Erratum: On the Binding of Neutrons and Protons

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In the preparation of the manuscript for the above Letter to the Editor the wrong drawing was used in making

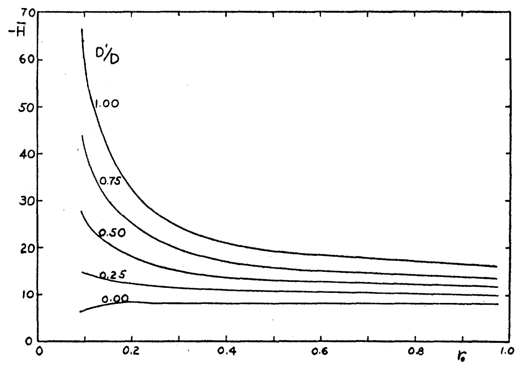

FIG. 1. The variational binding energy of H_3 *vs.* the "effective radius of interaction," r_0, for several values of D'/D, the ratio of depths of neutron-neutron to neutron-proton holes.

the cut for Fig. 1. The authors are not responsible for this error and the correct cut for their figure is shown here.

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Erratum: Precision Cosmic-Ray Measurements up to Within a Percent or Two of the Top of the Atmosphere

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To correct an error in the checking of proofs in this office the word **"proton,"** last line page 995 and line 23 second column, page 998 should read **"photon."**

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The β-Ray Spectrum of Li^8

According to a recent communication of Rumbaugh and Hafstad[1] there is a discrepancy between the mass of Li^8 as obtained from the reaction $Li^7+H^2\rightarrow Li^8+H^1$ and the reaction $Li^8\rightarrow Be^8+e^-$. From the former they conclude that $Li^8>8.022(8)$ and from the latter[2] $Li^8=8.019(3)\pm 0.001$. This discrepancy can be explained by supposing that the β-ray spectrum of Li^8 gives rise to an excited Be^8 nucleus so that the reaction reads $Li^8\rightarrow(Be^8)'+e^-$ with the understanding that $(Be^8)'$, Be^8 stand, respectively, for excited and normal nuclei, having an energy difference $(Be^8)'-Be^8>0.0035\pm 0.001$ mass units. In order that this explanation should work it is necessary to suppose that the disintegration of Li^8 into Be^8+e^- is ruled out by a selection rule and that there is available an excited level of Be^8 at least 0.002 mass units above the normal which is not ruled out. According to the calculations of Feenberg and Wigner[3] there exists a ^1D level of Be^8 at approximately 0.003 mass units above the normal ^1S level. The $(Be^8)'$ nucleus is in the ^1D level according to this explanation. On the other hand their calculations for Li^8 give a P level which is built on doublets in neutrons and on doublets in protons. The observed effect can, therefore, be explained by supposing that the normal level of Li^8 is a $^3P_2$ because then[4] the selection rule $\Delta i=0, \pm 1$ for total angular momentum will make the transition to $(Be^8)'$ possible and will rule out that to Be^8.

An explanation could be attempted by supposing that Li^8 is left in an excited state $(Li^8)'$ after the ejection of the proton. It could then emit a γ-ray, become a normal Li^8 and finally emit a β-ray. The energy of $(Li^8)'$ would have to be about 4 or 3 Mev above that of Li^8. It should be more probable that the protons will be emitted with the full available energy and that the Li^8 nucleus will be left in its normal state. One could suppose that Li^8 cannot be formed on account of a selection rule. The likely selection rules are those of the orbital, spin and total angular momenta as well as of parity.[5] The normal state of Li^7 is[3] an odd $^2P_{3/2}$ state, that of H^2 an even $^3S_1$ and that of Li^8 an even ^3P. It is possible to have conservation of parity[5] and of the total orbital and spin angular momenta as well as of their resultant by assuming the angular momentum of relative motion to be (a) zero initially and one finally or else (b) one initially and zero finally. Case (a) is more probable than (b) because the incident deuterons have a lower energy than the protons which could be emitted with the formation of Li^8. The fact that the final angular momentum of the proton is one and not zero does not decrease the probability of the reaction by a large factor because the addition of $\hbar^2/Mr^2$ to the potential barrier amounts to about 5 Mev at a distance of 4×10^{-13} cm. There is, thus, no special reason why the formation of Li^8 in its normal state should not occur. It appears, therefore, that the formation of an excited Be^8 is a more natural explanation. Gamma-rays of about 3 Mev energy should accompany the reaction on the present view.

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November 22, 1936.

[1] L. H. Rumbaugh and L. R. Hafstad, Phys. Rev. **50**, 681 (1936).
[2] H. R. Crane, L. A. Delsasso, W. A. Fowler, C. C. Lauritsen, Phys. Rev. **47**, 971 (1935).
[3] E. Feenberg and E. Wigner, Phys. Rev. in press.
[4] G. Gamow and E. Teller, Phys. Rev. **49**, 895 (1936).
[5] E. Wigner, *Gruppentheorie* (Vieweg & Son, 1931). See p. 287.