yCGS-2022 - 'Young Scientists CGS-2022 workshop'

Thursday 24 March 2022 - Friday 25 March 2022

Book of Abstracts

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233U(n, γ) measurements at LANSCE

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The Th-U fuel cycle, in which the ^{233}U plays an important role, has been proposed as an alternative to the U-Pu fuel cycle due to its reduced amount of transuranium elements. The experimental ^{233}(n,γ) cross section data available in the literature are scarce and were measured decades ago [1, 2, 3]. An accurate measurement of the ^{233}(n,γ) cross section is required by the NCSP (National Critically Safety Program) to complete the neutron-induced cross section data.
For ^{233} fission is around one order of magnitude more likely than capture, hence, the accuracy in the capture cross section measurement relies on the discrimination between the γ's produced in capture and fission reactions. This discrimination method requires the use of an experimental setup combining capture and fission detectors. Therefore a new measurement has been performed at LANL combining the Detector for Advanced Neutron Capture Experiments (DANCE) to measure γ's, with the NEUtron detector array at dANCE (NEUANCE) to detect neutrons coming from fission and determine by coincidence the γ's produced by fission reactions tagging them.
This measurement will provide cross section data in the Resonance Region (RR), focusing in the Unresolved Resonance Region (URR) in the keV neutron energy.

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Configuration mixing investigation in Ge isotopes through E0 strength measurements

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Experimental and theoretical studies of the germanium isotopes point increasingly toward exotic combinations of nuclear-structure effects, with indications of triaxiality, configuration mixing, and shape coexistence. Studies of the $E0$ strengths, which can provide a direct measure of the amount of configuration mixing, are lacking along the Ge chain. Thus, an experimental determination of $E0$ transition strengths is essential for an understanding of the evolution of structures in the germanium isotopes.

Beta-decay experiments populating excited states in the ^{72,74,76,78}Ge isotopes were performed at the Isotope Separator and Accelerator (ISAC) radioactive ion beam facility at TRIUMF. The GRIFFIN spectrometer combined with the PACES silicon array enabled us to perform both gamma-ray and electron spectroscopic investigations, to measure $E0$ strengths between states of $J > 0$. Preliminary results from this study will be discussed.

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Developing a charge plunger method for lifetime measurements in the heavy elements

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The Recoil Distance Doppler-Shift (RDDS) method for measuring the lifetime of excited nuclear states relies on the detection of gamma rays. In cases where the internal conversion coefficient (ICC) becomes large, e.g. for low energy transitions in heavy nuclei, the intensity of γ-ray emissions may be small and the RDDS method becomes impractical. To overcome this difficulty, a charge plunger technique has been previously employed by G. Ulfert et al.

The charge plunger technique relies on two effects that change the charge state of an ion. Firstly, the large increase of an ionic charge state due to a cascade of Auger electrons that follow the internal conversion of a transition depopulating an excited nuclear state. Secondly, when an ion passes through a thin foil it will pick up electrons causing the charge state to reset to a lower value. In a plunger setting this results in high and low charge components in the ionic charge state distribution (CSD) with intensities that depend on the flight time of the ions between the target and charge reset foil, the ICC of the transition and the lifetime of the excited state. Therefore, an analysis of high and low charge components can be used for lifetime measurements.

The charge plunger method has recently been used at the University of Jyväskylä Accelerator Laboratory, Finland, to perform lifetime measurements of yrast states in ^{178,180}Pt. The Differential Plunger for Unbound Nuclear States (DPUNS) was employed together with the vacuum separator MARA to observe the intensities of different charge states. The Jurogam 3 array was used to detect prompt γ-ray emission. The results for ^{178}Pt are presented here, along with two planned experiments on ^{222}Th and ^{254}No which have been approved to run at the University of Jyväskylä.

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Gamma spectroscopy of neutron-rich Y isotopes: Identification of new multi-quasiparticle isomers

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For the neutron number N = 60, a sudden onset of the deformation has been observed in Y isotopes at the ground state, which is manifested by the presence of rotational bands (e.g. [1]). On the other hand, the occurrence of shape coexistence in nuclei with N = 58 and 59, in this region (e.g. [2]), suggests that the evolution of the deformation is a more gradual process. Our recent research has shown that already in the N = 57, 96Y isotope the coexistence of spherical and deformed structures is present and a rotational band is built on the top of a new (6+), 181-ns isomer [3]. In the current analysis, we focused on the neutron-rich Y isotopes with N ≥ 60, in which the deformed structures are firmly established. For N = 60, i.e., in 99Y, in addition to the ground state rotational band, two other bands could be found above 11/2+ (1.6 ns) and 17/2+ (8 μs) isomers [4]. These isomers have been interpreted as three-quasiparticle states with π5/2[422]ν3/2[411]ν9/2[404] configuration. Our goal is to search for similar isomers with relatively high-spin in Y isotopes beyond N = 60 boundary.

The neutron-rich 100Y and 101Y isotopes have been produced in the fission of 235U active target [5] induced by thermal neutrons from the reactor at Institut Laue-Langevin. The level scheme up to excitation energy of 2.5 MeV has been established based on multi-fold gamma-ray coincidence relationships measured with the new, highly-efficient HPGe array FIPPS [6]. Additionally, the low-spin structures in 101Y have been examined using dedicated measurement where fission products were separated by the LOHENGRIN spectrometer.

By exploiting delayed- and cross-coincidence techniques [7], the extensive structures have been delineated. During the analysis, over 20 new gamma transitions, which feed previously known low-spin states, have been identified. Moreover, new isomeric states at higher excitation energy have been located. By using the delayed-coincidence method, it was possible to identify the structures above the isomers confirming their rotational characters. As in the case of 99Y isotope, the isomeric states could be interpreted as multi-quasiparticle type. The configurations of the new bandheads will be discussed based on the observed decay patterns, as well as Hartee-Fock-Bogoliubov calculations.

Existence of isomers in the 100Y and 101Y isotopes which are bandheads of rotational structures provides new information about deformation in neutron-rich nuclei around A = 100. It should be emphasized that this is in contrast with other isotopic chains with N > 60 and Z = 38-44, where the bandheads of the higher-located rotational structures are not isomeric.

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In-beam γ-ray spectroscopy of 94Ag

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The formal concept of isospin has been introduced to explain the apparent exchange symmetry between neutrons and protons. However, if the nuclear force were the same for protons and neutrons properties such as masses and excitation energies would depend only on the mass number A. Recent studies have shown that the Coulomb force cannot account for all deviations, suggesting that other isospin-symmetry-breaking components must be present. N≈Z systems present the perfect testing ground to probe isospin symmetry phenomena [1-3]. In particular, pairing correlations have a significant importance in the description of the nuclear structure of N=Z nuclei, where protons and neutrons are arranged occupying the same orbits, allowing T=0 np pairing in addition to the normal T=1. It was recently suggested that spin-aligned T=0 np pairs dominate the wavefunction of the y-rast sequence in ^{92}Pd [4]. Subsequent theoretical studies were devoted to probe the contribution of np pairs in other N=Z A>90 nuclei [5-6], suggesting that a similar pairing scheme strongly influences the structure of these nuclei. In an effort to further understand the influence of np pairing in self-conjugate nuclei, a recoil beta tagging experiment has been performed to try and identify the excited T=0 and T=1 states in odd-odd N=Z ^{94}Ag using the ^{40}Ca(^{58}Ni,p3n)^{94}Ag reaction. The experiment was conducted using MARA recoil separator and JUROGAM3 array at the Accelerator Laboratory of the University of Jyväskylä.

The detailed goals of the experiment, the setup, tentatively identified transitions, experimental CED and nuclear shell model predictions will be shown in this presentation. A preliminary interpretation of the experimental results will also be discussed.

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Indirect neutron capture measurements on radionuclides through neutron transmission with the new DICER instrument at LANSCE.

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With very few exceptions, direct measurements of neutron capture cross sections on radionuclides have not been possible. A number of indirect methods have been pursued such as the surrogate method [1], the γ-ray strength function method [2,3], the Oslo method [4-7] and the β-Oslo method [8]. Substantial effort has been devoted to quantify the usually large systematic errors that accompany the results from these techniques. A new instrument has been recently developed at the Los Alamos Neutron Science Center (LANSCE) to provide more accurate data on several radionuclides relevant to nuclear criticality safety, radiochemical diagnostics, astrophysics, nuclear forensics and nuclear security, by measuring the transmission of neutrons through radioactive samples and studying resonance properties. The Device for Indirect Capture on Radionuclides (DICER) [9-11] and associated radionuclide production at the Isotope Production Facility (IPF) [12, 13], both at LANSCE, as well radioactive sample fabrication, have been under development the last few years. A description of the new apparatus, preliminary data on a few mid-weight stable isotopes and efforts on radionuclide measurements will be presented.

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Investigation of shape coexistence and γ-softness in the neutron rich A≈100 region using lifetime measurements

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The A≈100 region is a diverse region of the nuclear chart with the occurrence of different nuclear structure phenomena. For example the well known sudden onset of collectivity in the neutron-rich Sr and Zr isotopes [1,2], the multiple shape coexistence in the neutron-rich stable Cd isotopes [3,4]

or the evidences for γ-softness in the Mo, Ru and Pd isotopes. Lifetimes of excited states in ^{98}Zr, ^{102}Mo and ^{112}Pd were measured using the (^{18}O, ^{16}O) two neutron transfer reaction in combination with the Plunger device at the Cologne FN Tandem accelerator [5.9]. In this reaction, a low amount of momentum and energy is transferred, making it a powerful tool for the investigation of nuclear structures dominating at low energies. This allows a detailed analysis of the shape coexistence phenomena in the Zr and Mo isotopes occurring at the transition from $N = 58$ to $N = 60$ [6,8] and the nuclear structure related to the γ-deformation in neutron-rich Mo and Pd isotopes [7,8]. The latter were compared to the interacting boson model (IBM), the Jean-Wilets γ-soft model and the Davydov-Filippov rigid triaxial rotor model.

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Investigation of the low-lying dipole response in real-photon scattering experiments

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Real-photon scattering experiments, also called Nuclear Resonance Fluorescence (NRF) experiments, are a well-established tool for investigating the low-lying dipole response in atomic nuclei due to the low-momentum transfer of photons [1,2]. By studying the angular distributions of the emitted photons during the decay of the previously excited nucleus, spin and parity quantum numbers can be assigned. Furthermore, total photoabsorption cross sections can be extracted in a model-independent way.
Systematic studies of the photoabsorption cross section can be utilized to investigate the properties of dipole excitation modes. For instance, in many nuclei an accumulation of electric dipole strength below and around the neutron separation threshold has been observed which is commonly denoted as Pygmy Dipole Resonance (PDR) [3,4]. Although the PDR strength is very small compared to the strength of the IsoVector Giant Dipole Resonance (IVGDR) [5], it might have some impact on the reaction rates in the rapid neutron-capture process (r process) [6,7]. During the last two decades, experimental and theoretical effort was put into the investigation of the PDR. Nevertheless, there are still some open questions concerning this excitation mode. Therefore, systematic investigations in different isotopic and isotonic chains have been performed, e.g., in the nickel isotopic chain.
The low-lying dipole response in ^{58,60,62}Ni has already been investigated in NRF experiments [8-10]. Furthermore, relativistic Coulomb excitation experiments in inverse kinematics on the unstable isotopes ^{68,70}Ni have been performed to extract the dipole strength [11-13]. Hence, ^{64}Ni is the missing

link for completing the systematics in the even-even Z = 28 nuclei.
In this contribution, the NRF technique will be explained by showing the analysis of two complementary NRF experiments on ^{64}Ni using a continuous bremsstrahlung and a quasi-monoenergetic photon beam. Additionally, recent NRF results of different nuclei will be presented.
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Lifetime measurements in A∼96 isotopes via the fast-timing technique.

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Shape coexistence is a fundamental phenomenon found in atomic nuclei. It consists in some states displaying different intrinsic deformations while having relatively similar excitation energies [1].

Neutron-rich nuclei belonging to the A100 region of the nuclear chart are known to show a large degree of deformation [2]. In particular, the limit N = 60 is well known for showing a dramatic shape change from spherical to deformed [3]. Due to the interplay between these spherical and deformed configurations, shape coexistence is expected in nuclei lying at the border between the two regions [4].
Nuclei belonging to the low-Z edge of the A100 deformed region of the nuclear chart were produced in the thermal-neutron-induced fission of a ^{233}U target at the ILL laboratory. The different isotopes were separated using the LOHENGRIN mass spectrometer and tagged by a ionization chamber. Due to the microsecond-long time of flight of fission products, only states populated via the decay of microsecond isomers in these nuclei, or those populated in the beta decay of their parent nuclei already implanted, were observed thanks to the emitted gamma rays.
Lifetime measurements of excited states in ^{96}Rb, $^{93-96}$Y and $^{94-95}$Sr were measured using the fast-timing technique [5] with $LaBr_3$:Ce gamma-ray detectors (scintillators), which is able to provide precise measurements down to the tens-of-picosecond regime. From these measurements, reduced transition probabilities and electric quadrupole moments were extracted to provide information on nuclear deformation in this region. In this contribution, preliminary results of the fast-timing analysis on several excited states in the abovementioned nuclei will be discussed, together with some still tentative insight of their physical interpretation. A comparison with theoretical predictions and results from neighbouring isotopes will also be made.

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Lifetime measurements in the sub-picosecond regime with the pγ-coincidence Doppler-shift attenuation method

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Nuclear level lifetimes are important properties of the atomic nucleus, as they yield information about transition strengths and nuclear wave functions. An established method to determine lifetimes in the sub-picosecond regime is the particle-γ coincidence Doppler-shift attenuation method (pγ-DSAM) [1]. As opposed to most DSAM approaches, the additional coincident detection of emitted γ-ray and scattered projectile allows the selection of excited states, thus eliminating feeding contributions. The coincidence data is obtained with the SONIC@HORUS detector array [2] situated at the 10 MV FN tandem accelerator in Cologne. It consists of 12 silicon particle detectors and 14 high-purity germanium (HPGe) detectors for the detection of γ-rays. With this method and setup, lifetimes of several dozens of nuclear levels can be determined in a single experiment.
Lately, the DSA method has been used to determine lifetimes of excited low-spin states of nuclei in the mass region of A ≈ 100 and above. Recent results on Ru, Sn [3] and Te [4] isotopes will be presented in this contribution.
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Low-spin excitations in the 206Tl and 205Pb nuclei studied by thermal neutron capture reactions

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Nuclei from the regions of doubly-closed shells may be considered an excellent ground for studying both a) the couplings between valence nucleons - this provides information on the effective nucleon-nucleon interaction and, b) couplings of the valence nucleons with core excitations, what may be used as a unique test of various effective interactions (Skyrme, Gogny, etc.) employed in mean-field based models.

206Tl, having only one-proton-hole and one-neutron-hole with respect to the 208Pb core, was populated in a thermal neutron capture reaction 205Tl(n,gamma)206Tl at Institut Laue-Langevin in Grenoble (France). To reach the low-spin structure of this nucleus, the gamma decay from the capture state was studied using the HPGe multidetector FIPPS facility. Gamma rays from the capture state, which in 206Tl is placed at 6.5 MeV, were detected by an array of 8 Ge clovers. The results of the double and triple gamma-coincidence analysis will be presented: 21 low-spin excited states were observed in 206Tl, 8 of them were newly established. As the detectors of FIPPS were placed in one ring in octagonal geometry, double-coincidence data could be sorted into the matrices corresponding to different average angles between the crystals. The analysis of gamma-ray angular correlations provided information about transitions multipolarities, which significantly helped with spin-parity assignments.

After extracting the information about spin and parity of the excited states in 206Tl, the level structure of this nucleus was compared to the results of shell-model calculations. The large number of low-spin states populated in neutron capture reactions on 205Tl, arising from one proton-hole and one neutron-hole excitations, can be used as a very good testing ground for the old and newly developed shell-model interactions in the south-west quadrant of the nuclear chart with respect to

208Pb. It will allow to benchmark the two-body matrix elements of the residual interaction in this important region of the nuclear chart.

In turn, the 205Pb nucleus has three neutron-holes with respect to the 208Pb core, which makes it even more demanding testing field for the shell-model calculations. In longer perspective the studies of its structure would also stimulate the works on the shell-model description with a term coming from three-body forces in the region of heavier masses nuclei.

The decay of the capture state in 205Pb populated at ILL in 204Pb(n,gamma)205Pb reaction was investigated using FIPPS array coupled to the 7 HPGe clovers from IFIN Bucharest. The preliminary results of double and triple gamma-coincidence analysis will be presented: the new findings on the 205Pb low-spin structure include 7 excited states and 85 gamma transitions.

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Measurement of prompt γ-rays from the neutron capture reaction of Pd isotopes in the eV energy range

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In the compound process of neutron-induced nuclear reactions, the parity symmetry (P-violation) is violated due to the effect of the weak interaction. It has been experimentally found that the helicity dependence of the reaction cross section due to the P-violating nucleon-nucleon interaction is enhanced by up to six orders of magnitude compared to the bare effect observed in few-nucleon reactions[1]. This amplification effect has been explained by using a statistical model based on the Random Matrix Theory. In this model, transition matrix element is expected to be inversely proportional to the square-root of the level density N. The accuracy of the existing experimental data of W, however, are not sufficient to verify the model, and thus more accurate data are demanded. W is related to the asymmety A_{L} of the helicity-dependent reaction cross section as the following equation;

$$A_L \approx -\frac{2xW}{E_{\mathrm{p}}-E_{\mathrm{s}}}\sqrt{\frac{\Gamma^{\mathrm{n}}_{\mathrm{s}}}{\Gamma^{\mathrm{n}}_{\mathrm{p}}}} \qquad \left(x \equiv \sqrt{\frac{\Gamma^{\mathrm{n}}_{\mathrm{p,j=1/2}}}{\Gamma^{\mathrm{n}}_{\mathrm{p}}}}\right), \tag{1}$$

where E_{s} and E_{p} are the resonance energies of the s-wave and the p-wave resonances, respectively. $\Gamma^{\mathrm{n}}_{\mathrm{s}}$ and $\Gamma^{\mathrm{n}}_{\mathrm{p}}$ are the corresponding neutron widths, respectively. x is the ratio of the partial p-wave neutron width to the total neutron width, it can be determined by measuring the angular dependence of the emitted γ-rays of the (n,γ) reaction [2]. Therefore, by measuring A_{L} and x, one can determine W experimentally from Eq. (1).

In this study, we focus on Pd isotopes which have relatively small values of N, and consequently N dependences of W are rather significant. To obtain x, the angular distributions of the prompt γ-rays from the p-wave resonance of the Pd isotopes were measured at the J-PARC MLF BL04 in February 2021. As a preliminary result, the following values of x were obtained for ^{108}Pd;

$$x = 0.9986^{+0.0003}_{-0.0099} \qquad \text{or} \qquad x = -0.9986^{+0.0099}_{-0.0003}. \qquad (2)$$

In this contribution, the experimental procedure and the result will be presented.

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Measurement of the bound-state beta decay of bare 205-Thallium and its nuclear astrophysical implications

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We report on the first direct measurement of the bound-state beta decay [1] of $^{205}\mathrm{Tl}^{81+}$ ions, an exotic decay mode, in which an electron is directly created in one of the empty atomic orbitals instead of being emitted into the continuum. One of the most awaited and pioneering experiments was realized in the spring beamtime at GSI, Darmstadt in 2020, wherein the entire accelerator chain was employed. $^{205}\mathrm{Tl}^{81+}$ ions (with no electron) were produced with the projectile fragmentation of $^{206}\mathrm{Pb}$ primary beam on $^{9}\mathrm{Be}$ target, separated in the fragment separator (FRS), accumulated, cooled, and stored for different storage times (up to 10 hours) in the experimental storage ring (ESR). The experimentally measured half-life value [2] draws a 4.7σ [3] and 7σ [4] tension with the theoretically predicted values, which could influence our understanding of the abundance of chemical elements in the early universe. In this contribution, the authors aim to present the s-process motivation and a preliminary value of the $^{205}\mathrm{Tl}^{81+}$ half-life.
This research has been conducted in the framework of the SPARC, ILIMA, LOREX, NucAR collaborations, experiment E121 of FAIR Phase-0 supported by GSI. The authors received support from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (Grant Agreement No. 682841 "ASTRUm").

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Nuclear structure studies at the FIPPS instrument at ILL

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The FIssion Product Prompt gamma-ray spectrometer (FIPPS) is the new nuclear physics instrument at the Institut Laue-Langevin (ILL). FIPPS takes advantage of an intense pencil-like neutron beam (flux 10^8 $n/s/cm^2$) for inducing neutron capture and neutron induced fission reactions and study the nuclear structure via high resolution gamma-ray spectroscopy. The array is composed by 8 Compton suppressed HPGe clover detectors. Ancillary devices are possible, as $LaBr_3$ detectors for fast timing measurements or additional clover detectors (from the IFIN-HH collaboration) to increase efficiency and granularity.
After a general introduction on the main features of the instrument, recent developments to improve the energy resolution and the sensitivity of the instrument for fission studies will be reported. In particular, the procedure and effects of the correction for the cross-talk among the crystals in a same clover will be reported.
The setup and results from the first test of a diamond-base active target for neutron induced fission will be reported. These results will be shown with the ones from the well-established scintillator-based active target used at FIPPS in recent campaigns. The use of a fission tag allows for an identification of transitions from weak branches and/or isotopes produced with small fission yields.
Finally, the recently developed GEANT4 simulation code will be presented, with particular focus on the angular correlation analysis with hybrid gamma-ray arrays and on the first simulations for the development of a plunger device for lifetime measurements in fission fragments.

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Shell Model description of nuclei: new frontiers

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The major challenge in the Shell Model framework is the diagonalization of the effective (generally two-body) Hamiltonian in the model space. Indeed, this is a huge task for open shell nuclei as the model space dimension grows combinatorially with the number of particles. In this talk, I will present our recent work aiming to tackle this problem in a deformed Hartree-Fock (HF) basis conserving good angular momentum. The construction of such basis can be done using mean field and beyond mean field techniques of the generator coordinate method (GCM) which has been extensively studied in the literature. However, the question of choosing relevant deformed HF states is not straightforward. For that, we have developed an efficient truncation scheme of the deformed HF basis which allow to apply the Shell Model in very heavy nuclear mass regions that are for now very difficult to do an exact diagonalization by standard methods. Benchmarks and several applications to nuclei from light, medium masses to superheavy ones will be presented.

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Statistical γ decay and isomeric ratio of ^{168}Er from resonance neutron capture

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γ-ray spectra following the radiative capture on well-isolated s-wave neutron resonances of ^{167}Er were measured with the Detector for Advanced Neutron Capture Experiments (DANCE) located at Los Alamos National Laboratory. This highly-segmented calorimeter is an ideal tool for detecting complete γ cascades due to its efficiency and solid angle coverage.

Information on quantities governing the γ decay within statistical model – level density and photon strength functions – were obtained from analysis of the experimental spectra and their simulated counterparts employing the modelling code DICEBOX. Conclusions about dipole photon strength functions, in particular the scissors mode, describing transitions to the ground state were found to be consistent with those reported for the neighboring well-deformed rare-earth nuclei.

Furthermore, γ decay in ^{168}Er is heavily influenced by the presence of a short-lived isomeric state at the excitation energy 1094 keV with the lifetime $\approx$ 100 ns. We were able to detect the cascades feeding the isomer and the isomeric decay and we deduced the isomeric ratio for a few resonances. The obtained values are not compatible with the isomeric ratio determined from simulations within the statistical model, as the simulated values are underestimated for all the tested model combinations.

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Structure of Ca isotopes between doubly closed shells

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Calcium nuclei between doubly closed shells, i.e. N=20 and N=28, offer a unique opportunity to investigate the evolution of nuclear structure from symmetric to neutron-rich systems. Along this isotopic chain, spherical configurations at shell closures are expected to be overcome by deformed

structures in mid-shell nuclei, already at low excitation energy. This will significantly affect the interplay between single-particle and collective excitations, as well as particle/hole-core coupling schemes which appear in odd-mass isotopes. In this context, Ca nuclei lie in a mass region where different theoretical models, with different predictive powers, can be applied and turn out to be complementary to each other. This embraces ab initio approaches [1], shell-model calculations [2], DFT's [3] and beyond-mean-field models [4-5].
In this work, we present recent results on the low-spin structure of $^{41-49}$Ca nuclei, populated in a series of (n,γ), neutron-capture experiments performed at Institut Laue-Langevin in Grenoble. These studies required the use of very rare target materials, such as ^{46}Ca and ^{48}Ca, as well as a radioactive ^{41}Ca sample. High-resolution γ-ray spectroscopy was performed by using the high-efficiency EXILL [6-7] and FIPPS [8] HPGe composite arrays. Several new γ rays were found, and level schemes were substantially extended up to the neutron-capture state, approaching a complete low-spin spectroscopy for these isotopes. Moreover, γ-ray angular correlations were performed in order to pin down the multipolarity of a number of transitions, thus helping in the spin-parity assignment of the observed states. A selection of the experimental results is discussed and compared with theoretical calculations, including those obtained with the Hybrid Configuration Mixing model recently developed by the Milano group [4,5,7].

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Study of fission dynamics following prompt gamma-ray spectroscopy

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Although nuclear fission has been discovered more than eight decades ago, the scenario related to the involvement of excitation energy (E_{ex}) and angular momentum (L) in controlling the reaction dynamics of a fissioning system has not been clearly understood. The potential energy surface of a fissioning system gets modified due to an enhancement in either one of the two or both the controlling parameters, which subsequently leads to the development of various fission modes of the concerned system. These observed fission modes are in general described on the basis of the random neck rupture model (i.e. brosa modes) [1]. In the present investigation, these features have been extensively studied for the most common fissioning system of ^{236}U produced at two different E_{ex} through two separate experiments: (i) ^{235}U(n_{th},f) during the EXILL campaign [2] at Institut Laue-Langevin (ILL), Grenoble, France, and (ii) ^{232}Th(α,f) during the INGA campaign [3] at (E_{lab} = 30 MeV) Variable Energy Cyclotron Centre (VECC), Kolkata, India. The later fissioning reaction can be considered as a surrogate to 14 MeV neutron-induced fission of ^{235}U, which is crucial for next-generation reactors. Prompt gamma-ray spectroscopy technique has been utilized to extract the relative even-even charge and mass yield distributions. Comparing the experimental results with the ENDF/B-VII.1 library results [4] reveals several features related to the role of E_{ex} and L in the

underlying dynamics of asymmetric and symmetric fission modes. This extensive study showed an interesting enhancement of symmetric fission yield component in surrogate reaction compared to the direct reaction mechanism. Detailed findings and explanations from the investigation will be presented at the workshop.

The EXILL and Indian National Gamma Array (INGA) collaborations are duly acknowledged. Help and support from the reactor operation staffs (at ILL, Grenoble), as well as the Cyclotron operation staffs (at VECC, Kolkata) are highly appreciated. This is a part of the work carried out with the financial assistance from the DAE-BRNS, Government of India [Project Sanction No. 37(3)/14/17/2016-BRNS].

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