

A Theory of Elasticity

I write to call to the attention of any of your readers who may be interested, the fact that there is given in the April (1937) issue of the *American Journal of Mathematics* (Johns Hopkins Press, Baltimore, Md.), a theory of elasticity which does not make any assumptions as to the infinitesimal nature of the strain. The following summary of the paper will give an idea of the results to be found in it:

Formulae are derived which enable one to calculate the stress in an elastic medium when the strain and the elastic energy density are known, no simplifying assumptions, such as smallness of strain, being necessary. For an isotropic elastic solid under hydrostatic pressure the following one constant formula gives good agreement with experimental observation (only two elastic constants λ , μ being used in the expression for the elastic energy density)

$$p = a(f + 5f^2); \quad f = \frac{1}{2}\{(V_0/V)^{\frac{2}{3}} - 1\}; \quad a = 3\lambda + 2\mu.$$

In the Young's modulus experiment the formula for the extensional stress (again using only the two constants λ , μ) is

$$T = E\epsilon \left\{ 1 - \frac{2\lambda + 3\mu}{\lambda + \mu} \epsilon \right\}; \quad E \text{ (Young's modulus)} = \frac{(3\lambda + 2\mu)\mu}{\lambda + \mu}$$

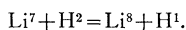
where $\epsilon = (2+e)e/(1+e)^2$, e being the relative extension. Hence T has a maximum value $(\lambda + \mu)E/4(2\lambda + 3\mu)$ occurring when $\epsilon = (\lambda + \mu)/2(2\lambda + 3\mu)$. For a true second-order approximation (the infinitesimal theory being regarded as a first-order approximation) five elastic constants occur and the corresponding formulae are either given or their derivation is immediate.

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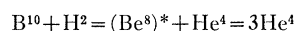
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The Disintegration of Li^8

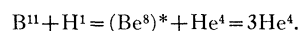
It was observed by Lewis, Burcham and Chang¹ that the β -ray disintegration of Li^8 is accompanied by a further disintegration of the residual Be^8 nucleus into two α -particles. In our letter to the *Physical Review*² we considered this reaction from a theoretical point of view. We tried to account for the discrepancy between the limit of the β -ray spectrum³ of Li^8 and the mass difference between Li^8 and Be^8 , as derived by Rumbaugh and Hafstad⁴ from the nuclear reaction.



Selection rules for β disintegration indicate that the Be^8 nucleus is left after the emission of the electron in an excited state. We stated that this excited state should emit γ -rays. However, estimates making use of penetration through the potential barrier for d waves show that the disintegration into α -particles should be more probable. Indeed, this probability is so large that it may be expected to broaden the excited Be^8 level considerably. Such a broadening has in fact been indicated in observations of Cockcroft and Lewis⁵ in the reactions



and especially in the work of Dee and Gilbert⁶ on



The experiments seem to indicate a half-value breadth of roughly 1 Mev for $(\text{Be}^8)^*$ which is most probably a 1D level.

These experimentally observed widths are in fair agreement with theoretical estimates on the basis of Gamow's formula for a d wave so this interpretation of it appears to be correct. The width due to γ -radiation from the Be^8 1D level should be smaller than 1 volt since it corresponds to $\Delta i = 2$. Thus the γ -radiation should be negligible in comparison with the alpha-particle emission. The long range alpha-particles (5 cm) are presumably due to transitions in a higher level.

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February 22, 1937.

¹ W. B. Lewis, W. E. Burcham and W. Y. Chang, *Nature* **139**, 24 (1937).

² G. Breit and E. Wigner, *Phys. Rev.* **50**, 1191 (1936).

³ H. R. Crane, L. A. Delsasso, W. A. Fowler, C. C. Lauritsen, *Phys. Rev.* **47**, 971 (1935).

⁴ L. H. Rumbaugh and L. R. Hafstad, *Phys. Rev.* **50**, 681 (1936).

⁵ J. D. Cockcroft and W. B. Lewis, *Proc. Roy. Soc.* **A154**, 246 (1936).
⁶ P. I. Dee and C. W. Gilbert, *Proc. Roy. Soc.* **A154**, 279 (1936), cf. especially §6.

The Common Ion Effect in Some Aqueous Solutions As Shown by Means of the Raman Effect

The suppression of ionization of zinc chloride in aqueous solution by adding the common chloride ion is demonstrable by means of the Raman effect. The binding between the zinc and chlorine atoms is homopolar in concentrated solutions and heteropolar in dilute solutions. Consequently any suppression of ionization will increase the intensity of the Raman line at $\Delta\tilde{\nu} 280$ corresponding to the symmetrical $(\nu_\pi)\text{Zn} \leftrightarrow \text{Cl}$ vibration.

In Fig. 1 are shown microphotometer tracings of solutions

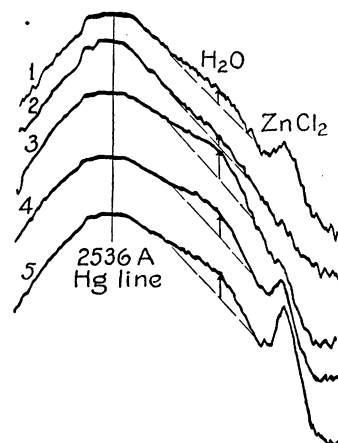


Fig. 1. The common ion effect in solution as demonstrated by means of the Raman effect. Curve 1, 1 molal ZnCl_2 ; curve 2, $\frac{1}{2}$ molal ZnCl_2 ; curve 3, $\frac{1}{4}$ molal ZnCl_2 , 1 molal NaCl ; curve 4, $\frac{1}{2}$ molal ZnCl_2 , 2 molal NaCl ; curve 5, $\frac{3}{4}$ molal ZnCl_2 , 2 molal NaCl .