Contribution ID : **63** Type : **Poster**

Evolution of nuclear shape around 28 shell gap in neutron deficient nuclei.

Tuesday, 18 July 2023 18:40 (15)

N,Z ~ 28 is the first shell gap originated due to the inclusion of spin - orbit (l.s) coupling term in the nuclear Hamiltonian. The lowering of $1f_{7/2}$ orbital from other fp space creates this shell gap though small excitation energy can excite nucleons from $1f_{7/2}$ orbital to upper fp orbitals and also to $1g_{9/2}$ orbital (depending upon the deformation of the system). The nuclei near stability line in neutron deficient side have proton Fermi energy below this 28 shell gap and neutron Fermi energy above 28 shell gap. The large shape driving effect of $1f_{7/2}$ and $1g_{9/2}$ orbitals can also bring collectivity in the system. Thus the nuclei in this mass region is a good testing ground to investigate the competition between the single particle excitation and collective excitation. Further the coupling between $2p_{3/2}$ and $1g_{9/2}$ orbitals ($\triangle$j=3, $\triangle$l=3), which are present in the configuration space can lead to octupole correlation in the system. Many interesting nuclear structure phenomenon are predicted and some of them are already observed in this mass region [1-6], including new magic numbers and prompt particle decay from the excited state.
An experiment was performed at VECC, Kolkata using 34 MeV α beam from K-130 cyclotron at VECC on ^{55}Mn target to populate nuclei around shape coexistent core (prolate and oblate shapes) of ^{56}Fe(Z=26, N=30) [1]. The aim was to see how the coupling of odd proton hole (^{55}Mn), odd neutron particle (^{57}Fe) and both proton and neutron hole (^{54}Mn) affects the structure of shape coexistent core of ^{56}Fe. The γ rays were detected using an array of 11 CS clover detectors placed at 3 different angles (2 at 40°, 6 at 90°, and 3 at 125°) and a LEPS detector at 40°. The PIXIE-16 digitizer based data acquisition system and IUCPIX package, developed by UGC-DAE CSR Kolkata [7], was used to record and process the data. The $\gamma\gamma$ symmetric and $\gamma\gamma\gamma$ matrices were constructed to establish the level scheme of the nuclei of interest. The asymmetric matrices were constructed to assign spin, parity and lifetime of the nuclear states. The analysis and interpretation have been almost completed.
Different nuclear shapes including spherical and deformed (both axial and triaxial shapes) at different excitation energies have been observed for these nuclei for the first time. The octupole correlation has also been observed. Detailed results will be presented in the conference.

References:

D. E. Appelbe et al., Physical Review C62, 064314 (2000)

E.K. Johansan et.al. , Eur. Phys. J. A 27, 157-165 (2006)

C.–H Yu et al., Physical Review C65, 061302(R) (2002)

N. Bendjaballah et al. Phys. Rev. Lett 36, 1536 (1976)

H. Kleis et al., Physical Review C104, 034310 (2021)

C. Andreoiu et.al. , Eur. Phys. J. A 14, 317-348 (2002)

S. Das et al., Nucl. Inst. Meth. Phys. Res. A 893, 138 (2018)

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Session Classification : Poster Session

Track Classification : Experimental Nuclear Structure