# $^{92}$Zr(p,p′), (pol p,p′) 1979De11,1968Di05

| Type | Author | History Citation | Literature Cutoff Date |
|---|---|---|---|
| Full Evaluation | Coral M. Baglin | NDS 113, 2187 (2012) | 15-Sep-2012 |

Others: 2011Re01, 2004He24, 2011Wa01, 1994PlZY, 1986Pl03, 1984Ka13, 1983Ba06, 1982Cr02, 1982Dj04, 1982Ka27, 1982Sc17, 1981An08, 1980Sc21 [E(pol p)=160 MeV], 1981Ba54, 1979Pl01, 1978De28, 1977De03, 1976De09, 1973OwZZ [E(p)=61 MeV], 1967Ma14, 1966St15.

2011Re01: calculated $\sigma(\theta)$ for 2330 level for E(p)=14.25 MeV, 19.4 MeV, 30 MeV, 103.5 MeV for comparison with existing measurements.

2011Wa01: calculated momentum-transfer dependence of $\sigma$ At E(p)=800 MeV for the fully-symmetric (934-keV) and the mixed-symmetry (1850) $2^+$ states for comparison with new measurements performed At iThemba labs (FWHM=30) and data from 1983Ba06; see also 2006VoZY.

2004He24: E(p)=50 MeV; calculated $\sigma(\theta)$ for elastic scattering.

1994PlZY: E(pol p)=18.6 MeV; $\theta$(c.m.)≈45°−110° (6 angles); A($\theta$), 930 level.

1986Pl03: E(pol p)=20 MeV; $\theta$(c.m.)≈30°−150°; $\sigma(\theta)$A($\theta$); 930, 1850, 2070, 4420 levels.

1984Ka13: E(pol p)=103.5 MeV; FWHM≈250 keV; $\theta$(lab)=12°−28°; $\sigma(\theta)$, A($\theta$); DWBA; deduced $\beta_L$R; 0, 930, 1490, 2350, 2470 levels; GQR and GMR+GDR regions.

1983Ba06: E(pol p)=800 MeV; FWHM=120 keV; $\theta$(c.m.)≈3°−20°; $\sigma(\theta)$, $A_y(\theta)$; DWBA. See also 1981Ba54.

1982Cr02: E(p)=201 MeV; FWHM=80 keV; $\theta$(c.m.)≈5°−55°; $\sigma(\theta)$; DWBA; M1 giant resonance. See also 1982Dj04, 1981An08.

1982Ka27: E(p)=115 MeV; FWHM=250 keV; $\theta$(lab)=14°−30°. $\sigma(\theta)$; DWBA; giant resonances.

1982Sc17: E(pol p)=104 MeV; $\theta$(c.m.)=12.5°−51°; $\sigma(\theta)$, $A_y(\theta)$; Optical model; elastic only.

1979De11: E(pol p)=40 MeV; FWHM=60-80 keV; $\theta$(c.m.)≈20°−120 ‘; $\sigma(\theta)$, A($\theta$); 930, 1500, 2340, 2480 levels. See also 1978De28, 1977De03.

1979Pl01: E(pol p)=20 MeV; $\theta$(c.m.)≈30°−150°; A($\theta$); 930, 1500, 1850, 3230, 4040+4060 levels.

1977De03: E(pol p)=30 MeV, FWHM=80-100 keV; $\theta$(c.m.)≈25°−125°. $\sigma(\theta)$, A($\theta$); DWBA. See also 1976De09.

1968Di05: E(p)=12.7 MeV, FWHM=40 keV, $\theta$(lab)=25°−165°; ΔE≤1%; DWBA; 21 levels.

1967Ma14: E(p)=14.25 MeV, $\theta$(c.m.)≈30°−140°; 17 levels.

1966St15: E(p)=19.4 MeV, FWHM=80 keV, ΔE=10 keV, $\theta$=20°−160°; DWBA; 18 levels.

For the 930($2^+$), 2330($3^-$), 1490($4^+$) and 2480($5^-$) states, coupled-channel calculations using the vibrational model reproduce measured cross sections and analyzing powers well (1979De11).

## $^{92}$Zr Levels

| E(level)[†] | L[‡] | $\beta_L$[#] |
|---|---|---|
| 0.0 | | |
| 930 *10* | 2 | 0.13 |
| 1370 *14* | 0[@] | |
| 1490 *10* | 4 | 0.068 |
| 1850 *10* | 2[d] | 0.055 |
| 2050 *10* | 2 | 0.043 |
| 2180?[b] *22* | | |
| 2330 *10* | 3 | 0.18 |
| 2470 *10* | 5[@] | 0.075[@] |
| 2651?[a] | | |
| 2815 | | |
| 2850 *10* | (2) | 0.054 |
| 2950[a] | | |
| 3040 *10* | 2 | 0.039 |
| 3180 *32* | | |
| 3220 *10* | 4[@] | 0.06[@] |
| 3320 *10* | | |
| 3440[c] *10* | 4[@] | 0.09[@] |
| 3620 *10* | | |

Continued on next page (footnotes at end of table)

## $^{92}$Zr(p,p′), (pol p,p′) 1979De11,1968Di05 (continued)

### $^{92}$Zr Levels (continued)

| E(level)[†] | Jπ | L[‡] | $\beta_L$[#] | Comments |
|---|---|---|---|---|
| 3870 *10* | | | | |
| 3940?[&] *39* | | | | |
| 3990[&] *40* | | | | |
| 4020 *10* | | | | |
| 4150 *10* | | | | |
| 4300 *10* | | | | |
| 4430[c] *10* | | (2) | 0.064 | |
| 4720[&] *47* | | | | |
| 8.8×10$^3$[e] *2* | 1$^+$[e] | 0[e] | | Jπ: from L=0. |
| 14.4×10$^3$[f] *2* | | 2+4[f] | | |
| 17.5×10$^3$[g] *3* | | 0+1+4[g] | | |

[†] From 1966St15 if ΔE=10 keV, from 1968Di05 if ΔE>10 keV and from 1967Ma14 if ΔE unstated. E values from 1966St15 are typically 15 to 20 keV low, based on comparison with adopted E for E<3300. An additional level at 2750 *10*, reported by 1966St15 and 1967Ma14, has been reassigned by 1968Di05 to $^{90}$Zr.

[‡] Deduced from DWBA analysis of $\sigma(\theta)$ (1966St15).

[#] $\beta_L$-values from 1966St15.

[@] From 1968Di05.

[&] Observed by 1968Di05 only.

[a] Observed by 1967Ma14 only.

[b] Reported by 1969Di05 only. Energy similar to that of known $^{90}$Zr state but, based on peak strength in the $^{92}$Zr spectrum, authors conclude that it cannot be ascribed to $^{90}$Zr alone.

[c] Possible doublet; 1968Di05 report peak broader than expected for single level (1968Di05).

[d] From 1983Ba06.

[e] From 1982Cr02, for M1 giant resonance; Γ=1.4 MeV *2* (1982Cr02,1982Dj04) (supersedes 1.7 MeV *2* from 1981An08).

[f] From 1984Ka13, for GQR; Γ=3.6 MeV; %EWSR: 43% 6 (L=2), 4.0% 15 (L=4). Other: 1982Ka27.

[g] From 1984Ka13, for GMR+GDR; Γ=3.3 MeV; %EWSR: 27% 12 (L=0), 9.5% 25 (L=4), 65% (L=1). Note, however, that observed Γ for this L=0+1+4 resonance is less than that in (γ,n) for GDR alone. Other: 1982Ka27.