Comitato Nazionale per L'Energia Nucleare
ISTITUTO NAZIONALE DI FISICA NUCLEARE

Sezione di Napoli
65/3

INFN/BE - 65/3
8 Aprile 1965.

S. Notarrigo and P. Cuzzocrea : SHELL EFFECTS IN (n, 2n) REACTION CROSS SECTIONS AT ≈ 14 MeV. -

Reparto Tipografico
dei Laboratori Nazionali di Frascati

Istituto Nazionale di Fisica Nucleare
Sezione di Napoli

INFN/BE-65/3
8 Aprile 1965

S. Notarrigo and P. Cuzzocrea: SHELL EFFECTS IN (n, 2n) REACTION CROSS SECTIONS AT $\approx$ 14 MeV(*).

In a previous note[1] it has been shown that (n, p) and (n, α) cross sections at $\approx$ 14 MeV had strong shell effects.

In fact, the ratio between the reaction cross section and the quantity $e^{0.43\ E^+}$, E^+ being the excitation energy of the residual nucleus minus the energy corresponding to the Coulomb barrier, was strongly enhanced at closed neutron shells and subshells. It has been pointed out, also, that the quantity $e^{0.43\ E^+}$ gives roughly the statistical model prediction for the cross section, throughout the mass region.

In the present paper we have analyzed in the same way the (n, 2n) cross sections reported by M. Bormann[2].

This analysis is shown in Fig. 1, where we have plotted as function of N the ratio $\sigma(n, 2n)/\sigma_c \cdot \omega$; σ_c being the total reaction cross sections for neutron of 14 MeV calculated with an optical model[3] and

$$\omega = 1 - (1 + 0.43\ E^*)\ e^{-0.43\ E^*}$$

where E^* is the excitation energy of the residual nucleus and 0.43 is the same constant used in[1] for (n, p) and (n, α) cross sections.

One can see that this ratio is equal to unity within a factor of two, except for nuclei with N< 20. Shell effects are less pronounced than in (n, p) and (n, α) reaction[1] but are still present.

This strongly support the conclusion suggested in[1] that a level density of the form $\omega(E) = C.\ e^{-E/T}$ can give, within a factor of two (for N > 20) the reaction cross section and that the deviations are to attribute

---

(*) - Partially supported under a contract between EURATOM and CNEN.

to a different mechanism.

Thanks are due to Prof. G. Cortini, R. A. Ricci and A. Rubbino for interesting discussion.

REFERENCES

(1) - S. Notarrigo and P. Cuzzocrea, Internal Report INFN/BE-65/1.
(2) - M. Bormann, private communication, (in press in Nuclear Phys.).
(3) - G. S. Mani, M. A. Melkanoff and I. Iori, Report CEA 2380 (1963).

^^^^^^^^^^^^^^^^^

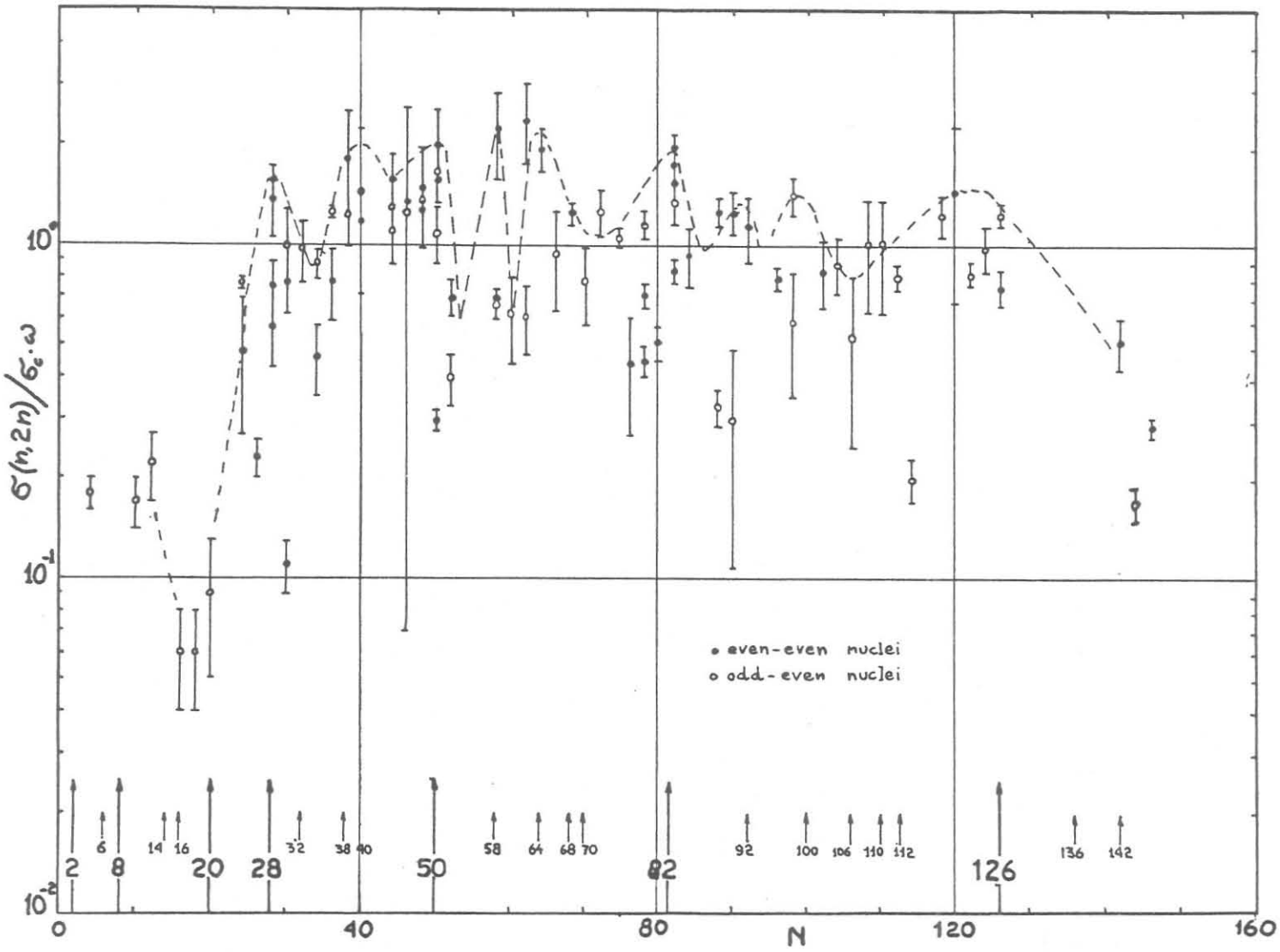

FIG. 1 - Ratio $\sigma(n, 2n)/\sigma_c \omega$ versus neutron number N. The line is intended only as a guide for the eye. The arrows indicates shell and subshell closures.