to expansion. This can be done by working with the energy-momentum representation.

An interaction similar to (1) has been derived by Matthews[3] from the Tomonaga-Schwinger formalism. Integrating Matthews' result over a hyperplane perpendicular to the time-axis, we find

$$H_{p_1'p_2',p_1p_2}=-\tfrac{1}{2}f^2(2\pi)^3\psi_{p_1'}(1)\dagger\rho_2\psi_{p_1}(1)\psi_{p_2'}(2)\dagger\rho_2\psi_{p_2}(2)$$
$$\times\exp\left[i(\Delta E_1+\Delta E_2)t\right]\left\{\frac{1}{\epsilon_k^2-(\Delta E_1)^2}+\frac{1}{\epsilon_k^2-(\Delta E_2)^2}\right\}, \quad (2)$$

where the ψ's are creation or destruction operators for the nucleons as defined by Watson and Lepore.[4] The essential difference between (1) and (2) is that the χ's are c-number column-matrices and the ψ's are q-number column-matrices. For a direct transition between states in which the nucleons have positive energies, (1) and (2) lead to the same result. On the other hand, if we apply the perturbation formula

$$\Sigma_c\, H_{ac}H_{cb}/(E_a-E_c) \quad (3)$$

for indirect transitions with H given by (1) and (2), respectively, it is easily seen that (1) and (2) do not lead to the same result when negative energy states are involved in the intermediate states. This example shows that Dirac's relativistic equation for two particles, which deals with particles with energies of both signs, does not always agree with the hole theory, in which the negative energy states are correlated to pair creation. The situation here is similar to the situation in Weisskopf's calculation of the self-energy of the electron.

When all the states a, b, c in (3) are positive-energy states, (1) and (2) give the same result. This result diverges logarithmically, owing to the cancellation of ϵ_k^2 with $(\Delta E_i)^2$, both of which vary as k^2 at high energies. This divergence is independent of the magnitude of the coupling constant f, and has nothing to do with the question of the convergence of the Born approximations.

It is instructive to compare this divergent result with the finite result obtained by Watson and Lepore[4] from the Feynman-Dyson formalism for the S-matrix due to the exchange of two mesons (reference 4, Sec. IIC). Nambu[5] has suggested the use of the difference between Watson and Lepore's result and the result that follows from (3), with H given by the potential energy of the second order, to define the potential energy of the fourth order. The above consideration shows that the potential energy of the fourth order thus obtained diverges if (1) or (2) is taken to be the potential energy of the second order. This seems to show that the retarded interaction (1) or (2) is unsuitable as the potential energy of the second order.

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Radioactive Hg^{203} and Hg^{205}

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Assignments of the 46-day mercury activity to the Hg^{203} nuclide and the five-minute mercury activity to the Hg^{205} nuclide have been reported previously in the literature.[1,2] Using electromagnetically separated Hg^{202} enriched to 97 percent and Hg^{204} enriched to 89 percent, these mass assignments have been verified, the radiation from Hg^{205} studied, and the thermal neutron activation cross sections for the reactions,

$$Hg^{202}(n,\gamma)Hg^{203}, \quad (1)$$
$$Hg^{204}(n,\gamma)Hg^{205}, \quad (2)$$

with pile neutrons determined.

A 2.37-mg sample of enriched Hg^{202} was irradiated in the ORNL reactor for three weeks together with a cobalt monitor. The decay of portions of the activated sample was followed on both a high pressure ion chamber and a conventional thin end window G-M counter. These data indicate all the activity to have a 46.5-day half-life. Aluminum absorption and coincidence counting data are in accord with the accepted disintegration scheme of a 0.20-Mev β followed by one gamma-ray of 0.280 Mev.[3] Using a total conversion coefficient of 25 percent for the 0.28-Mev gamma, the activity of this source was determined using the high pressure ion chamber and the method described by Overman and Jones.[4] Agreement between this value and that obtained through absolute beta-counting was within 5 percent.

Utilizing the average flux calculated from the Co^{60} activity produced in the cobalt monitor, the isotopic cross section for production of Hg^{203} with pile neutrons was calculated. σ (isotopic) was found to be 3.8 barns; σ (atomic) is thus 1.1 barns. Way and Haines,[5] in the only other available work on the production of Hg^{203}, list σ (isotopic) as 2.4 barns.

A 23.8-mg sample of Hg^{204} was dissolved in dilute HNO_3 and suitable aliquots of this material taken for activation. Active aliquots were evaporated on watch glasses and the decay was followed for several days on a G-M counter equipped with a scaler and continuous recorder. Upon subtraction of the long-lived weak activities due to contaminants in the diluent, the Hg^{205} was found to exhibit a half-life of 5.6 min. Cross sections for neutron capture were obtained by exposing aliquots of Hg^{204}, together with a Mn monitor, in the ORNL reactor for 1190 seconds. Beta-activity of the Hg^{205} was determined by absolute beta-counting. Total Mn^{56} activity induced in the Mn monitor was assessed from ion chamber measurements. Using this figure, the average flux during exposure was calculated. For reaction (2)

$$\sigma\ \text{(isotopic)}=0.47\ \text{barn},$$
$$\sigma\ \text{(atomic)}=0.032\ \text{barn}.$$

The only other published value for the constant, σ (atomic), is 0.023.[6] The absorption curve data were treated by Feather analysis using P^{32} as a comparator. The range of the simple beta-spectrum was found to be 813 mg/cm² of Al, corresponding to a β_{max} of 1.75 Mev. Krishman and Nahum[2] list 1.62 Mev as the beta end point.

Table I summarizes the experimental data obtained.

Table I. Summary of data.

	Hg^{203}	Hg^{205}
$T_{\frac{1}{2}}$	46.5 days	5.6 min
β_{max}	...	1.75 Mev
σ (isotopic)[a]	3.8 barns	0.47 barn
σ (atomic)[a]	1.1 barns	0.032 barn

[a] Pile neutrons.

* Based on work performed under the AEC.
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Empirical Correlation for a Thermoelectric Property of Superconductors

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The recently published[1] results of the thermoelectromotive force existing at the superconducting-normal junction of a metal showed that the data for tin and thallium fell on the same line when E was plotted as a function of $1-(T/T_c)^2$ on a log-log basis. E is the thermoelectromotive force of the superconducting-normal junction of the same metal, T is the absolute temperature, and T_c is the superconducting transition temperature for zero