Gamma ray spectroscopy of ^{118}Cd from fission data

Kaushik Katre[1],* A. Sharma[2], I. Bala[1], Yashraj[1] , L. S. Danu[3], D. C. Biswas[3] , S. Muralithar[1] and R. P. Singh[1]

[1]*Inter University Accelerator Center, Aruna Asaf Ali Marg, New Delhi 110067, India*
[2]*Deptartment of Physics, Himachal Pradesh University, Shimla 171005, India*
[3]*Nuclear Physics Division, Bhabha Atomic Research Center, Mumbai 400085, India*
* *email: k_katre@iuac.res.in*

Introduction

Emergence and evolution of collective behaviors in nuclei is of prime importance in the quest to understand the nuclear many body problem. Transitional nuclei in A~100 are best candidates to study this evolution. In particular excitations in cadmium isotopes exhibit good interplay between single particle and collective degrees of freedom. In our effort to study some of these nuclei we have invoked ^{238}U(^{18}O,*f*) reaction. A number of neutron rich Cd and other isotopes were populated up to moderate spin in this reaction [1]. We describe below our study from this reaction for ^{118}Cd.

Experiment details

The experiment was performed using 15 UD pelletron accelerator facility at IUAC, New Delhi. A beam of ^{18}O of energy 100 MeV was bombarded on self supporting target of ^{238}U having thickness ~ 15 mg/cm^2 .The beam energy was about 20% above the coulomb barrier. The compound nucleus produced during reaction was ^{256}Fm having maximum excitation energy about 50 MeV. A large number of nuclei have been identified in this reaction [1]

The gamma (γ) rays emitted from the de-exciting fission fragment were detected by Indian National Gamma Array (INGA) which comprised of 18 Compton suppressed Clover detector [4]. The Clover detectors were mounted at a distance of about 24 cm from the target. The detectors were mounted at an angle of 32˚, 57˚, 90˚, 123˚ and 148˚ with respect to beam direction. The data collection was Hit-Pattern based using CANDLE Software [2]. The data were collected with minimum requirement of two or higher fold γ-ray coincidences in event-by-event mode. The Off line data analysis was carried out by using CANDLE and INGASORT [3] analysis programs .

Result and Discussion

A total of ~ 10^6 two and higher fold events have been collected in γ-γ matrix. The gain was matched so that the data from each detector had a constant energy dispersion of 0.5 keV per channel. The calibration was done using ^{152}Eu radioactive source. The angle independent E_γ -E_γ matrix was constructed. The matrix was constructed with gain of 0.5 keV per channel. Gain drifts observed for some crystal of the detectors were corrected using the in beam lines of identified dominant isotopes.

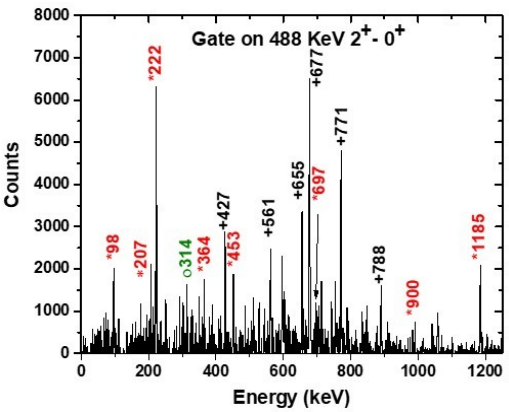

FIG. 1 γ-ray energy spectra obtained with gate on 2^+ - 0^+ (E_γ = 488 keV) of ground state band of ^{118}Cd. Gamma ray peaks marked with '+' are identified with ^{118}Cd nucleus, Gamma ray peaks marked with 'o' are identified with ^{128}Te nucleus [1], peaks marked by '*' are yet to be identified.

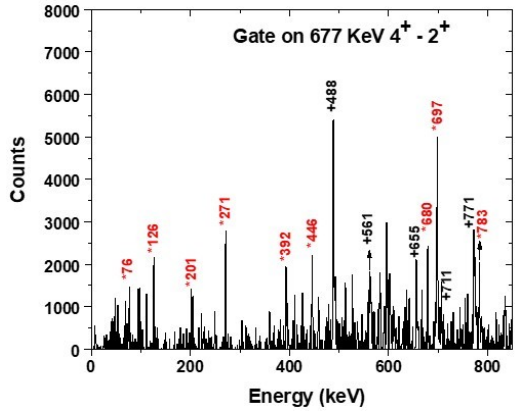

Fig. 2 γ-ray energy spectra obtain with gated on 4^+ -2^+ (E_γ = 677 keV) of ground state band of ^{118}Cd. Gamma ray peaks marked with '+' are identified with ^{118}Cd nucleus, peaks marked by '*' are yet to be identified.

The gamma energy spectra gated on the 2^+ - 0^+ (E_γ = 488 keV) and 4^+ - 2^+ (E_γ = 677 keV) ground state band for ^{118}Cd are shown in figures 1 and 2. In the gated gamma energy spectra we see the transition lines belonging to ^{118}Cd marked by "+" and ^{128}Te marked by "o" which is the dominant complimentary fragment of ^{118}Cd. Some of the lines marked by " * " are yet to be identified. Whether these lines belong to ^{118}Cd or complimentary nuclei are being investigated. In the literature states up to an excitation energy of about 4 MeV are identified in ^{118}Cd [5]. However no information on intensity of the γ- transition is mention. Many of the spin and parities are also tentative. Further analysis of the data is under progress and will be presented in the symposium.

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