

2 years Postdoctoral position in applied mathematics

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1 Context

We have the pleasure to announce the opening of a two year post-doctoral position funded by the AMIDEX foundation and the Archimède Institute through the interdisciplinary project “Propagation in twisted waveguides”.

This project gathers three researchers in applied mathematics and mathematical physics from the Centre de Physique Théorique (CPT), the Institut Fresnel (two physics institutes) and the Institut de Mathématiques de Marseille (I2M) (a mathematic institute).

This position is a unique opportunity for the successful applicant to work in an interdisciplinary environment and be part of the international networks constituted by collaborators of the three project members (Czech Republic, United States, Germany, United Kingdom...).

2 Scientific framework

The project concerns the study of propagation in waveguides of specific geometry obtained by a twist (not necessarily constant) of a straight guide of any section along its longitudinal axis. In the case of quantum propagation ([2,7,8]) in a certain regime, recent works show that the effect of the twisting prevents the appearance of bound states in the guide. Furthermore, if they existed in the configuration before torsion, then it can even make them disappear. In this project, we want to reconsider this question but in different physical contexts: relativistic quantum mechanics and the Dirac equation ([1]), sound propagation and the wave equation and also the important case of electromagnetism and the Maxwell operator ([3,4,5]). The idea is to understand the effects of geometry on guided propagation in different physical settings. These questions require skills in both quantum physics and electromagnetism as well as in fine analysis of PDEs.

One of the topical applications (given the increasing use of optical fibers) would be a better understanding of signal propagation in optical fibers and how to play on the geometric param-

eters to reduce the signal loss. Other potential applications concern cloaking in acoustics ([6]) and artificial magnetism in strained photonic crystals ([9]).

3 Desired experience

We are looking for a candidate with a strong background in partial differential equations, spectral theory and/or a good formation in theoretical physics (quantum physics, acoustics, electromagnetism) and scientific computing.

4 Practical information

The position is expected to start from April 2023 to September 2023 and the successful candidate will be localized at the Institut Fresnel (Marseille). She/He will be mentored by Philippe Briet, Maxence Cassier and Thomas Ourmières-Bonafos. The project members will meet weekly to discuss the advances of the project.

Note that some fundings are available to cover travel expenses in order to participate to conferences.

5 How to apply ?

The candidate have to send an e-mail before **15th February 2023** to Maxence Cassier (cassier@fresnel.fr) with the following documents:

- a CV containing, in particular, a full list of publications and the list of given talks,
- A 2 pages research statement.

Moreover, to be taken under consideration, the applicant have to be supported by two to four experienced researcher who will send by e-mail their recommandation letter to Maxence Cassier (cassier@fresnel.fr). The selected candidates will be interviewed online by the three project members.

6 Bibliography

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