SHELL STRUCTURE STUDIES IN THE Pb-REGION

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The 3s-proton occupancy in ^{208}Pb is of considerable interest in determining the role of short-range correlations. Absolute spectral functions from the (e,e′p) reaction and other observables indicate an occupancy of about 50%, far below the many-body theory predictions of 60 to 90%. In order to determine this important quantity, we use the CERES (Combined Evaluation of Relative spectroscopic factors and Electron Scattering) method,[1] which avoids the use of questionable absolute spectroscopic factors and accounts for experimental cutoffs in the spectroscopic sums by a network of interrelated relative spectroscopic factors from (d,^{3}He), (e,e′p) and (^{3}He,d) reactions and information from elastic electron scattering. To supplement previous (d,^{3}He) experiments with poorer energy resolution on ^{205}Tl(Ref. 2) and ^{206}Pb(Ref. 3), we measured (d,^{3}He) cross sections and vector analyzing powers at 80 MeV incident energy on the isotone triplet ^{204}Hg, ^{205}Tl, and ^{206}Pb, all relative to ^{208}Pb.

The measurements were preformed the with K600 magnetic spectrometer. Targets of isotopically enriched ^{204}HgS, ^{205}Tl, evaporated on thin carbon backings, and ^{206}Pb, as a self-supporting foil, were used. Particle identification was established via time of flight through the spectrometer. An energy resolution of about 30 keV was achieved, enough to separate the 39 keV ground state doublet of ^{203}Au. Portions of ^{3}He spectra are shown in Fig. 1.

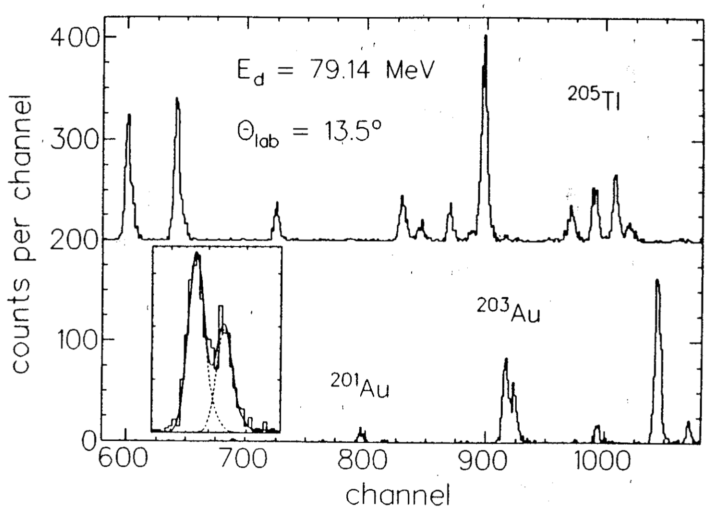

Figure 1. Parts of ^{3}He-spectra from ^{206}Pb (top) and ^{204}Hg (bottom) with equal energy scales as used to determine the Q-values for ^{202,204}Hg.

As a by-product we were able to determine the atomic masses of ^{201}Au and ^{203}Au with much greater accuracy compared to in previous experiments.[4] For the Q-value of the (d,^{3}He) reaction on the ^{204}Hg target nucleus and a ^{202}Hg contaminant we obtained Q= −3340.9 (3.4) keV and −2738.8 (3.5) keV, respectively, which reduces the errors on the

Differential cross sections and vector analyzing powers were measured in an angular range of 4° to 28°. Samples for ^{208}Pb are shown in Fig. 2. Unique l, j-assignments and relative spectroscopic factors were extracted using finite-range DWBA calculations (see solid curves in Fig. 2). In the ^{205}Tl(d,^{3}He) reaction we found, so far, no positive evidence for s-strength near 3.89 MeV, which removes the previous discrepancy with (e,e′p) experiments. The data obtained on ^{204}Hg largely agree with previous (t,α) work.[4] The CERES sum rule analysis is in progress.

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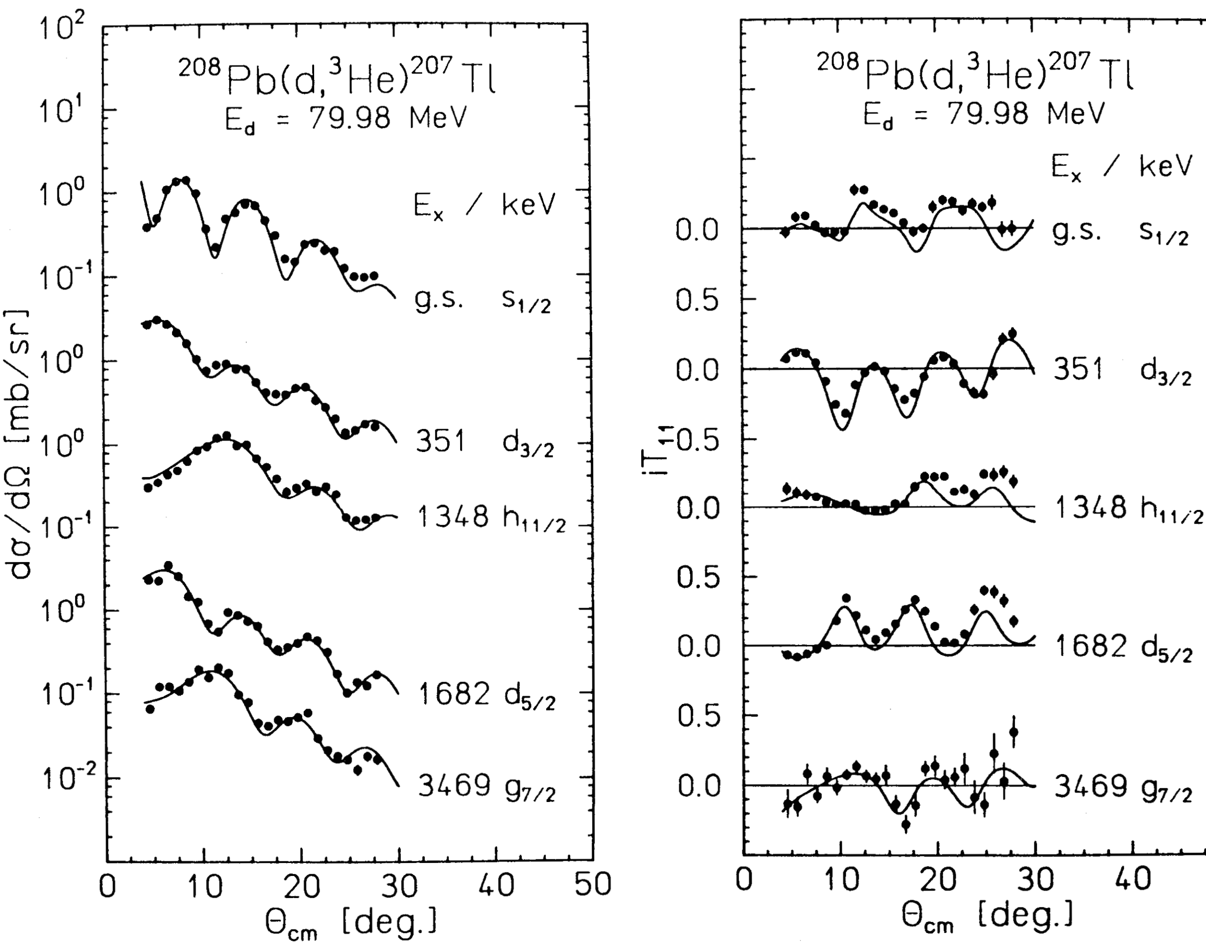

Figure 2. Differential cross sections and vector-analyzing powers for transitions on the reference target ^{208}Pb. Solid curves represent finite-range DWBA calculations.