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Coulomb excitation of 66Ge

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The Coulomb excitation of ^{66}Ge has been performed for the first time using "safe" bombarding energies at the HIE-ISOLDE facility at CERN. Motivation to study ^{66}Ge arises from the anomalous rotational behaviour of the high-lying first 2_1^+ state observed in even-even isotopes in the $A \sim 70$ region [1]. Low-lying 0^+ excited states have been determined for even-even neutron-deficient Se[2] and Kr[3] isotopes, which are signatures of shape coexistence [4]. In particular, the Germanium and Selenium isotopes have received a considerable amount of interest because they lie between the doubly magic ^{58}Ni and the strongly deformed neutron-deficient ^{76}Sr isotopes. This region has shown a complicated interplay between non-collective and collective degrees of freedom due to large sub-shell gaps at both prolate and oblate deformation for proton and neutron numbers $N, Z = 34, 36$ [4,5]. In addition, macroscopic-microscopic models suggest gamma-softness for ^{64}Ge through oblate-prolate shape coexistence in ^{68}Se and ^{72}Kr to some of the most deformed nuclei at ^{76}Sr and ^{80}Zr.

A particle-γ coincidence experiment using the MINIBALL array and double-sided silicon detectors has allowed the determination of transitional and diagonal matrix elements in ^{66}Ge, yielding new measurements of the reduced transition probability connecting the ground and the 2_1^+ states, or $B(E2; 0_1^+ \rightarrow 2_1^+)$ value, and the spectroscopic quadrupole moment of the 2_1^+ state, $Q_S(2_1^+)$. A relatively large $B(E2) = 29.4(30)$˜W.u. has been extracted using beam-gated data at forward angles – less sensitive to second-order effects – as compared with the adopted value of $16.9(7)$ W.u., but in closer agreement with modern large-scale shell-model calculations using a variety of effective interactions and beyond-mean field calculations. A spectroscopic quadrupole moment of $Q_S(2_1^+) = +0.41(12)$ eb has been determined using the reorientation effect from the target-gated data at projectile backward angles – more sensitive to the reorientation effect. Such an oblate shape is in agreement with the corresponding collective wavefunction calculated in the present work using beyond mean-field calculations and its magnitude agrees with the rotational model, assuming $B(E2) = 29.4(30)$ W.u.

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Authors: Dr ABRAHAMS, Kenzo; Prof. ORCE GONZALEZ, Jose Nicolas (University of the Western Cape (ZA))

Co-authors: GAFFNEY, Liam (University of Liverpool (GB)); JENKINS, David (University of York); AKAKPO, Elijah (The University of the Western Cape); BROWN, Adam Sebastian (University of York (GB)); DOHERTY, Daniel (University of Surrey (GB)); Dr GARRETT, Paul; MEHL, Craig Vernon (University of the Western Cape (ZA)); NGWETSHENI, Cebo (University of the Western Cape (ZA)); Prof. NTSHANGASE, Sifiso (University of Zululand); Dr RAJU, Kumar; SPAGNOLETTI, Pietro Nicola (UWS - Univ. of West of Scotland (GB)); WADSWORTH, Robert (University of York); ZIELINSKA, Magdalena (CEA Saclay); Mr MONTES, Elias (The University of the Western Cape); Dr RAINOSKI, Georgi (Sofia)

Presenter: Dr ABRAHAMS, Kenzo

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