bcamath.org/en/research/lines/QM>
- Singularity Theory and Algebraic Geometry is a multidisciplinary group studying singularities from different viewpoints. Group Leader: Javier Fernández de Bobadilla  
<http://www.bcamath.org/en/research/lines/STAG>

The BCAM research environment is international and open to national and international collaborations, the candidate must have willingness to team working and traveling.

Requirements:

- A master's degree in mathematics.
- An excellent academic record.
- Solid knowledge of the topics related to the corresponding PhD project.

Skills:

- Good communication and interpersonal skills.
- Ability to effectively communicate and present research ideas to researchers with different background (e.g., mathematicians and engineers).
- Ability to clearly present information in spoken (talks) and written (papers) form.
- Good command of spoken and written English.

**BCAM** is a world-class research center located in Bilbao (Spain). **It obtained the Severo Ochoa Center of Excellence award in 2013 and 2018** given by the Spanish Ministry of Science, Innovation and Universities. BCAM is part of the **ERCOM** European Research Centers on Mathematics networks: <http://www.ercom.org>. BCAM has endorsed the **Charter & Code** in 2008 and has been awarded the **HR Excellence in research Logo** in 2016.

The fellow **will receive all the needed support from BCAM to be fully integrated** in the group and in the center. In terms of **transferable & complementary skills**, BCAM is carrying out the **Action Plan** within Human Resources Strategy for Researchers (HRS4R) BCAM action plan <https://bit.ly/2MH1R9S>. A successful applicant will benefit of the training program on topics such as: **Gender Balance, Leadership, Effective Communication/Teamwork, Ethics and Research, Citizenship Science, etc.**

## Group Leader

1. Title: Prof.
2. Full name: Javier Fernandez de Bobadilla
3. Email: [jbobadilla@bcamath.org](mailto:jbobadilla@bcamath.org)
4. Research project/ Research Group website (Url):  
<http://www.bcamath.org/en/research/lines/QM>
5. Website description: Website of the MP group.

## Additional website (optional, max. 5 websites)

- Quantum Mechanics: <http://www.bcamath.org/en/research/lines/QM>
- Statistical Physics: <http://www.bcamath.org/en/research/lines/SP>
- Singularity Theory And Algebraic Geometry: <http://www.bcamath.org/en/research/lines/STAG>

## INPhINIT Offer, eligibility requirements, evaluation and selection process

Incoming:

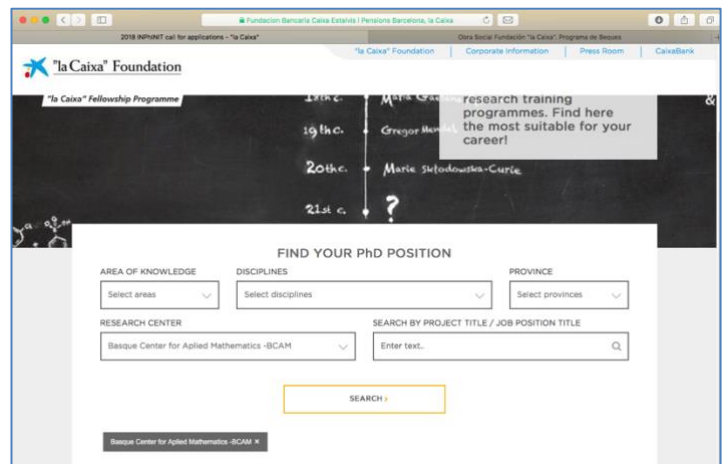
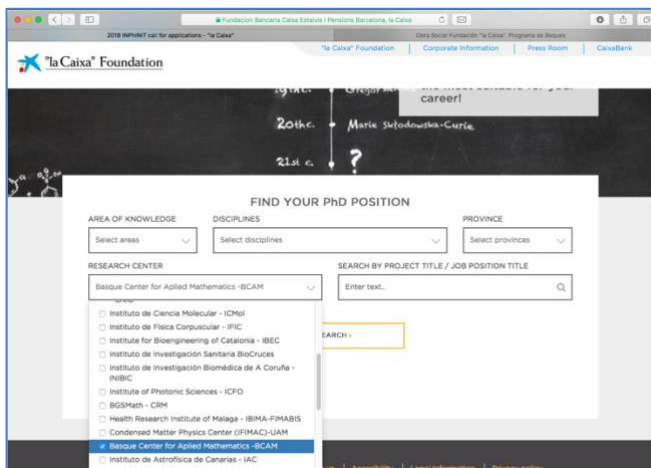
<https://fundacionlacaixa.org/es/becas-doctorado-inphinit-incoming>

Retaining:

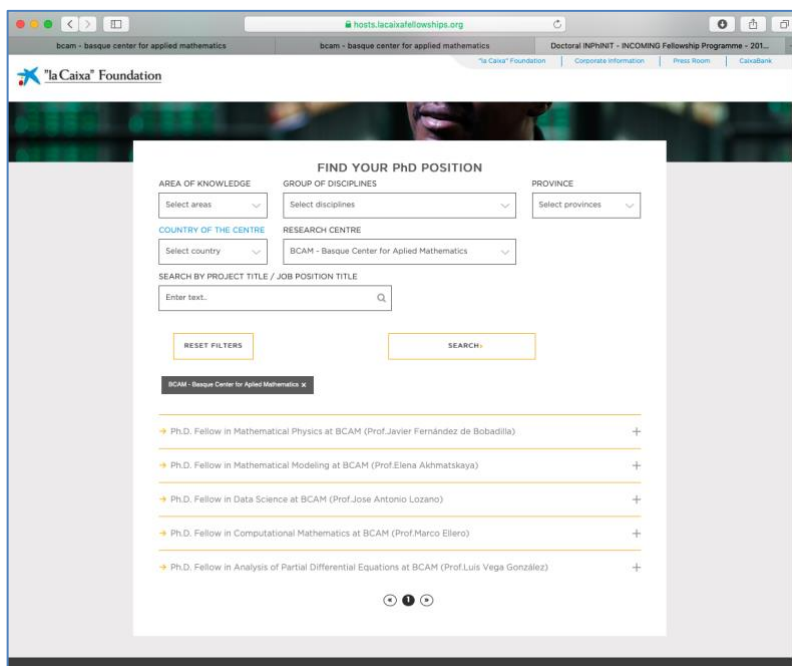
<https://fundacionlacaixa.org/es/becas-doctorado-inphinit-retaining>

How to Apply:

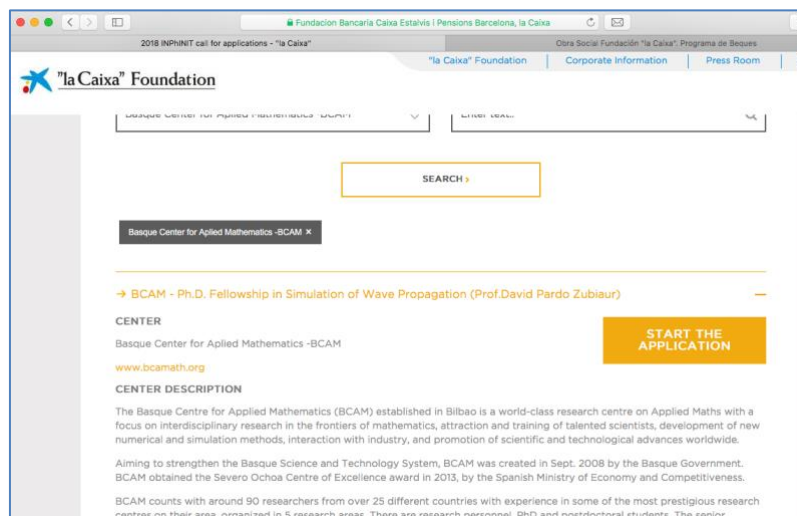
1. Click in <https://hosts.lacaixafellowships.org/finder>, click in RESEARCH CENTRE and choose "Basque Center for Applied Mathematics - BCAM"



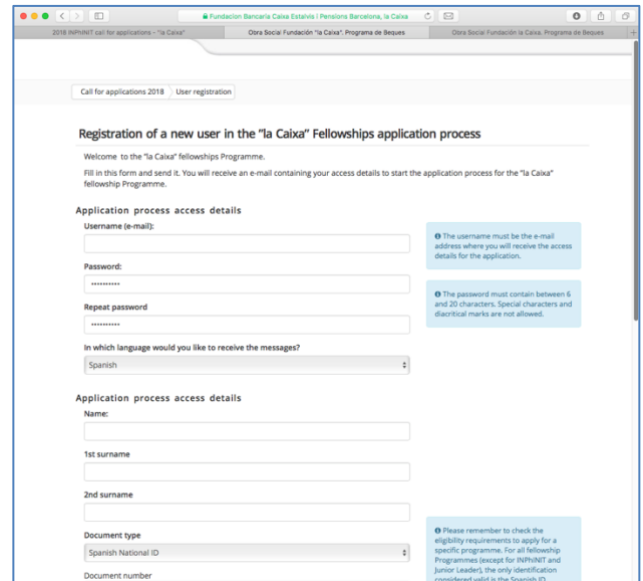
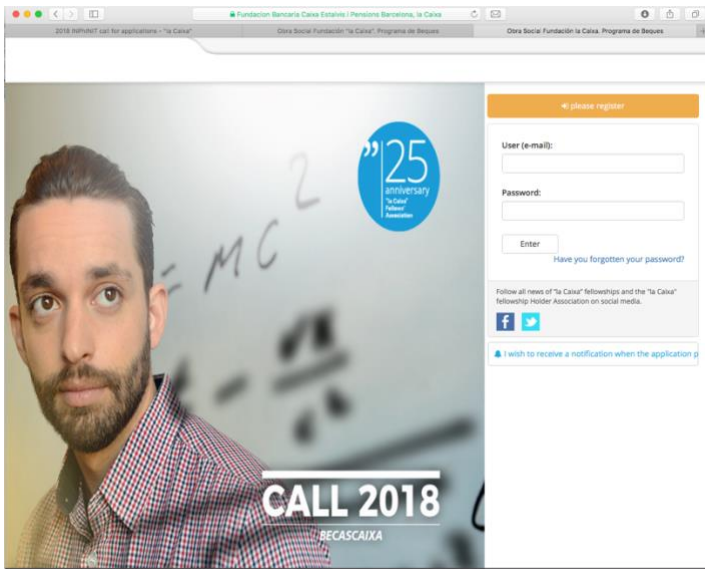
2. Click in "SEARCH" and the displayable will list the positions offered



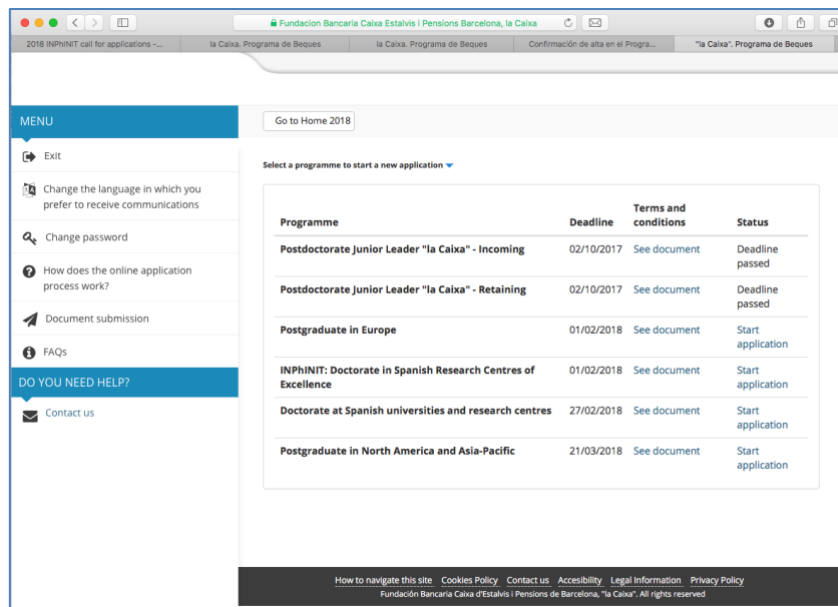
3. Click in the selected PhD Offer and click in "START THE APPLICATION"



- The system will open a new window with the application website <https://www.lacaixafellowships.org/index.aspx>. Click in "Please register" for new applicants.



- After the registration, the system will send to you the confirmation email and the link to access into the system. Now you are in the position to access into the application system. Please choose INPhINIT: Doctorate in Spanish Research Centre of Excellence.



- Now you are in the position to fill the application form, upload the required documents and choose the project thesis. To choose the project thesis, click in "Studies to be Pursued", choose the centre and the position.

2018 INPhINIT call for applications - "la Caixa" | Fundación la Caixa, Programa de Becas | Fundación la Caixa, Programa de Becas | Confirmación de alta en el Programa de Bec. | Fundación la Caixa, Programa de Becas

Miguel A. Benitez | Start of application period 2018 | Miguel A. Benitez | Application 77574

Start | Documents | Personal data | **Studies to be pursued** | Reference letters | CV | Statement of purpose

Highlight the mandatory fields that I have not completed yet.

**Information about the prospective research centre**

Field of study:  
Choose a field

Subfield of study:  
[Dropdown]

Chosen centre:  
Basque Center for Applied Mathematics -BCAM

Position:  
 Traducción:EligePosicion  
 BCAM - Ph.D. Fellow in Heuristic Optimization: Estimation of Distribution Algorithms for Combinatorial Optimization Problems with Constraints  
 BCAM - Ph.D. Fellow in Machine Learning: Data mining of stream time series  
 BCAM - Ph.D. Fellow in Machine Learning: Rare event prediction with machine learning method  
 BCAM - Ph.D. Fellow in Statistical modelling of high-throughput phenotypic data in plant breeding  
 BCAM - Ph.D. Fellow in the Mathematical Design of Complex Materials  
 BCAM - Ph.D. Fellow in Wildlife Propagation Modeling  
 BCAM - Ph.D. Fellowship in Applied and Computational Mathematics  
 BCAM - Ph.D. Fellowship in Simulation of Wave Propagation  
 BCAM - Ph.D. Fellowship in Sparse array regression and variable selection in high-dimensional problems  
 BCAM - Ph.D. Fellow in Mathematical Neuroscience: Controlling Neurons in Real-Time  
 BCAM - Ph.D. Fellow in Mathematical Neuroscience: Modeling and Unravelling Complex Neuron Communication  
 Ph.D. Fellowship in Applied Mathematics - Applied Analysis  
 Ph.D. Fellowship in Applied Mathematics - Applied Statistics (1/2)  
 Ph.D. Fellowship in Applied Mathematics - Applied Statistics (2/2)  
 Ph.D. Fellowship in Applied Mathematics - CFD Computational Technology  
 Ph.D. Fellowship in Applied Mathematics - Machine Learning  
 Ph.D. Fellowship in Applied Mathematics - Mathematical Modeling in Bioscience  
 Ph.D. Fellowship in Applied Mathematics - Modelling and Simulation in Life and Materials Sciences  
 Ph.D. Fellowship in Applied Mathematics - Quantum Mechanics  
 Ph.D. Fellowship in Applied Mathematics - Simulation of Wave Propagation  
 Ph.D. Fellowship in Mathematics - Harmonic Analysis (inverse problems)  
 Ph.D. Fellowship in Mathematics - Singularity Theory and Algebraic Geometry

Remember to write in English

On the contact sign date, I must accredit that I am able to enrol in the first year of a doctoral [Immediately prior to the publication date of the final list of selected candidates (29 may 2018)].