Study of the $^{32}$S(\(\tau, d\))$^{33}$Cl and $^{32-33}$S(\(\tau, \alpha\))$^{31-32}$S Reactions (*).

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Summary. — The reactions $^{32}$S(\(\tau, d\))$^{33}$Cl and $^{32-33}$S(\(\tau, \alpha\))$^{31-32}$S have been studied at 10.4 MeV incident energy. Absolute differential cross-sections have been measured and angular distributions have been analysed in terms of the distorted-wave Born approximation. Good agreement is obtained between experimental S-factors from the reactions on $^{32}$S and the results of recent theoretical calculations, while S-factors from the $^{33}$S(\(\tau, \alpha\))$^{32}$S reaction are found to be considerably larger. The use of the (\(\tau, \alpha\)) reactions to obtain spectroscopic information and its DWBA analysis are examined and the accuracy of the extracted S-factors discussed.

1. — Introduction.

In the last years there was a considerable interest about nuclei in the (s-d)-shell, both from the theoretical and the experimental point of view. Studies of the properties of these nuclei were carried out with shell model methods, involving an inert $^{28}$Si core with active $s_{\frac{1}{2}}$ and $d_{\frac{3}{2}}$ orbits, then worked out to include $d_{\frac{5}{2}}$-states too (1,2). Also, an intermediate-coupling vibrational model has been presented (3), in which quasi-particles and anharmonic core effects are taken into account.

(*) To speed up publication, the authors of this paper have agreed to not receive the proofs for correction.


Fig. 1 - Energy spectrum from the $^{38}S(r, d)^{37}Cl$ reaction. $E_d = 10.4$ MeV, $\theta_r = 27^\circ$. 

channel number

counts/channel