A study of the excited 0^+ states in ^{188}Pb

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In Pb isotopes close to the neutron mid-shell at N=104, experimental evidence for shape-coexisting configurations and associated collective bands has been observed. These structures intrude down to energies close to the spherical ground state and can be associated with intruder 2p-2h and 4p-4h proton shell-model excitations across the Z=82 energy gap. Calculations using the deformed mean-field approach, essentially equivalent to the shell-model method, reveal three different shapes (spherical, oblate and prolate configurations). It remains a challenge for both theoretical and experimental studies to obtain a consistent and detailed description of all the observed phenomena.

The low-lying excited 0^+ states in ^{188}Pb have been probed in γ-decay fine structure studies or in-beam conversion electron measurements. γ-ray experiments have identified an exited 0_2^+ state at 591 keV and associated it with a prolate structure [1,2]. These findings are in contrast with earlier measurements which reported a 0_2^+ at ~570 keV [3,4]. Candidates for the 0_3^+ state associated with a prolate at 767 keV was also proposed by Allatt et al. [4]. An in-beam conversion electron spectroscopy measurement performed by Le Coz et al., proposed the two low-lying 0^+ states at 591 keV (oblate) and 725 keV (prolate) [5]. Consequently, together with the spherical ground state, the three 0^+ states with largely different structures reflect the triple-shape coexistence phenomenon in ^{188}Pb. Moreover, the triple-shape coexistence has been revealed by the existence of three isomeric states associated with different structures (spherical 12^+, oblate 11^- and prolate 8^-) and characteristic band structures on top of these states [6].

In this presentation we will discuss the simultaneous in-beam measurement of γ rays and internal conversion electrons of ^{188}Pb performed at the Accelerator Laboratory of the University of Jyväskylä, Finland, employing the SAGE spectrometer [7]. We will introduce our findings on the excited 0^+ states and the interband transitions and present our state-of-the-art simulation code employing the NPTOOL framework [8] in Geant4 [9].

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