Contribution ID: **40** Type: **not specified**

Coulomb excitation of superdeformed states in 42Ca

Monday, 27 June 2016 17:20 (20 minutes)

A Coulomb excitation experiment to study electromagnetic properties of the strongly-deformed band in 42Ca and its coupling to yrast states was performed at the Laboratori Nazionali di Legnaro in Italy using the gamma-ray spectrometer AGATA Demonstrator and the DANTE charged particle detector array. Gamma rays from Coulomb excited 42Ca nuclei were measured in coincidence with calcium projectiles back-scattered on 208Pb and 197Au targets and detected by three position-sensitive MCP detectors forming the DANTE array. For this study, the AGATA Demonstrator spectrometer consisting of three clusters was used for the first time in a nuclear physics experiment.

The motivation for this measurement was the observation of a rotational structure in 42Ca, which is similar to previously identified super-deformed bands in several A~40 nuclei, such as 40Ca, 36,38Ar, 44Ti. Lifetime measurements in 42Ca using the Doppler-shift attenuation method suggest a smaller deformation of the band built on the second 0+ state (1837 keV) than in the case of 40Ca. On the other hand, the moment of inertia of this band was found to be very similar to the one of the super-deformed band in 40Ca. Another argument for the highly-deformed character of this band was the observation of its preferential feeding by the low energy component of the highly split GDR decaying from 46Ti.

In the present experiment, Coulomb excitation was used for the first time to populate the highly-deformed band and to study its decay. Shape parameters of a weakly-deformed ground-state band and highly-deformed slightly triaxial side band in 42Ca were determined from E2 matrix elements measured in the first low-energy Coulomb excitation experiment performed with AGATA. The picture of two coexisting structures is well reproduced by new state-of-the-art large-scale shell model and beyond-mean-field calculations. In this talk the experimental evidence for superdeformed and slightly triaxial character of the band built on the excited 0+ state will be discussed.

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Session Classification: Nuclear Structure with Radioactive beams