

Complete Spectroscopy of Negative Parity States in ^{208}Pb with $E_x \lesssim 6.5$ MeV

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The study of the doubly magic nucleus ^{208}Pb is of key interest as more and more doubly magic nuclei come into the reach of modern experiments. The schematic shell model without residual interaction (SSM [1]) predicts 70 particle-hole states with negative parity for $E_x^{SSM} < 6361$ keV (Fig. 1, left panel). Recent experiments revealed new identifications, new spin and parity assignments for many states [1]. The main source of information comes from the study of the inelastic proton scattering on ^{208}Pb via isobaric analog resonances (IAR) in ^{209}Bi . Additional data is known [2], especially for the $^{207}\text{Pb}(d,p)$ reaction. The excitation of the states by these two reactions is highly selective; they excite only certain neutron particle-hole configurations in each state. In Fig. 1 neutron and proton configurations are marked by solid and dotted lines, respectively. Experiments on the $^{208}\text{Pb}(p,p')$ and $^{207}\text{Pb}(d,p)$ reactions have been performed with the Q3D magnetic spectrograph of the Maier-Leibnitz-Laboratorium at München at an energy resolution of 3 keV FWHM. The $^{208}\text{Pb}(p,p')$ reaction via an IAR LJ in ^{209}Bi is equivalent to the neutron pickup reaction on a target of ^{209}Pb in an excited state LJ . In each state of ^{208}Pb , it excites the components $LJ^{+\nu} \otimes lj^{-\nu}$ with a neutron hole lj and a neutron particle LJ . The sum rules for 64 out of 70 particle-hole configurations with spins $0^- - 8^-$ are thus found to be complete within 10%; the completeness of six not directly detectable configurations (built with the $f_{5/2}^{+\pi}$ proton) is deduced. The presence of a large gap in the SSM space at $6033 \leq E_x^{SSM} < 6361$ keV together with the determination of the configuration mixing in all 70 states allows to deduce matrix elements of the residual interaction [3].

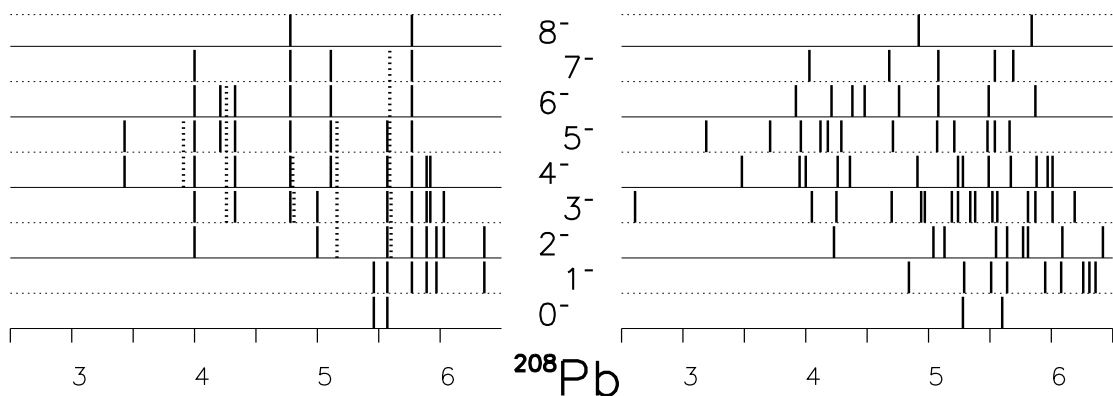


Figure 1: (left) SSM configurations, (right) identified states with spins $0^- - 8^-$ and $2.5 < E_x \lesssim 6.5$ MeV.

[1] A. Heusler et al., Phys. Rev. C 74:034303 (2006); Phys. Rev. C 75:024312 (2007); Phys. Rev. C 82:014316 (2010); Eur. Phys. J. A 46:17 (2010); Eur. Phys. J. A 47:22 (2011); J. Phys. (London) G 38:105102 (2011).

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