

Coulomb excitation [2006Sp01,1982Ve09,1977Sc36](#)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 201,1 (2025)	31-Oct-2024

Also includes inelastic scattering in [1991A119](#).

[2006Sp01](#): $^{12}\text{C}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=65 MeV ^{32}S beam from the Cologne tandem accelerator. Target was 0.33 mg/cm² natural carbon.

Scattered particles were detected with a Si counter and γ rays were detected with a NaI(Tl) and a Ge detectors. Measured E_γ , $\gamma(\theta, H, t)$, particle- γ -coin, Doppler-shift attenuation. Deduced lifetime, g-factor, B(E2) for 2230 level. Comparisons with shell-model calculations.

[1991A119,1989A114](#): $^{27}\text{Al}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=100 MeV ^{32}S beam from the XTU-Tandem of the Legnaro National Laboratories. Target was 30 $\mu\text{g}/\text{cm}^2$ ^{27}Al on a carbon backing. Scattered particles were detected with two silicon position-sensitive detectors. Measured particle yields. Deduced B(E3) and deformation parameters for 2230 ([1989A114](#)) and 5010 ([1991A119](#)) levels from DWBA analysis of measured inelastic-scattering $\sigma(\theta)$.

[1982Ve09](#): $^{208}\text{Pb}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=122-160 MeV ^{32}S beams from the ANU 14UD Pelletron accelerator. Target was enriched PbS (98.7%). Scattered particles were detected with an annular silicon surface-barrier detector. Measured ^{32}S yield. Deduced static quadrupole moment and B(E2) for 2230 level.

[1981Da08](#): $^{60}\text{Ni}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=70-73 MeV ^{32}S beams were from the Munich MP tandem accelerator. Target was 240 $\mu\text{g}/\text{cm}^2$ enriched (99.8%) ^{60}Ni foil. Scattered particles were detected with an annular particle counter and γ rays were detected with a NaI(Tl) and a Ge(Li) detectors. Measured ^{32}S and γ -ray yields, particle- γ coin. Deduced static quadrupole moment for 2230 level.

[1980Ba40](#): $^{208}\text{Pb}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=122 MeV ^{32}S beam was from Chalk River. Target were enriched (99.14%) ^{208}Pb and/or PbO with thicknesses of 30-50 $\mu\text{g}/\text{cm}^2$. Scattered particles were momentum-analyzed with a Q3D spectrometer and detected with a position-sensitive heavy-ion gas counter. Measured $\sigma(E(^{32}\text{S}),\theta)$. Deduced static quadrupole moment of 2230 level. [1980Ba40](#) also report lifetime of 2230 level using $^4\text{He}(^{32}\text{S},\alpha'\gamma)$ with DSAM method. See ($\alpha,\alpha'\gamma$) data for details.

[1977Sc36](#): $^{28,29,30}\text{Si}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=47-51 MeV ^{32}S beams from the single MP Tandem Van de Graaff at Brookhaven National lab. γ rays were detected with a Ge(Li) detector. Measured γ -ray yield, Doppler-shift attenuation. Deduced lifetime and B(E2) for 2230 level.

[1974OI02](#): $^{204}\text{Pb}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=100, 112.5 and 125 MeV ^{32}S beams were from the Chalk River. Target was 90% enriched ^{204}Pb with a thickness of about 1mg/cm². Scattered particles were detected with an annular particle counter and γ rays were detected with NaI(Tl) detectors. Measured particle- γ -coin, yield, $\gamma(\theta, H, t)$. Deduced static quadrupole moment and B(E2) for 2230 level; g-factor for ^{204}Pb .

[1971Ha47](#): $^{112}\text{Cd}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=90 and 100 MeV ^{32}S beam from Chalk River MP Tandem accelerator. Target was 340 $\mu\text{g}/\text{cm}^2$ metallic ^{112}Cd . Scattered particles were detected with an annular surface-barrier detector and γ rays were detected with NaI(Tl) detectors. Measured ^{32}S and γ -ray yields, particle- γ -coin. Deduced matrix elements, static quadrupole moment and B(E2) for 2232 level.

[1970Ha24](#): $^{50}\text{Ti}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=67 MeV at Chalk River, with the same setup as [1971Ha47](#). Deduced an upper limit for the static quadrupole moment of 2232 level.

[1970Na05](#): $^{206}\text{Pb}(^{32}\text{S},^{32}\text{S}'\gamma)$ E=130-150 MeV ^{32}S from the Lawrence Radiation laboratory, Berkeley. Target was ^{206}Pb . NaI detectors. Measured E_γ , $\gamma(\theta)$. Deduced static quadrupole moment of 2230 level using reorientation effect method.

Other:

[2008Wr01](#): $^{100}\text{Mo}(^{32}\text{S},^{32}\text{S}'\gamma)$ Measured ^{32}S and γ -ray yields at HIL in Warsaw.

 ^{32}S Levels

E(level)	J^π	$T_{1/2}$	Comments
0	0^+		
2230	2^+	166 fs 19	$T_{1/2}$: from DSAM in 1977Sc36 , $\tau=240$ ps 27. Other: $\tau=242$ fs 11 deduced by 1977Sc36 from their measured B(E2) \uparrow extracted from γ -ray yield; $\tau=258$ fs 8 from DSAM in 2006Sp01 , but the uncertainty of about 3% is considered too small for DSAM and likely doesn't include the systematic uncertainty from stopping power theory which could be 10-20%; $\tau=250$ fs 12 from the average B(E2) $\uparrow=0.0298$ 6 below. Static quadrupole moment Q=-0.160 22 (1982Ve09 ,constructive), -0.18 4 (1981Da08), -0.15 10 (1980Ba40), -0.175 5 (1971Ha47), -0.20 6 (1970Na05), <0.25 (1970Ha24). Other: -0.133 22 (1982Ve09 ,destructive); -0.066 17 from 1974OI02 is discrepant with all other studies. -0.16 2

Continued on next page (footnotes at end of table)

Coulomb excitation 2006Sp01,1982Ve09,1977Sc36 (continued) ^{32}S Levels (continued)

<u>E(level)</u>	<u>J^π</u>	<u>Comments</u>
		from 2021StZZ compilation, which has adopted the value from 1982Ve09. Additional information 1. B(E2) \uparrow =0.0297 13, weighted average of 0.0292 17 (1982Ve09,constructive), 0.0334 70 (1980Ba40), 0.0300 13 (1977Sc36), 0.0305 16 (1974Ol02), 0.0284 20 (1971Ha47), all determined from γ -ray or ^{32}S yield. Other: 0.0307 17 (1982Ve09,destructive). g-factor=+0.44 10 (2006Sp01), using transient-field technique. Deformation parameters β_2 (Coulomb)=0.29, β_2 (nucleon)=0.27 (1989Al14).
5010	3 ⁻	B(E3) \uparrow =0.0070 5 (1991Al19). Deformation parameters β_3 (Coulomb)=0.39 1, β_3 (nucleon)=0.39 1 (1991Al19).

† From Adopted Levels.

 $\gamma(^{32}\text{S})$

<u>E_γ</u>	<u>$E_i(\text{level})$</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Mult.</u>
2230	2230	2 ⁺	0	0 ⁺	[E2]

Coulomb excitation 2006Sp01,1982Ve09,1977Sc36Level Scheme