MASTER IN PHOTONICS – PHOTONICS BCN
EUROPHOTONICS-POESII MASTER COURSE

PROPOSAL FOR A MASTER THESIS

Dates: April - September 2017

Laboratory : Departament de Física Quàntica i Astrofísica
Institution: Universitat de Barcelona
City, Country : Barcelona, Spain

Title of the master thesis: Reflection and refraction of matter waves in two-component Bose-Einstein condensates

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Summary of the subject (maximum 1 page) :

In this project, our aim is to investigate the reflection and transmission of matter waves between two immiscible Bose-Einstein condensates within the mean field approximation. We will study the propagation of excitations of a condensate (sound waves and grey solitons) between the interface generated by the phase separation of two immiscible components. The dynamics will be investigated by solving the two coupled time-dependent Gross-Pitaevskii equations in order to obtain the matter wave analogous of the light refraction index.
First we will consider a 1D system, in which the velocity change of the incident matter wave will be investigated. In a second step, an extension to the 2D case can be numerically investigated; in this case we will consider different incident angles of the matter wave with respect to the interface.

[1] L. Pitaevskii and S. Stringari, “Bose-Einstein condensation and superfluidity”, Oxford University Press (2016).
[2] S. Burger, et al, Phys. Rev. Lett. **83**, 5198 (1999).

Keywords : Bose-Einstein condensates, matter waves, solitons

Additional information :
* Required skills : knowledge of python and fortran

* Miscellaneous :