# Lifetime measurements in neutron deficient *I* nuclei having A<120

Anand Pandey[1,*], S. K. Chamoli[1], Ravi Bhushan[1], Aman Rohilla[2], Bharti Rohila[3], C. Majumder[4], Subodh[3], Kaushik Katre[5], A. Kumar[3], I. M. Govil[3], H. P. Sharma[6], S. Chakraborty[7], R.P. Singh[5], S. Muralithar[5], Yashraj[5]

[1]*Department of Physics and Astrophysics, University of Delhi, Delhi 110007, India*
[2]*Institute of Space Sciences and Physics, Shandong University, Weihai-264209, China.*
[3]*Department of Physics, Panjab University, Chandigarh 160014, India*
[4]*Department of Physics, Indian Institute of Technology Bombay, Mumbai-400076, India*
[5]*Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi 110067, India*
[6]*Department of Physics, Banaras Hindu University, Varanasi, India*
[7]*Variable Energy Cyclotron Centre, Kolkata-700064, India*
** Email: pandeyanand799@gmail.com*

## Introduction

In odd-A nuclei above Z ≈ 50, exhibit coexistence of states with different degrees of collectivity. The neutron deficient transitional nuclei (Z ≈ 53) features well developed rotational structures. The occupancy of [550]1/2$^-$ and [404]9/2$^+$ intruder orbitals from the bottom of $\pi h_{11/2}$ and top of $\pi g_{9/2}$ subshell respectively result in sizeable prolate quadrupole deformation, $\beta_2$ ~ 0.25. The competition between single-particle and collective degree of freedom determines the structure of nuclei at high spins. At high spins, the nuclear angular momenta are generated more efficiently by aligning valence nucleons rather than by the collective rotation of nuclei. In this scenario, rotational structure gives way to more complex single-particle structures. Non-collective oblate states have been observed to perturb the smooth nature of the yrast sequence in $^{115}$I [1]. In this context, the measurement of nuclear level lifetimes in neutron deficient $^{115}$I is important to understand the nucleon-nucleon interaction. Previously, spectroscopic investigations have been carried out in $^{115}$I [1,2]. In the present work, lifetimes have been measured for the excited states in $^{115}$I using Doppler Shift Attenuation (DSA) method.

## Experimental Details

The high spin states were populated using $^{93}$Nb ($^{28}$Si, α2n) $^{115}$I fusion evaporation reaction at a beam energy of 115 MeV provided by the 15UD pelletron accelerator present at IUAC, Delhi. High purity $^{93}$Nb thin target (thickness ~ 0.9 mg/cm$^2$) on an 8 mg/cm$^2$ thick Pb backing was used for the in-beam nuclear experiment. The de-excitation γ-rays produced in the reaction were detected using the Indian National Gamma Array (INGA) setup [3], consisting of 16 Compton suppressed Clover detectors arranged in five rings at angles 32°, 57°, 90°, 123°, and 148° with respect to the beam direction. Prompt $\gamma$ - $\gamma$ coincidences events (~ $10^8$) were collected in the 12 shifts of beam time experiment.

The list mode data acquired during experiment was calibrated for energy and efficiency using $^{152}$Eu source. Several asymmetric (Eγ-Eγ) matrices were constructed using INGAsort for the analysis purpose. For the DSAM analysis, all vs. 148$^0$, all vs. 90$^0$ and all vs. 32$^0$ matrices were utilized. The background subtracted spectra were projected by gating below (GTB) the transition of interest. The data was analyzed using the DECHIST, HISTAVER, and LINESHAPE codes by J. C. Wells [4]. The lifetime for some of the yrast states in $^{115}$I were successfully deduced for the first time.

## Results and Discussions

Partial level scheme of $^{115}$I [1] relevant to the present measurement is shown in Figure 1. All the yrast transitions were observed in the

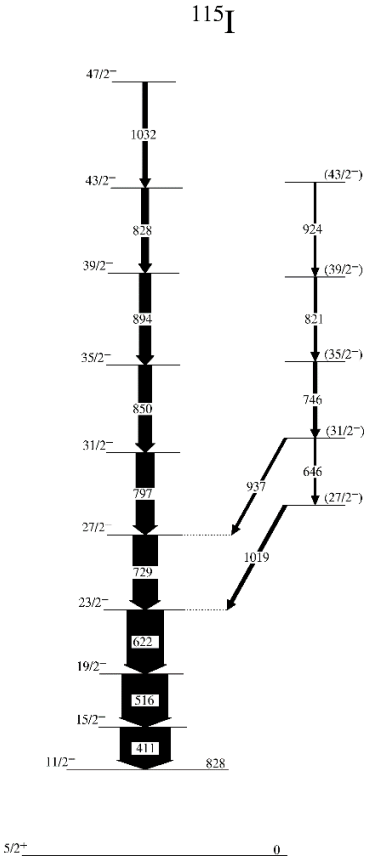


*Figure 1 Partial level scheme of $^{115}$I [1].*

411 keV gated coincidence spectra as shown in Figure 2. The typical lineshape observed for the two yrast transitions in $^{115}$I are shown in

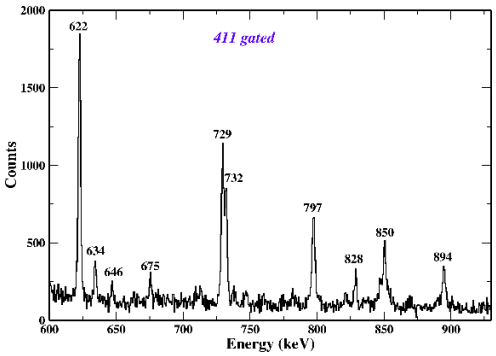


*Figure 2. Coincidence spectrum in $^{115}$I obtained from gating on 411-keV transition.*

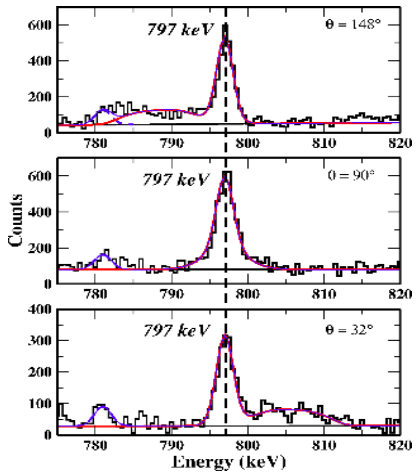


*Figure 3. Lineshape observed for 797 keV yrast transitions in $^{115}$I.*

Figure 3. Preliminary analysis has been carried out to evaluate the lifetime value of some of the yrast states. The detailed results will be presented at the time of conference.

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## References:

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