course of a paper on the hydrodynamical equations of a non-viscous electronic fluid, Sorokin[4] has also discussed the use of the variational principle. He advances reasons for supposing that in applying the method to a "superfluid," it is necessary to vary the velocities and not the positional coordinates of the particles, since the description of the "superfluid" depends on the former rather than the latter. He also deduces Eq. (1) from the Lagrangian. Both authors point out that this equation depends on more than simply vanishing viscosity, but neither indicates where the more stringent conditions is introduced in using the variational method.

The use of the Lagrangian implies that for every thermodynamical state of the system there is only one possible value of the magnetic induction, since there is a one-one correspondence between the values of the Lagrangian and of the parameters which specify the state of the system. As has been pointed out above, this is the theoretical implication of the Meissner effect. Thus, to formulate the Lagrangian of the system and to use the variational method automatically ensures that this experimental fact is included in the formulation. It is therefore hardly a matter for surprise that an analysis, which assumes implicitly the single-valued property of the parameters which is the essence of the thermodynamic reversibility demonstrated by the Meissner-Ochsenfeld experiment, should lead to Eq. (1) without any arbitrary constant.

[1] F. and H. London, Proc. Roy. Soc. **A149**, 71 (1935); F. London, *Une Conception Nouvelle de la Supraconductivilité* (Hermann et Cie, Paris, 1937).
[2] C. Eckart, Phys. Rev. **54**, 920 (1938).
[3] E. Cook, Phys. Rev. **58**, 357 (1940).
[4] V. S. Sorokin, J. Exper. Theor. Phys. U.S.S.R. **19**, 553 (1949).

Erratum: Excitation Functions for (α,n), $(\alpha,2n)$ and $(\alpha,3n)$ Reactions on Indium

[Phys. Rev. **76**, 424 (1949)]

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THE following typographical errors have been noted in the above paper:

Caption of Fig. 2, page 425, second line, should read: Circles indicate $In^{115}(\alpha,n)Sb^{118}$, triangles indicate $In^{115}(\alpha,2n)Sb^{117}$, squares indicate $In^{115}(\alpha,3n)Sb^{116}$ cross sections; arrows A and B indicate the Coulomb barrier heights for $r_0=1.5$ and $r_0=1.3$, etc.

Page 425, column 1, sixteen lines from the bottom instead of: ". . . upon quarter-mil foil." read: ". . . upon quarter-mil aluminum foil."

Nuclear Spin $\frac{1}{2}$ for Te^{123} and Isotope Shift in the Tellurium Spectrum

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August 11, 1949

FROM the hollow-cathode discharge spectrum** of 123-enriched tellurium*** we have found that the spin of the Te^{123} nucleus is $\frac{1}{2}$ unit. Unfortunately the electron structure of tellurium is not sufficiently well known at present to allow the determination of the nuclear magnetic moment, μ_{123}. However, in verifying Fowles' discovery[1] of spin $\frac{1}{2}$ for Te^{125}, we find the splitting of the lines in the spectra of the two isotopes to be identical except for a scale factor, which yields the tentative value $\mu_{125}/\mu_{123}=1.208$ (greatest deviation found, 5 percent) for the ratio of the moments.

An isotope shift of the order of hundredths of a wave number unit is evident in several of the lines.

Earlier tellurium hollow-cathode spectra in this laboratory were obtained by Mr. J. S. Ross; further investigations, including especially that of the isotope shift, are under way in this laboratory.

* Work done on Navy contract N7onr-285TO#1, NR 019 107.
** With auxiliary dispersion produced by a special Hilger spectrograph bought with funds granted by the University Research Committee.
*** Produced by the Y-12 plant, Carbide and Carbon Chemicals Corporation, and obtained by allocation from the United States Atomic Energy Commission.
[1] G. R. Fowles, Phys. Rev. **76**, 571 (1949); kindly communicated to us in advance by Professor Jenkins.

Three-Body Scattering with Central and Tensor Forces

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THE scattering of neutrons and deuterons (or protons and deuterons) has been calculated using a combination of central and tensor type interaction. The interaction between any two elementary particles is taken to be of the following form.

$$U(r)=G_{ij}(1+\gamma S_{ij})J(r).$$

γ is taken to equal 0.775. The function $J(r)$ which represents the range and depth of the nuclear interaction equals $V\exp(-4\alpha r^2)$. V represents the depth of the interaction and $1/2(\alpha)^{\frac{1}{2}}$ represents the range of the nuclear forces. S_{ij} represents the tensor operator $3(\boldsymbol{\sigma}_i\cdot\mathbf{r})(\boldsymbol{\sigma}_j\cdot\mathbf{r})/r^2-(\boldsymbol{\sigma}_i\cdot\boldsymbol{\sigma}_j)$. The exchange character of interaction is represented by G_{ij}, five forms of which are used.

1. Ordinary	$G_{ij}=1$
2. Majorana	$G_{ij}=P_{ij}$
3. Heisenberg	$G_{ij}=P_{ij}Q_{ij}$
4. Charge symmetric	$G_{ij}=-\frac{1}{3}(\boldsymbol{\tau}_i\cdot\boldsymbol{\tau}_j)$
5. Charge and spin symmetric	$G_{ij}=-\frac{1}{3}(\boldsymbol{\tau}_i\cdot\boldsymbol{\tau}_j)(\boldsymbol{\sigma}_i\cdot\boldsymbol{\sigma}_j)$.

P_{ij} and Q_{ij} represent operators which interchange the space coordinates and the spin coordinates of the nuclear particles, i and j, respectively. The operators τ and σ represent the isotopic spin and ordinary spin of a nuclear particle. The deuteron wave function is represented by

$$\psi_D(\rho)=(2\alpha/\pi)^{3/4}\exp\{-\alpha\rho^2\}.$$

The Born approximation is used in calculating the cross section for scattering. The use of the Born approximation is questionable in view of the fact that the kinetic energy is of the same order as the interaction energy. The evaluation of the spin sums is completed by means of spur theory with annihilation operators; the spin wave function therefore need not explicitly be written down. The spin sums were first evaluated and then the space integrals completed. Since the spur of the tensor operator is zero, the total cross section for the scattering process is just the algebraic sum of the cross section for the central forces and the cross section for the tensor forces.

In making these calculations, the Coulomb repulsion between the two protons is neglected. This is not a serious defect, since at high energies the Coulomb terms contribute only at very small angles. Under these conditions, the scattering of neutrons and deuterons is identical with the scattering of protons and deuterons. The scattered wave function is also anti-symmetrized with respect to the two neutrons or the two protons in the scattering process in order to satisfy the Pauli principle. The partial cross section is $\sigma(\theta)d\omega$ where $\sigma(\theta)=C(\sigma_C+\sigma_T)$. ($\sigma_C$—central interaction contribution; σ_T—tensor interaction contribution.) The constant C