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AUTHOR: Neudachin, V.G.; Orlin, V.N.; Smirnov, Yu.F.

TITLE: Monopole part of the Majorana forces and nucleon quadrupling in light nuclei Report, Thirteenth Annual Conference on Nuclear Spectroscopy held in Kiev 25 Jan to 2 Feb 1963

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TOPIC TAGS: nucleon quadrupling, α cluster, shell model, Majorana forces, Majorana monopole, light nucleus, nucleon coupling, α decay energy, polonium

ABSTRACT: It is known (J.M.Blatt and V.Weisskopf, Theoretical Nuclear Physics, N.Y. 1952; J.P.Elliott and A.M.Lane, Handbuch der Physik, 39, 1957) that in light nuclei Majorana forces are largely responsible for the specific effect of quadrupling or α -clustering, i.e., the following effects: "sawtooth" variation of the nucleon coupling energy as a function of A, exceptionally high location of the lowest level with $T = 1$ in nuclei with $N = Z = 2m$, persistence of LS coupling with $N = Z = 2m$, a relatively low α -particle detachment energy, etc. Interpretation of these phenomena from the standpoint of the α -particle model proved to be unsatisfactory, for, as analysis

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of the experimental data shows, the overlapping of the α -clusters is very significant. As a result the level diagrams of light nuclei are not correctly described by the α -particle model, but, on the other hand, the spectra of p shell nuclei, for example, are satisfactorily described by the shell model. Hence it is more logical to analyze quadrupling in the framework of the shell model, wherein the effect is associated with the Young diagram [f] of the orbital part of the wave function. Such an analysis has been carried out by J.P.Elliott and A.M.Lane (Handbuch der Physik 39,1957). In the present paper the role and significance of Majorana forces are discussed and analyzed. More specifically, there is considered the Majorana monopole $M(0)$ which, as analysis of the experimental data shows, is the principal "carrier" of quadrupling in light nuclei, i.e., responsible for the effect that the more symmetrical [f], the higher the coupling energy. The energy role of quadrupling factors, i.e., the Majorana monopole $M(0)$, is particularly great in p shell nuclei and decreases in going to heavier nuclei. This is connected with increase of both the principal quantum number N_0 and the length parameter of the oscillator well. Among the factors discussed is the influence of $M(0)$ forces on the positions of levels with $T = 1$ and the relation between the energy effects of quadrupling and reduced α widths. Consideration is also given to the effect of the forces and clustering in Po isotopes. In conclusion, it is noted that the inference that nucleon

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quadrupling in light nuclei is due to $M(0)$ forces was formulated briefly in a review by two of the authors (V.N.Orlin and Yu.F.Smirnov) in collaboration with V.V. Balashov and I.B.Teplov, devoted to the structure of light nuclei and presented at the Twelfth All-Union Conference on Nuclear Spectroscopy held in Leningrad in January 1962. "The authors are grateful to L.A.Pokrovskii for carrying out a number of the calculations and to S.S.Vasil'yev and I.B.Teplov for assistance in carrying out the work." Orig.art.has: 33 groups of formulas and 2 figures.

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Symmetrical Theory of the Electron and the
Position, by E. Majorana, 23 pp.

ITALIAN, per, Nuovo Cimento, Vol XIV, 1937,
pp 171-184.

SLA Tr 2455

Sci - Nuclear Physics

Aug 57

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Atoms Oriented in a Variable Magnetic Field, by Ettore
Majorana.

ITALIAN, per, Nuovo Cimento, Vol IX, 1932, pp 43 - 50.
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AEC Tr 1074

Scientific - ~~Physics~~
Physics

A.L.A. 379

Dec 1951 CTS

A 7455

New Magneto-Optic Research, by Q. Majorana,
15 pp.

ITALIAN, per, Nuovo Cimento, Vol I, Apr 1943,
pp 120-125.

SLA Tr 57-1189

Sci - Physics

52,301

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