Octupole correlations in ^{118}Xe; A fresh look via lifetime measurement

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The Xe nuclei with mass A < 120 are perfectly placed to study the octupole correlations phenomena. For these nuclei, the presence of octupole driving $h_{11/2}$ and $d_{5/2}$ orbitals near the Fermi surface make them suitable to exhibit octupole correlation. Other than Xe nuclei such octupole correlations have also been reported in several other isotopes of Cs and Ba having N < 70. In previous high spin gamma ray spectroscopy measurements in ^{118}Xe nuclei though the octupole correlations have been reported in Refs. but in almost all the cases a precise data on parity assignments and the quadrupole moment of the bands involved were missing. Also, in cases where the octupole correlations has been discussed in relation to the observed inter-band transitions, 1022 keV ($7^- \rightarrow 6^+$), 846 keV ($9^- \rightarrow 8^+$), 726 keV ($11^- \rightarrow 10^+$) and 924 keV ($8^- \rightarrow 8^+$) in ^{118}Xe, the quoted B(E1) values have errors in the range from 4% to 28%. One of the important source of uncertainty in these E1 values is the quadrupole moment of the bands involved apart from the observed low intensity of these transitions. In the present work, the ^{118}Xe nucleus was reinvestigated with the aim: 1) to update the level scheme with inclusion of more γ transition in the non-yrast bands (if any), 2) to confirm the suggested parities of various excited bands with polarisation measurements and 3) to get a precise value of the quadrupole moment of the bands involved in octupole correlations by lifetime measurement of excited states. We have also performed the triaxial projected shell model (TPSM) calculations to investigate the observed band structures further.

High spin states in ^{118}Xe have been populated via ^{93}Nb (^{28}Si, xpyn) ^{118}Xe fusion-evaporation reaction at a beam energy of 115 MeV provided by the 15 UD pelletron accelerator facility at the Inter University Accelerator Center, New Delhi. In the experiment, several new γ-transitions have been found and are placed appropriately in the level scheme. Theoretical study using the triaxial projected shell model (TPSM) approach suggests that the first band-crossing is due to the alignment of two neutrons, and a parallel band tracking the yrast configuration is the γ-band built on the two-quasiparticle state. Enhanced E1 transition rates have been obtained between opposite parity bands, involving $\nu h_{11/2}$ and $\nu d_{5/2}$ orbitals having $\Delta j = \Delta l = 3$, indicates the presence of octupole correlation in this nucleus. More details of the analysis and the physics outcomes will be discussed during the presentation.