where

$$
\begin{aligned}
n_{1,2}^2 = \{&(ag - a^2)\varepsilon_1 + ag(\varepsilon_1 - \varepsilon_3) + b^2\varepsilon_1 \\
&+ (\varepsilon_1^2 a - \varepsilon_2^2 a + \varepsilon_1\varepsilon_3 g)\beta^2 \pm [(\varepsilon_1^2 a - \varepsilon_2^2 a - \varepsilon_1\varepsilon_3 g)^2\beta^4 \\
&- 2a\varepsilon_1(\varepsilon_3 g - \varepsilon_1 a)^2\beta^2 + 2a^2\varepsilon_2^2(\varepsilon_1 a + \varepsilon_3 g)\beta^2 \\
&+ 2b^2\varepsilon_1(a\varepsilon_1^2 - a\varepsilon_2^2 + g\varepsilon_1\varepsilon_3)\beta^2 - 8abg\varepsilon_1\varepsilon_2\varepsilon_3\beta^2 \\
&+ (g\varepsilon_3 - \varepsilon_1 a)^2 a^2 + b^2\varepsilon_1(b^2\varepsilon_1 - 2a^2\varepsilon_1 + 2ag\varepsilon_3)]^{1/2}\} / 2\varepsilon_1 ag\beta^2,
\end{aligned}
$$

$$a = \mu_1 / (\mu_1^2 - \mu_2^2), \qquad b = \mu_2 / (\mu_2^2 - \mu_1^2), \quad g = 1 / \mu_3.$$

The regions of integration are determined by the following inequalities (cf. reference 3):

$$\mathrm{I}: \beta^2 n_m^2 > \beta^2 n_1^2 > 1, \qquad \mathrm{II}: \beta^2 n_m^2 > \beta^2 n_2^2 > 1.$$

In the case of a non-gyrotropic uniaxial crystal ($\epsilon_2 = b = 0$) we have

$$-d\mathscr{E} / dz = \mu_0^2 v^{-4} \int\limits_{\mu_3(\varepsilon_1\mu_1\beta^2 - 1)/\mu_1 > 1} \omega^3 d\omega \cdot \mu_3^2 (\varepsilon_1\mu_1\beta^2 - 1) / \mu_1.$$

From the above it is apparent that the radiation intensity for an anisotropic dielectric ($\mu_1 = \mu_3 = 1$) differs from an isotropic dielectric only in that $\epsilon \rightarrow \epsilon_1$. In this case, in general ϵ_3 does not appear in the final expression. The formula for the isotropic case coincides with the well known expression obtained by Frank[1] (cf. also reference 4). It should be noted that the results which have been obtained apply for Cerenkov radiation of a small closed current loop. In this case by μ_0 we are to understand the magnetic moment associated with the current loop.

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RELATION BETWEEN THE GRAVITATIONAL CONSTANT, THE CHARGE TO MASS RATIO OF THE ELECTRON, AND THE FINE STRUCTURE CONSTANT

I. G. IVANTER

Institute of Scientific Information, Academy of Sciences, U.S.S.R.

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THE following numerical relation exists between the gravitational constant $G = 6.673 \times 10^{-8}\ \mathrm{g}^{-1}\ \mathrm{cm}^3\ \mathrm{sec}^{-2}$, the electron mass m, the electron charge e, and the fine structure constant $\alpha = e^2/\hbar c = (137.0377 \pm 0.0016)^{-1}$

$$\frac{1}{G}\left(\frac{e}{m}\right)^2 = \left(\frac{4\pi}{3}\right)^{\hbar c/2e^2}.$$

This relation is extremely sensitive to the value of the fine structure constant; nevertheless, the numerical relation holds to an accuracy of 1%.

It may be assumed that this simple relation is no accident.

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SATURATION IN A HYPERON SYSTEM

V. A. FILIMONOV

Institute for Nuclear Physics, Electronics, and Automation, Tomsk Polytechnic Institute

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THE phenomenon of saturation is a characteristic property of a system of nucleons. At the present time it is believed that saturation is due to certain attributes of two-body nucleon forces — namely the repulsion at short distances and the exchange character of some of the forces. The main features of contemporary phenomenological nucleon-nucleon potential are deduced from meson theory. Thus repulsion at short distances is related to the existence of the function $\delta(\mathbf{r})$ in the second-order interaction potential of pseudoscalar meson theory. The energy of a system of nucleons depends strongly on the radius of the repulsive core and on the admixture of exchange forces. A decrease in the radius of the repulsive core and in the amount of exchange forces leads to a considerable increase in the binding energy of a system of nucleons.[1]

According to present-day ideas about hyperons the forces between them are of the same order of magnitude as nucleon-nucleon forces. However the details of the mechanism responsible for hyperon-hyperon forces may be different from those involved in nucleon-nucleon interactions. Thus, for example, second order forces arising from the exchange of a single π or K meson between two Λ^0 particles are forbidden by isotopic invariance of strong interactions. In these cases the forces may arise in fourth order as a result of the exchange of two π or K mesons:

$$\Lambda + \Lambda \to \Sigma + \pi + \pi + \Sigma \to \Lambda + \Lambda,$$
$$\Lambda + \Lambda \to N + K + K + N \to \Lambda + \Lambda,$$
$$\Lambda + \Lambda \to \Xi + K + K + \Xi \to \Lambda + \Lambda.$$

The main part of these forces has a non-exchange character. The absence of forces due to the exchange of a single particle eliminates the theoretical basis for the introduction of repulsion at short distances as is done in the nucleon-nucleon case.

This different character of hyperon-hyperon forces should affect the behavior of a system of many hyperons. In particular it is possible that conditions may exist favorable to the formation of a hyperon system with a large mass defect which would be stable against transformation into the proton-neutron state. For a system of Λ particles and nucleons the stability condition against transition to the nucleon state has the form

$$L(m_\Lambda - m_N) + B(A + L) + T_N + T_\Lambda + U < 0, \qquad (1)$$

where A and L are the number of nucleons and Λ particles; m_N, T_N, m_Λ, T_Λ are the masses and kinetic energies of the nucleons and Λ particles respectively; B is the absolute value of the binding energy per nucleon in nuclear matter; and U is the potential energy due to the interaction between the particles.

To estimate the conditions necessary for the fulfillment of the inequality (1), a calculation of binding energy of a system of nucleons and Λ particles was carried out under certain assumptions about the forces. It was assumed that a Wigner-type short range force acts between two Λ hyperons and between a Λ hyperon and a nucleon which gives rise to zero binding energy for the $\Lambda\Lambda$ and ΛN systems. In the interaction of nucleons with each other only a repulsion at r_c = 0.4 f was taken into account. The nucleons and hyperons were treated as a degenerate Fermi gas. Under these assumptions it was found that when the Λ particles are distributed with constant density inside a sphere of radius $R = r_0 L^{1/3}$, condition (1) is satisfied for $r_0 \approx 0.9$ f. Here the minimum energy is obtained if the nucleons are distributed inside a sphere of the same radius and the ratio of nucleons to Λ particles is $A/L \approx 1.6$ f.

When condition (1) is satisfied the proton-neutron state will be metastable against a transition to the hyperon-nucleon state.

At present only incomplete information exists about the hyperon-nucleon interaction and none about the hyperon-hyperon forces. Neither can meson theory given an unambiguous answer to this question. Therefore it is not possible to draw any definite conclusions about the behavior of a system of many heavy particles or about the saturation properties of such a system; however neither should one discount the possibility that a stable baryon system other than the proton-neutron state might exist.

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DYNAMICAL MODEL IN THE THEORY OF THE BROWNIAN MOTION

V. B. MAGALINSKIĬ

Moscow State University

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LET us consider a dynamical model that has been discussed repeatedly[1-3] in connection with the problem of the reciprocal relations of dynamical processes and statistical laws: an oscillator with mass m and frequency ω_0 linearly coupled with a set of a large number of independent harmonic oscillators with frequencies ω_k ($k = 1, 2, \ldots, N$; $N \gg 1$). In the present note we give a simple derivation of some general relations in the theory of the Brownian motion on the basis of this model.

The Hamiltonian of the system in question is written in the form

$$H = \frac{p^2}{2m} + \frac{1}{2} m\omega_0^2 q^2 + \frac{1}{2}\sum_k (p_k^2 + \omega_k^2 q_k^2) + gq\sum_k \alpha_k q_k, \qquad (1)$$

where q and p are the coordinate and momentum of the oscillator with frequency ω_0, q_k and p_k