Abstract
Nuclear physics research developed at international radioactive beam facilities is leading to unprecedented discoveries in the structure and dynamics of nuclei. The radioactive beam facility "Isotope mass Separator On-Line facility" (ISOLDE) at CERN [1] is a world leading infrastructure in basic and applied nuclear physics research, currently producing post-accelerated radioactive beams in the energy range 0.5 - 10 MeV/A with the HIE-ISOLDE linac [2]. The scientific program covers a broad range of topics, from basic nuclear structure to nuclear astrophysics [3]. These studies can benefit from the use of a high-resolution recoil separator, the HIE-ISOLDE Superconducting Recoil Separator (ISRS) [4]. In this contribution we will discuss last technical developments, including beam dynamics, SC magnets and cryostats.
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Cd impurities in Vanadium oxides: a hyperfine interaction investigation using 111mCd nuclei

Authors: Anastasia Burimova[1]; Osmar Flavio Leite Neto[1]; Brianna Bosch-Santos[1]; Eduardo Lima Correa[1]; Luciano Fabricio Dias Pereira[2]; Tatiane Silva Nascimento Sales[1]; Ibere Souza Ribeiro Jr[1]; Messias Santos Costa[3]; Cleidilane Costa[3]; Thanh Thien Dang[4]; Dmitry Zyabkin[5]; Koen Karl F van Stiphout[6]; Adeleh Mokhles Gerami[7]; Joao Martins Correia[8]; Juliana Schell[4]; Artur Wilson Carbonari[1]

[1] *Instituto de Pesquisas Energéticas e Nucleares, IPEN-CNEN/SP, 05508-000 São Paulo, Brazil.*

[2] *Instituto de Pesquisas Energéticas e Nucleares, IPEN-CNEN/SP, 05508-000 São Paulo, Brazil*

[3] *Faculdade de Ciencias Exatas e Tecnologia, Universidade Federal do Pará, 68440-000 Abaetetuba, PA, Brazil*

[4] *Institute for Materials Science and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, 45141 Essen, Germany*

[5] *Institute of Micro- and Nanotechnologies (IMN) MacroNano®, TU Ilmenau Ehrenbergstrasse 29 98693 Ilmenau, Germany*

[6] *Institut fur Kern- und Teilchenphysik, II. Physikalisches Institut Georg-August-Universität Göttingen Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany*

[7] *School of Particles and Accelerators, Institute for Research in Fundamental Sciences (IPM), P.O. Box 19395-5531, Tehran, Iran*

[8] *Centro de Ciências e Tecnologias Nucleares (CCTN), Instituto Superior Técnico, Universidade de Lisboa, Portugal*

Corresponding Author: artur.wilson.carbonari@cern.ch

The number of metastable phases, the capriciousness at changing external conditions, and lack of accurate description of local behavior already resulted in severe misinterpretation of experimental outcomes for vanadium oxides[1–3]. The scope of already implemented and potential applications of vanadium oxides is, indeed, impressive, particularly as a battery cathode for energy storage[4].

Doping is widely exploited as a means of application-oriented tuning of the material properties. The properties of each particular phase may be tuned by doping to satisfy specific requirements and/or improve the functional performance. In the work here reported, electric quadrupole interaction on ^{111m}Cd nuclei implanted in vanadium pentaoxide doped with different concentrations of Cd were measured with time-differential perturbed angular correlations (TDPAC).

Pure V_2O_5 as well as doped with 1%, 5%, and 10% of Cd were measured at different temperatures. To correlate the results with the possible formation of different phases and compounds, samples of VO_2, CdV_2O_6, and $Cd_2V_2O_7$ were also measured. The intention is to provide a comprehensive description, at an atomic level, of the doping effects on the local crystal structure and the electronic

structure around the impurity and the consequences on the properties of the host oxides. Preliminary results show that the probability of formation of cadmium vanadates is low but the temperature and atmosphere of measurements have an important effect on the local scale.

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Characterization of ionic and highlying states in RaF to guide future experiments

Author: Konstantin Gaul[1]

Co-authors: Ronald Fernando Garcia Ruiz [2]; Robert Berger [3]

[1] *Philipps Universitaet Marburg (DE)*

[2] *Massachusetts Institute of Technology, CERN*

[3] *Universität Marburg*

Corresponding Author: konstantin.gaul@chemie.uni-marburg.de

After the theoretical prediction of Radium monofluoride (RaF) as laser-coolable molecule and a versatile probe of fundamental physics [1] the first spectroscopic identification and characterization was achieved at ISOLDE [2]. This experiment paved the way to study the nuclear structure of short lived Radium isotopes in molecular systems and presented a first step in the effort to search for violations of fundamental symmetries [3]. In these neutralisation-reionisation
experiments a three color laser excitation scheme is used to reduce background to enable measurements of high resolution spectra. So far, however, the character of the intermediate states from which ionization takes place is not established. Furthermore, at the present stage of experiments RaF molecules are rather hot having several vibrational levels occupied. This makes interpretations of rovibrational spectra complicated and would limit the efficiency of laser-cooling
schemes.
In this contribution we study energetically high lying excited electronic states of RaF on the level of relativistic Fock-space coupled cluster calculations. Furthermore, we consider ionic states to explore possibilities for reducing the translational and vibrational energy of RaF molecules.

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Beta-decay studies to explore physics beyond the weak-interaction standard model