

## Proposition de thèse/stage 2019 - Phd proposal 2019

**Global description of nuclear radioactivity and cluster states using relativistic energy density functional approaches**

**Global description of nuclear radioactivity and cluster states using relativistic energy density functional approaches**

**Établissement** Université Paris-Sud

**École doctorale** Particules, hadrons, énergie et noyaux: Instrumentation, Imagerie, Cosmos et Simulation

**Spécialité** structure et réactions nucléaires

**Unité de recherche** Institut de physique nucléaire d'orsay

**Directeur de la thèse** [Elias KHAN](#)

**Co-Encadrant** Jean-Paul EBRAN

**Début de la thèse** le 1 octobre 2018

**Date limite de candidature** 10 juillet 2019

### **Mots clés - Keywords**

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EDF, structure nucleaire

EDF, Nuclear structure

### **Profil et compétences recherchées - Profile and skills required**

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Master student at the M2 level with some knowledge of nuclear structure phenomenology and models

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## **Description de la problématique de recherche Project description**

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Recent advances in the description of nuclear cluster states allowed to provide an understanding of the physical effects at its origin, such as the number of nucleons, the depth of the confining potential, the excitation energy, the deformation or the density of the system [1]. With this respect the use of relativistic energy density functionals (EDF) has been shown to be of major importance.

Very recently the impact of the spatial localisation of the nucleonic wave function, emerging from the studies of cluster states, allowed to pinpoint alpha radioactive nuclei over the nuclear chart [2]. Concomitantly it has been shown that microscopic EDF approaches could also be linked to cluster radioactivity in the non-relativistic case [3].

The thesis proposal is aimed to describe both cluster and alpha radioactivities from the relativistic EDF approach. This shall extend the universal understanding of nuclear phenomenology from quantum liquid and cluster states to the more dynamical aspects of nuclear radioactivity.

The candidate will have to deal with both nuclear phenomenology on cluster states or radioactivities, as well as relativistic microscopic model such as Relativistic Hartree Bogoliubov calculations for deformed nuclei.

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## Thématiques /Contexte

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Universal approaches in nuclear physics

## Objectifs

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Develop a microscopic description of alpha and cluster radioactivities based on relativistic EDF

## Précision sur l'encadrement

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Thèse basée à l'IPN Orsay encadrée par E. Khan avec co encadrement par J.-P Ebran (CEA)

## Conditions scientifiques matérielles (conditions de sécurité spécifiques) et financières du projet de recherches

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The work will be done in the theoretical physics group of IPN Orsay

## Objectifs de valorisation des travaux de recherche du doctorant : diffusion, publication et confidentialité, droit à la propriété intellectuelle,...

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Standard publication approach

## Ouverture Internationale

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Collaboration with the Zagreb group

## Références bibliographiques

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[1] J.P. Ebran, E. Khan, T. Niksic and D.Vretenar, Nature 487, 341 (2012)  
J. Phys. G 44, 103001 (2017) and refs therein.

[2] J.P. Ebran, E. Khan, R.-D. Lasserri, and D. Vretenar, Phys. Rev. C 97, 061301(R) (2018).

[3] M. Warda, A. Zdeb, and L. M. Robledo, Phys. Rev. C 98, 041603(R) (2018).

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