Ru, Rh, and Pd can increase the value of T_c of the samples (see Ref. 3). We studied the system Nb–Ru–H and two of its close analogs V–Ru–H and Ta–Ru–H, and amongst the phases forming in these systems under high pressures we discovered hydrides with values of T_c ranging from ~ 3 up to ~ 5 K, while for the starting alloys without hydrogen $T_c \ll 2$ K. This result suggests that if the data on the existence of superconducting hydrides in the systems Nb–Rh–H and Nb–Pd–H are confirmed and, as in the case of Nb–Ru–H, superconducting hydrides are also observed in the analog systems, then it will be possible to prepare and study in the near future an entire new group of diverse superconducting hydrides, thereby beginning the construction of the minimum necessary experimental base for subsequent analysis of the character and mechanism of the effect of hydrogen on the superconducting properties of d metals.

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A. A. Ruzmaĭkin. *Magnetic fields on the sun.* The sun is a laboratory of dimension $7 \cdot 10^{10}$ cm. Here astronomy, hydromechanics, plasma physics, and nuclear physics are intertwined. Thermonuclear fusion, Alfvén waves, the hydromagnetic dynamo, and new ideas about the neutrino are the products of scientific interest in the sun.

The equilibrium of the sun as a star is determined by the balance between the force of gravity and the pressure gradient. On the other hand, solar activity is the interplay of motions and magnetic fields. Magnetic fields are directly observed in active phenomena (in the spots, regions of flares, protuberances) or are linked with them (heating of the corona, coronal holes).

The flow of the solar plasma is a combination of large-scale motions (differential rotation, meridional circulation) and random motions (turbulent convection). The magnetic field in such a medium is a stochastic quantity. On small scales separate concentrations of the field, intensified at the boundaries of the convective cells (supergranules) stand out. Observations show that their scale is of the order of $(1-3) \cdot 10^7$ cm, and the field intensity is of the order of $(1-2) \cdot 10^3$ G. This is similar to the picture, characteristic for the transport of the magnetic field in a random medium, of intermittency,[1,2] modified by the expulsion of the field toward the boundaries of the convective cells.[3] The existence of a characteristic scale is indicated by the form of the correlation function of the fluctuation fields, calculated by N. I. Kliorin, D. D. Sokolov, and the author for the isotropic model of the dynamo.

There exists an average, large-scale magnetic field on the sun. Its axisymmetric poloidal component has an intensity of the order of 1 G and the main spatial mode is of the dipole type, oriented along the rotational axis. The field in the spots is interpreted as the manifestation of a subphotospheric toroidal magnetic field, whose lines are oppositely oriented in the northern and southern hemispheres of the sun. The intensity of this field can be estimated if the total magnetic flux of the spots and the relative fraction ε of the area of the sun's surface occupied by them over a definite period of time are known: $B_\varphi \sim \Phi/\varepsilon 4\pi R_\odot^2$. For example, for the period 1964–1974 $\Phi \approx 1.6 \cdot 10^{23}$ Mx, $\varepsilon \approx 5 \times 10^{-3}$ (these data were reported to the author by K. S. Tavastshern), which gives $B_\varphi \approx 6 \times 10^2$ G. Near the boundary of the convective shell with a radiant core, in a narrow layer of the order of $5 \cdot 10^5$ cm, this field can be intensified up to 10^7 G, owing to the effect of diamagnetic expulsion.

In addition, the sun has a weak nonaxisymmetric field (about 0.5 G), corresponding to the dipole and (or) quadrupole, whose axes lie in the plane of the solar equator (the so-called sectoral structure).

It has been hypothesized that strong fields exist in the solar core. However, fields with an intensity exceeding 10^7 G, whose lines penetrate up to the surface, would give a much too strong flux at the surface. Helioseismology could provide the decisive word with regard to such fields.

The sun's magnetic field does not remain constant. Small-scale fields vary in an irregular, random manner. The axisymmetric, sectoral component varies approximately with the rotational period of the sun around its axis. The 22-year cycle of the axisymmetric field is well known. In addition, one stronger branch of the field extends from latitudes of the order of 40° to the equator, and another weaker branch extends from these latitudes to the poles, which is well observed in observations of protuberances.[4] Every 11 years the dipole component reverses and the orientation of the toroidal field changes. Modulation with a characteristic time of approximately three periods and deep, irregular minima, observed by nuclear methods based on the content of the ^{14}C isotope in tree rings, are superposed on the 22 year cycle. The behavior of the activity near the Maunder minimum has also been studied at the Leningrad Physicotechnical Institute.[5]

The transport and intensification of the average magnetic field are determined primarily by turbulent diffusion, differential rotation $\Omega(r,\theta)$, and the average spirality of the turbulent convection. Neglecting diffusion, as Yoshimura first showed, the solution has the form of a dynamo wave propagating along the surfaces $\Omega = \text{const}$. Taking into account diffusion, geometric characteristics, and boundary conditions requires complicated computational experiments; see, for example, Ref. 6. In recent years, S. V. Starchenko and the author applied the asymptotic method developed by V. P. Maslov and his coworkers to the solution of the problem, which made it possible to obtain a quasianalytic solution for the field with an arbitrary dependence $\Omega(r,\theta)$. In particular, it was shown that the dependence of Ω, determined from helioseismological data, corresponds best to a solution in the form of two dynamo waves with different amplitudes propagating from some latitude to the equator and the poles.

The intriguing problem of explaining the global activity minima remains unsolved. The appearance of minima is linked with the stochastic nature of the dynamo and the idea of a strange attractor. The first rough models confirm this viewpoint (see the review in Ref. 7), but these are only initial steps.

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M. B. Voloshin, M. I. Vysotskiĭ, and L. B. Okun'. *Possible electromagnetic properties of the neutrino and variations of the solar neutrino flux.* Present limits on the magnetic moment of the neutrino are close to 10^{-10} μ_B ($\mu_B = e\hbar/2m_e c$ is the Bohr magneton). The data obtained by Reines[1] *et al.* on scattering of reactor neutrinos $\bar{\nu}_e$ by electrons imply[2] the limit $\mu_\nu < 2\cdot10^{-10}\mu_B$. The limit $\mu_\nu \lesssim 0.7\times10^{-10}\mu_B$ was obtained from an analysis of the cooling of stars of the young white dwarf type owing to the decay of plasmon into a $\nu\bar{\nu}$ pair.[3]

In the standard $SU(2)\times U(1)$ theory of the electroweak interaction μ_ν is proportional to the neutrino mass m_ν and is extremely small: $\mu_\nu \approx 3\cdot10^{-19}\mu_B$. In extended models, however, for example in the $SU(2)_L \times SU(2)_R \times U(1)$ theory, in which there is a (small) mixing of left- and right-hand W bosons, the magnetic moment of the neutrino is proportional to the given mixing and the mass of the τ lepton and can reach values near $10^{-10}\mu_B$. It has not been excluded that μ_ν of the same order of magnitude can be obtained in extended schemes by other mechanisms also (through charged Higgs bosons, supersymmetric particles, etc.).

Our purpose is to call attention to the fact that the existence of a neutrino magnetic moment $\mu_\nu \sim 10^{-10}\mu_B$ can lead to the existence of specific variations of the experimentally recorded[4] flux of solar neutrinos, correlated with the solar activity. These variations are determined by the interaction of μ_ν with the magnetic field H existing in the so-called convective zone of the sun. The quantity $|\mathbf{H}|$ varies with the 11-year quasiperiodicity and in years with maximum solar activity should reach values characteristic for a magnetic field in solar spots $H \approx (2\text{–}4)\cdot10^3$ G, decreasing by at least an order of magnitude at the minimum of activity. In addition, the field has a toroidal structure (oriented along the azimuth). Taking into account the fact that the depth of the convective zone $L \approx 2\cdot10^{10}$ cm, we find that for $\mu_\nu \approx 10^{-10}\mu_B$ the angle φ of rotation of the spin of the neutrino owing to precession in the field H, $\varphi = \mu HL$, can reach in years of solar activity values of the order of unity. In addition, the flux of left-polarized neutrinos, which is the only one detected experimentally,[4] decreases according to the formula $N_L = N_0\cos^2\varphi$. As a result there arises[5] a variation of the recorded flux which is anticorrelated with the 11-year cycle of solar activity.

Together with this cycle, for high-energy neutrinos, formed in processes including ^{7}Be and ^{8}B, half-year variations[6] of the observed flux should also occur. The latter variations are determined by the fact that the field $\mathbf{H}$ changes sign at the equator and the size of the transitional region between $+\mathbf{H}$ and $-\mathbf{H}$ equals $\pm(5\text{–}7)^\circ$ in latitude, which corresponds to a linear size of $\pm(6\text{–}8)\cdot10^9$ cm—larger than the region in which the high-energy neutrinos are formed ($3\cdot10^9$ cm). Because of the inclination of the earth's orbit relative to the plane of the solar equator (equal to 7°15′) the neutrinos arriving on the earth pass through a region in which the field has different intensity (close to zero) when the earth is located in the plane of the solar equator (at the beginning of June and the beginning of December) and an intensity $\sim H_{\max}$, when the earth is located at its maximum distance from this plane (at the beginning of March and the beginning of September). It is also clear that the half-year modulation of the flux should be maximum during years when the sun is active.

Experimental data[4] indicate that the variations of the neutrino flux discussed above could exist, but the statistical sample for these indications is too small. In this connection, it is of great interest to study the data on variations obtained by the new solar-neutrino detectors which are now under construction. It is important that the collection of data with the improved statistical base should begin by the end of the 1980s, i.e., the beginning of the next expected maximum in the solar activity near 1991.

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