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Meetings and Conferences

SCIENTIFIC SESSIONS OF THE DIVISION OF GENERAL PHYSICS AND ASTRONOMY OF THE USSR ACADEMY OF SCIENCES

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STARTING with 1963, soon after the formation of the Division of General Physics and Astronomy (called the Division of General and Applied Physics before 1968), the Division has been organizing periodic scientific sessions. The purpose of the sessions was to cast light on a wide circle of problems in physics and astronomy, and these sessions were designed not only for the members of the Division but to no lesser a degree for all scientific workers.

Since 1963 through March 1969, 55 such scientific sessions were held, in which approximately 500 papers and communications were delivered. As a rule, each session consists of three meetings and is held in the last Wednesday and Thursday of each month at the P. N. Lebedev Physics Institute of the USSR Academy of Sciences; every one is free to attend these sessions. A number of travel sessions were also held.

In our days, when physics and astronomy have grown colossally, scientific work has become more and more specialized. As a result, the conferences and seminars have as a rule a rather narrow scope. This situation and tendency is inevitable, and cannot be changed. But specialization undoubtedly also hides a certain danger, or to put it better, has unfavorable consequences. How can we neutralize the consequences of the narrowing specialization? This question is important and is worthy of attention. One of the steps in the right direction was the proliferation of review journals and of the survey literature (see in this connection the article by C. Herring, Physics Today 21, (9), 27, 1968). Another measure is to hold scientific gatherings (sessions, seminars) intended not for a narrow group of specialists, but for all physicists and astronomers. The scientific sessions of the Division are among the latter.

It might seem that these sessions should be highly popular. But this is true only in part. There are cases when only a few listeners attend very interesting papers. In addition, some participants of the sessions come only to hear one paper, close to their specialty, and walk out when "foreign" papers are delivered.

Insofar as a mature scientist is concerned, I do not feel justified to give any advice, which would furthermore be useless. But the sessions are attended also by young people. To some degree it is precisely the young scientists, graduate students, and students who need the sessions and to whom they are particularly useful. With respect to this group of listeners we can boldly state that by not attending the sessions, or by skipping the majority of papers, they themselves do not know what they are doing. A person about to enter or just entering the scientific life is usually not aware of which papers are useful and important to him, and which are not. Incidentally, even the most experienced persons cannot always say so, but at least they are capable with a higher degree of probability to estimate beforehand the character of the paper and furthermore have many additional sources of information.

The tasks of the scientific sessions of the Division of General Physics and Astronomy of the USSR Academy of Sciences and of our journal are in many respects parallel. It is therefore natural that a number of papers delivered at the sessions are also published in this journal. We now make the next step: the proceedings of the sessions will be published in the pages of this journal in greater detail, as is done below with the respect to the 55th scientific sessions, held in March 1969.

—V. L. Ginzburg

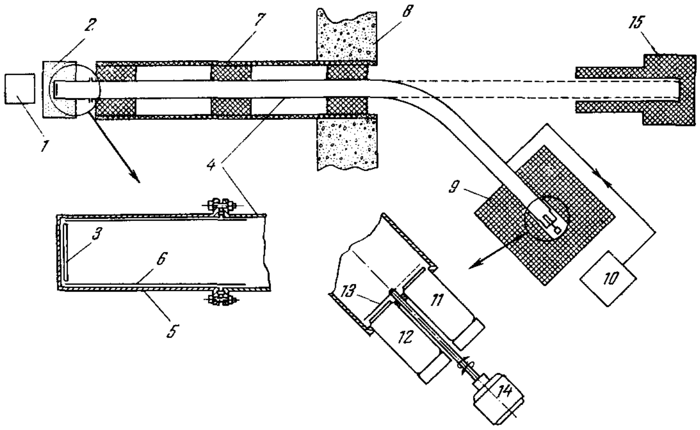
On 26 and 27 March 1969, a scientific session of the Division of General Physics and Astronomy of the USSR Academy of Sciences was held at the conference hall of the P. N. Lebedev Physics Institute. The following papers are delivered:

1. F. L. Shapiro, Searches for Electric Dipole Moment of the Neutron and Ultracold Neutrons.
2. G. I. Makarov and V. V. Novikov, Problems of Propagation of Superlong Radio Waves in the Earth-ionosphere Waveguide Channel.
3. E. A. Konorova and S. F. Kozlov, Diamond Detector for Nuclear Radiation.
4. I. V. Karpova, S. G. Kalashnikov, O. V. Konstantinov, V. I. Perel', and G. V. Tsarenkov, Recombination Waves in Compensated Germanium.
5. Yu. M. Gal'perin, I. L. Drichko, Yu. V. Ilisavskiĭ, and V. A. Kudinov, Possibility of Obtaining and Using Amplification of Ultrasound by a Semiconductor in a Magnetic Field.
6. A. A. Vedenov, A. M. Dykhne, and M. D. Frank-Kamenetskiĭ, Melting of DNA Molecules.
7. A. S. Tibilov and A. M. Shukhtin, Generation of Radiation by Ion-ion Recombination.

We publish below brief contents of these papers.

F. L. Shapiro, Searches for Electric Dipole Moment of the Neutron and Ultracold Neutrons.

The study of the decay of neutral K mesons has recently revealed phenomena contradicting the principle of invariance to time reversal. One of the consequences of this discovery is the possible existence of electric dipole moments (EDM) in elementary particles. In this connection, several scientific groups organized experiments on the measurement of the electric dipole moment of the neutron (see, for example[1]). The best accuracy was attained by an American group[2], who have shown that if the EDM of the neutron does exist



Experimental Setup

1—IBR reactor, 2, 3—moderator (2—paraffin, 3—polyethylene layer 1 mm thick); 4—copper tube with inside diameter 9.4 cm, total length 10.5 m; 5—aluminum tube, 6—cylinder of copper foil; 7—shield (paraffin with boron carbide); 8—two-meter concrete wall of the reactor room; 9—detector shield (paraffin); 10—system for evacuating and filling the tube; 11, 12—detectors (FÉU-13 photomultipliers with layers of ZnS + lithium compound); 13—copper shutter 1.6 μ thick; 14—mechanism for moving the shutter; 15—trap for the direct neutron beam.

at all, its magnitude is smaller than the elementary charge multiplied by 5×10^{-23} cm. The sensitivity of the employed resonance method is limited in final analysis by the time of stay of the neutron in the apparatus, which amounts to $\tau = 2 \times 10^{-2}$ sec. The possibility, noted by Ya. B. Zel'dovich, of storing in a closed cavity very slow neutrons (velocity $v < 5$–8 m/sec), which experience total reflection from the vacuum-medium interface at arbitrary incidence angles[3], makes it possible to realize a time τ on the order of the average radioactive decay time of the neutron (10^3 sec). In principle this should raise the sensitivity of the resonance method of measuring EDM by five orders of magnitude. These arguments have induced a group of physicists in the neutron physics laboratory of the Joint Institute for Nuclear Research (Dubna) to verify the possibility of extracting such ultracold neutrons (UCN) from a reactor and of storing them[4]. The experimental setup is shown in the figure. Neutrons leaving the moderator 3 with velocity exceeding 5.7 m/sec were absorbed upon collision with the walls of the copper tube 4, or else emerged to the outside. The neutrons with lower velocities, experiencing total reflection from the copper, diffused along the evacuated tube to the neutron detectors 11 and 12, and were registered whenever the very thin copper shutter 13 was opened, or else were reflected from the shutter if the latter was closed. Accordingly, the counting rate of the detector decreased sharply when the shutter was closed. Special experiments have made it possible to estimate the diffusion time of the UCN from the moderator to the detector, which turned out to be of the order of 200 sec.

The results of the experiments have shown that UCN are produced and propagate in accordance with the theoretical expectations. This makes it possible to plan experiments on the measurement of the decay period of the neutron and its EDM. It can be assumed that the UCN will find also other applications based on the use of their low energy ($\sim 10^{-10}$ eV), their focusing ability, and other properties.

1. F. L. Shapiro. Usp. Fiz. Nauk 95, 145 (1968) [Sov. Phys. Usp. 11, 345 (1968)].

2. J. K. Baird, P. D. Miller, W. B. Dress, and N. F. Ramsey, Preprint of article submitted to Physical Review (1969).

3. Ya. B. Zel'dovich, Zh. Eksp. Teor. Fiz. 36, 1952 (1959) [Sov. Phys.-JETP 9, 1389 (1969).

4. V. I. Lushchikov, Yu. N. Pokotilovskiĭ, A. V. Strelkov, and F. L. Shapiro, ZhETF Pis. Red. 9, 40 (1969) [JETP Lett 9, 23 (1969)].

G. I. Makarov and V. V. Novikov. Problems in the Propagation of Superlong Radio Waves in the Earth-ionosphere Waveguide Channel.

Radio waves of the superlong band (SLW) propagate in the spherical waveguide channel produced by the earth's surface and the lower part of the ionosphere, which in the frequency range under consideration (1–60 kHz) behaves like a conductor of uneven height, having an anisotropy as a result of the influence of the earth's magnetic field. The properties of the ionosphere and of the earth vary in both the radial and tangential directions, but in most cases the change of the properties of the media in the tangential directions is slow, and in first approximation this circumstance can be disregarded. As a result, the problem of propagation of SLW in the near-earth waveguide reduces mathematically to a construction of the solution of Maxwell's equations with specified sources for a spherically layered medium consisting of three regions. The first region $a \le r \le a + h$ (where a—earth's radius and h—height of the lower edge of the ionosphere over the earth's surface) is a homogeneous isotropic medium with properties practically coinciding with the properties of vacuum. The second region $0 \le r \le a$ is a conducting isotropic medium, the properties of which, generally speaking, depend on the radial coordinate r. Finally, the third region $r > a + h$ (ionosphere) is an *anisotropic conductor* with a *conductivity* that varies with the altitude. Even in such an idealized formulation, it is impossible to construct a strictly analytic solution of the problem, since the variables cannot be separated in Maxwell's equations that describe the field in the anisotropic ionosphere. At the present time there is an approximate analytic solution for this problem, but it still requires further refinement and a quantitative investigation of the limits of its applicability.

The problem of propagation of SLW was considered by many authors[1-10], who used different ways and approximations for the construction of the solution and