Energy Levels in $^{65}$Cu (*).

M. D. Hossain (**)

Department of Physics, University of Calabar - Calabar, Nigeria

(riccuto il 10 Luglio 1979; manoscritto revisionato ricevuto il 2 Ottobre 1980)

Summary. — The reaction $^{64}$Ni(p,γ)$^{65}$Cu was studied in some detail, covering proton energies from 1.30 MeV to 4.100 MeV. Gamma-ray asymmetries were measured to assign spins and parities to resonance levels as well as to bound levels of $^{65}$Cu. The excitation energies as well as the spins and parities of the low-lying states in $^{65}$Cu were found to be in good agreement with the prediction of the weak-coupling model.

1. — Introduction.

In the recent past, a number of studies was made both theoretical (1-8) and experimental (9-11) on $^{65}$Cu. However, not much is known about the properties of the low-lying states of $^{65}$Cu experimentally. The main purpose of this paper

(*) Work done at the Nuclear Physics Laboratory, University of Oxford, England.
(**) Permanent address: Atomic Energy Centre, Dacca, Bangladesh.
is to report the properties of the low-lying states of $^{60}$Cu from a study of the $^{58}$Ni(p, $\gamma$)$^{60}$Cu reaction. The intensities and energies of gamma-rays following proton capture in $^{58}$Ni were measured at different proton energies ranging from 1.300 MeV to 4.100 MeV. The asymmetries of prominent gamma-rays were measured to ascertain spins and parities of compound states as well as of bound states.

2. Experimental procedure.

All experiments were performed with proton beam from the 6 MeV Van de Graaff Accelerator at AERE, Harwell. The beam resolution was better than 1 keV, which enabled us to measure the excitation function in 1 keV steps. The beam was collimated by a number of tantalum collimators accompanied by lead shields. In order to minimize the deposition of impurities on the target surface during the experiment, a cold trap was inserted in between the target chamber and the last vacuum pump in the beam line (fig. 1).

![Diagram of beam line](image)

Fig. 1. - Sectional drawing of the beam line.

Targets were prepared from a 99.77% enriched $^{58}$Ni isotope obtained from AERE, evaporated in vacuum on the thick high-purity gold backings from a directly heated tungsten boat. Prior to evaporation the target blanks were etched in aqua regia. The process was found to be very effective in reducing the most persistent contaminant $^{19}$F. The mounted targets were cooled with compressed air.

For data collection two Ge(Li) detectors of approximately of equal size were used. The energy resolution of each detector was approximately 5 keV at the 1.33 MeV line of the $^{60}$Co source.

2'1. Relative detection efficiency of the two Ge(Li) detectors ($^{12,13}$). - The detectors were mounted at fixed angles of 0° and 90° with respect to the proton