

Collectivity of Exotic Silicon Isotopes

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The determination of the strength of the electric quadrupole transition between the ground state and first excited state with spin-parity $J^\pi = 2^+$ (the $B(E2; 0^+ \rightarrow 2^+)$ value) in an even-even nucleus provides a measurement of the low-lying quadrupole collectivity. The $B(E2)$ values for the $Z=14$ nuclei $^{34,36,38,40,42}\text{Si}$ were measured via intermediate-energy Coulomb excitation at the National Superconducting Cyclotron Laboratory in East Lansing, Michigan. The secondary beams were produced by the fragmentation of a ^{48}Ca primary beam guided onto a high- Z secondary target. De-excitation gamma-rays, indicative of the inelastic process, were detected around the secondary target position with the high-efficiency scintillator array CAESAR in coincidence with scattered particles tracked on an event-by-event basis in the S800 spectrograph. The results comprise the first measurements of the quadrupole collectivity of $^{40,42}\text{Si}$. The measured $B(E2)$ values are compared to large-scale shell model calculations and provide insight into the evolution of shell structure and deformation in this region. This work was supported by the National Science Foundation under grants PHY-0606007, PHY-0722822 and PHY-0758099.