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Exotic light nuclei; The structure of ^{12}C and the mirror states of ^{9}Be | ^{9}B

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Despite all the information we have accumulated during the past decades about the structure of ^{12}C we have not resolved a number of detail, for example, the geometry of its second excited state at 7.65 MeV (0^+), the Hoyle-State, has not yet been solved. Recent results have showed a possible 2^+ resonance between 9-12 MeV that could be related with a collective rotational or vibrational excitation while a resonance at 13.3 MeV is a strong candidate for the corresponding 4^+ excitation. In particular, a most recent measurement in which a new high spin Jπ = 5^- resonance at 22.4 MeV which matches with that predicted ground state rotational band of an oblate equilateral triangle with a D3h symmetry. Symmetry that was observed for the first time in nuclear physics. Through angular correlations it was possible to characterize the 22.4 state in terms of spin and parity.
The structure of A=9 nuclei are relevant in astrophysics and nuclear structure. The measurement of the low-lying excited states in 9B nucleus through the ^{9}Be(^{3}He,t)^{9}B reaction, with the K600 spectrometer in conjunction with a segmented silicon detector array was performed at iThemba LABS facility. Of particular interest was the investigation of the first ½$^+$ state in ^{9}B in order to address discrepancies that currently exist between theoretical models in describing these nuclei.

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