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On the Shape of ^{20}Ne : Solution to Long-Standing Nuclear Conundrum

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The spectroscopic quadrupole moment of the first excited 2_1^+ state, $Q_s(2_1^+)$, at 1.633 MeV in ^{20}Ne has been determined from reorientation effect Coulomb-excitation measurements at safe energies using the {small AFRODITE} array at iThemba LABS. A diagonal matrix element of $\langle 2_1^+ || \hat{E}2 || 2_1^+ \rangle = -0.34(5)$ eb yields a large value

of $Q_s(2_1^+) = -0.26(4)$ eb, which presents strong discrepancies when compared with cluster-model and mean-field calculations, which underestimate it by at least 30%, and is in disagreement by 3σ with the collective model of Bohr and Mottelson. Nevertheless, a slightly larger nuclear polarizability than the one assumed in previous work resolves this 45-year old conundrum between Coulomb-excitation measurements versus nuclear theory and the collective model.

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