ERASMUS MUNDUS MASTER IN NUCLEAR PHYSICS
Academic Year 2024/2025

MASTER THESIS PROPOSAL

TITLE: Study of exotic nuclei via beta decay with GRIFFIN

SUPERVISOR(S): Bruno Olaizola Mampaso

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UNIVERSITY/RESEARCH CENTER: IEM-CSIC, Madrid, Spain

ABSTRACT
(just few lines 5-10 explaining briefly the idea of the proposed work and the place where it will be developed).

The GRIFFIN array at TRIUMF, Canada, is currently the state-of-the-art decay spectrometer, with one of the highest gamma-ray efficiencies and a suit of ancillary detector that allows for in-depth decay experiments. It is routinely used to study the structure of some of the most exotic isotopes with extreme neutron-to-proton ratios.

What are you going to do? The master research project will consist of the data analysis of recent GRIFFIN experiments. You will analyze the beta decay of exotic nuclei and build their level schemes, making use of different nuclear physics techniques, such as angular correlations, conversion electron spectroscopy or ultra-fast timing.

What are you going to learn? During this work, you will familiarize yourself with GRIFFIN and TRIUMF, a world-leading laboratory. You will also learn to use powerful analysis tools like ROOT, the most commonly used software in the nuclear and particle physics field. Finally, you will gain in-depth knowledge about nuclear structure far from stability and a wide range of nuclear physics detectors, able to detect gamma rays or charged particles.

ERASMUS MUNDUS MASTER IN NUCLEAR PHYSICS
Academic Year 2024/2025

MASTER THESIS PROPOSAL

TITLE: Beta decay experiments at ISOLDE, CERN

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ABSTRACT
(just few lines 5-10 explaining briefly the idea of the proposed work and the place where it will be developed).

The ISOLDE laboratory, at CERN, pioneered the development of radioactive beams, and it is still considered a world-class laboratory in nuclear physics. One of its experimental lines is the ISOLDE Decay Station (IDS), which is the permanent setup to conduct decay experiments of exotic nuclei, with a special focus on beta decay. The CSIC and UCM groups routinely use IDS to unravel the nuclear structure of isotopes far from the Valley of Stability.

What are you going to do? The master research project will consist of the data analysis of recent IDS experiments. You will analyze the beta decay of exotic nuclei, building their level schemes and measuring the lifetime of excited state in the picoseconds (10^{-12} s) range.

What are you going to learn? During this work, you will familiarize yourself with the fundamental aspects of decays experiments at IDS, and with the ISOLDE facility at CERN. You will also learn how to use powerful analysis tools like ROOT, the most popular software in the nuclear and particle physics field. Finally, you will gain in-depth knowledge about nuclear structure far from stability and a wide range of nuclear experimental techniques.

JOINT EUROPEAN MASTER IN NUCLEAR PHYSICS
Academic Year 2025/2026

MASTER THESIS PROPOSAL

TITLE: Estudio de reacciones de transferencia de 2n en los núcleos ^{9}Li y núcleo halo ^{11}Be
Study of 2n Transfer Reactions in the nuclei ^{9}Li and the halo nucleus ^{11}Be

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ABSTRACT

(just few lines 5-10 explaining briefly the idea of the proposed work and the place where it will be developed).

^{11}Li are ^{11}Be are the archetype of 2n-halo and 1n-halo respectively. The structure of halo nuclei is defined as a system where the last nucleons, due to the low binding energy and angular momentum, spend a large part of their time far from the core. While the ground state of ^{11}Li has been well-established as a mixture of p (59(1)%), s (35(4)%), and d (6(4)%) waves, its excited states remain a topic of debate. Experiment IS690 was carried out at the HIE-ISOLDE facility at CERN employed a novel approach to investigate the excited states of ^{11}Li, directly populating these states via the (t,p) reaction of the simpler ^{9}Li nucleus. On the same line we have also measured the (t,p) reaction in the halo nucleus ^{11}Be try to characterize ^{13}Be structure in order to better understand the 2n-halo formation in the nucleus 14Be.
The latter experiment took place in October 2025. The experimental setup was designed to provide good angular coverage and energy resolution at ranges where protons were likely to be emitted. The master project aims to do a preliminary analysis of this recent experiment performing good energy calibrations of the different detectors and GEANT4 simulations in order to separate the different reactions channels.

JOINT EUROPEAN MASTER IN NUCLEAR PHYSICS

Academic Year 2025/2026

MASTER THESIS PROPOSAL

TITLE: In-beam spectroscopy and lifetime measurements in the north-east region of ^{80}Zr

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ABSTRACT

(just few lines 5-10 explaining briefly the idea of the proposed work and the place where it will be developed).

The mass region above ^{80}Zr (Z = N = 40) has gained much attention during the last two decades due to the recent theoretical and experimental works published. Nuclei in this region can exhibit a transition from collective behaviour to spherical configuration. The latest results show a clear competition of the shape coexistence with triaxiality for nuclei above ^{80}Zr. However, there is a deficit of experimental information in this region. Hence, the aim of this master thesis is to study the transition probabilities of the low-lying bands in Mo and Zr nuclei. The nuclei of interest be populated via the ^{24}Mg(^{64}Zn,2n) fusion-evaporation reaction at JYFL. The results will be discussed and combated to different theoretical calculations.

JOINT EUROPEAN MASTER IN NUCLEAR PHYSICS

Academic Year 2025/2026

MASTER THESIS PROPOSAL

TITLE: Commissioning and characterization of the focal plane detector for the ISRS prototype

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ABSTRACT
(just few lines 5-10 explaining briefly the idea of the proposed work and the place where it will be developed).

The first stage of the ISRS (ISOLDE Superconducting Recoil Separator) project is under construction. It will imply the commissioning of a linear recoil separator composed of two quadrupoles and a selector magnet. In order to have a complete prototype for the focal plane detectors for the system, as part of this first stage, several kinds of detectors will be proposed. The program for this Master thesis is the commissioning and characterization of DSSSD, SiC and LaBr detectors, by using radioactive sources and stable beams produced in accelerators as CMAM (Madrid) and ISOLDE (CERN Switzerland). The student will be formed in the management of the most modern kind of detectors for charge particles, neutrons and photons, getting contact with modern electronics, digitizers, data acquisition codes and data analysis programs. In parallel, the student will be able to be part of measurement currently in course as part of the IEM-CSIC group activities.