

## Positive Parity States in $^{208}\text{Pb}$

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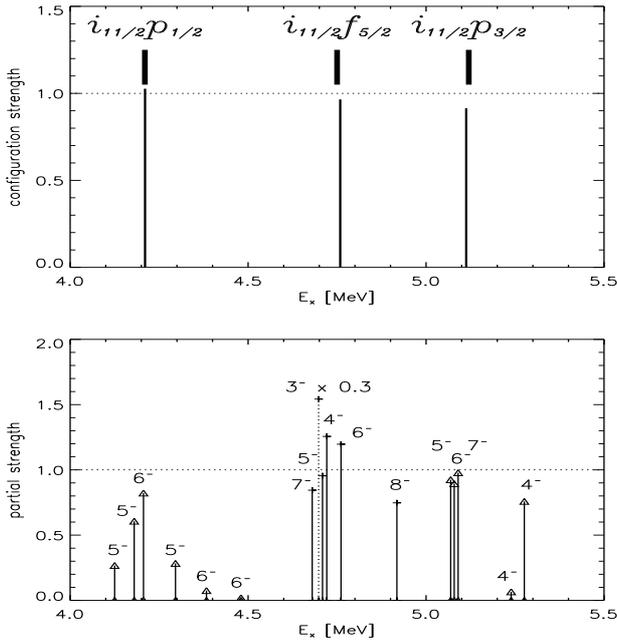
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Data from the  $^{208}\text{Pb}(p, p')$  experiment performed in 2003 [1] and an accompanying experiment of  $^{207}\text{Pb}(d, p)$  performed in 2004 are still being evaluated. Results discussing the  $i_{11/2}f_{5/2}$  and  $i_{11/2}p_{3/2}$  multiplets in  $^{208}\text{Pb}$  are published [2]. Fig. 1 summarizes the results. The mixing strength in the two lowest  $0^-$  states in  $^{208}\text{Pb}$  mainly derived from the  $^{207}\text{Pb}(d, p)$  experiment is discussed in [3].

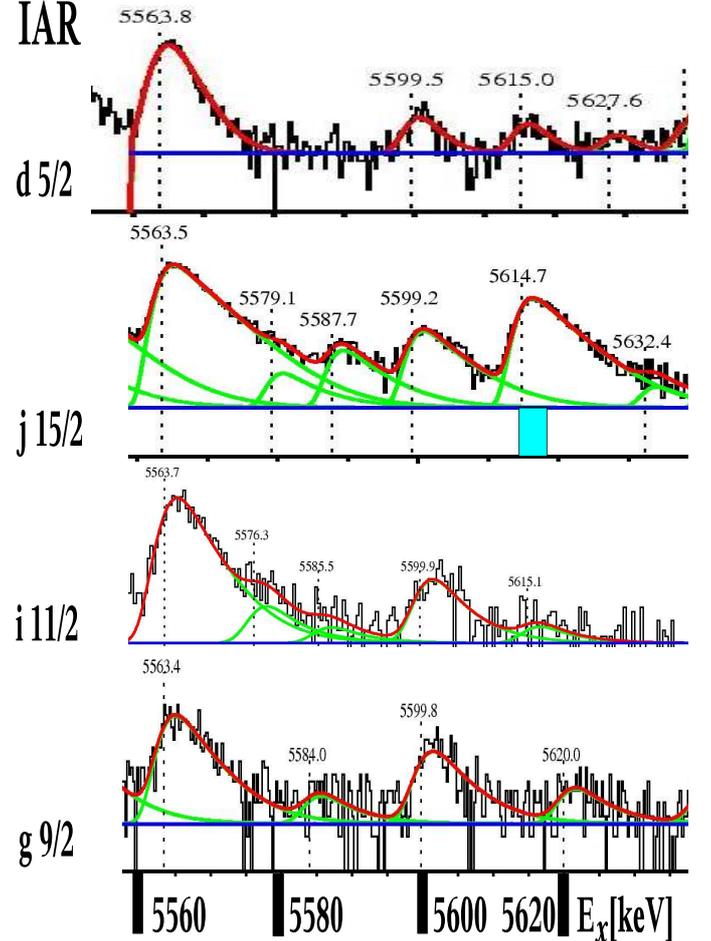
**Fig. 1:** (Lower) The states bearing the main strength of the particle-hole configurations  $i_{11/2}p_{1/2}$ ,  $i_{11/2}f_{5/2}$ ,  $i_{11/2}p_{3/2}$  with spins  $5^-$  and  $6^-$ ,  $3^- - 8^-$ ,  $4^- - 7^-$ , respectively, are identified. Each multiplet is spread across about 300 keV. (Upper) For each multiplet, the derived centroid excitation energy and the total configuration strength agree remarkably well with the shell model without residual interaction as indicated by thick bars and the dotted line, respectively – excepting the 4698  $3^-$  state with strong admixtures of configurations  $g_{9/2}p_{3/2}$  and  $d_{5/2}p_{1/2}$ .



The intruder resonance  $j_{15/2}$  in  $^{209}\text{Bi}$  is of special interest, since it populates positive parity states. Fig. 2 shows spectra of 80 keV length taken on four of the seven known analog resonances. With a resolution of up to 2.5 keV, about 6 states are identified, but only two states are known. The assignment of spin and dominant configuration is based on the comparison of the angle averaged cross section to single particle decay widths derived from the experiment [2] and shell model calculations. The state at  $E_x = 5615$  keV is identified to have dominant  $j_{15/2}p_{3/2}$  strength. From similar measurements of the excitation functions, especially at three proton energies close

to the  $j_{15/2}$  resonance, in a preliminary analysis we identify more than 20 states with components of the configurations  $j_{15/2}p_{1/2}$ ,  $j_{15/2}f_{5/2}$ ,  $j_{15/2}p_{3/2}$ . The shell model predicts 40 1p-1h states with positive parity and spins  $5^+ - 10^+$  below  $E_x = 6.1$  MeV.

**Fig. 2:** Spectra of  $^{208}\text{Pb}(p, p')$  taken on the  $g_{9/2}$ ,  $i_{11/2}$ ,  $j_{15/2}$ ,  $d_{5/2}$  analog resonance in  $^{209}\text{Bi}$  shown on a logarithmic scale. The states at  $E_x = 5563$  and  $5599$  keV are known to have spin  $3^-$  or  $4^-$  and  $0^-$ , respectively. The level at  $E_x = 5615$  keV is excited on the  $j_{15/2}$  resonance in a selective manner.



### References

- [1] A. Heusler, G. Graw, R. Hertenberger, H.-F. Wirth and P. von Brentano, Annual report 2003, p. 21; Annual report 2004, p. 21
- [2] A. Heusler, G. Graw, R. Hertenberger, F. Riess, H.-F. Wirth, T. Faestermann, R. Krücken, J. Jolie, D. Mücher, N. Pietralla, P. von Brentano, Phys. Rev. **C74** (2006) 03403
- [3] A. Heusler, G. Graw, R. Hertenberger, F. Riess, H.-F. Wirth, R. Krücken, P. von Brentano, Phys. Rev. **C75** (2007) 024312