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A joint scientific session of the Division of General Physics and Astronomy and the Division of Nuclear Physics of the USSR Academy of Sciences was held on June 16 and 17, 1982 at the P. N. Lebedev Physics Institute of the USSR Academy of Sciences. The following papers were presented:

June 16

1. *Yu. D. Bulanzhe (Boulanger), Yu. E. Nesterikhin, and N. P. Pariĭskiĭ*, On the stability of the Earth's gravitational field.

2. *L. S. Marochnik*, Some special aspects of the position of the Solar System in the Galaxy.

3. *A. A. Starobinskiĭ, L. P. Grishchuk, and Ya. B. Zel'dovich*, The problem of the initial state of the Universe.

June 17

4. *V. D. Kulakovskiĭ, I. V. Kukushkin, and V. B. Timofeev*, Spin-oriented exciton gas in uniaxially deformed germanium.

5. *G. A. Askar'yan*, Possibilities for enhancement of the transmission of light and other forms of radiation through soft turbid physical and biological media.

6. *G. A. Askar'yan and B. M. Manzon*, The "Laser Dragon"—flash-discharge of light into the atmosphere in the direction of the beam.

7. *G. A. Askar'yan, I. A. Kossyĭ, and V. A. Kholodilov*, Ray-jet engines (with demonstration film).

We publish below brief contents of six of the papers.

Yu. D. Bulanzhe (Boulanger), Yu. E. Nesterikhin, and N. P. Pariĭskiĭ. *On the stability of the Earth's gravitational field.* The first work on the nontidal measurement of the force of gravity was carried out by the USSR Academy of Sciences Seismological Institute in the Caucasus in 1935. However, the pendulum apparatus that existed at that time was not accurate enough. It became necessary to develop new and improved measuring systems. The war held up these investigations for a long time, and it was possible to pick them up again only in the mid-1950s, when more sensitive instruments, the relative gravimeters, were developed.

Barth proposed a theoretical basis for possible global variations of the force of gravity. It was based on the assumption that the Earth's core may be capable of moving relative to its enveloping shells. Arguments were advanced indicating the possibility of significant variations of gravity, possibly ranging up to 0.5 mGal/yr. However, these hypotheses were not confirmed either theoretically or experimentally.

N. N. Pariĭskiĭ has shown that if the variations in the force of gravity are due to processes that result from nonuniformity of the earth's rotation, they could amount to no more than a few tens of μGal/yr. Estimates of the gravity changes that could be caused by readjustment of the earth's crust give values of the order of magnitude of 0.05 μGal/yr. The annual and Chandler motions of the poles may cause changes ranging up to several μGal/yr in middle latitudes. The mass displacements resulting from the aggregate of the geodynamic phenomena could move the earth's center of mass by an amount of the order of magnitude of 10 mm/yr, which, in turn, would change the force of gravity at the earth's surface by 2–3 μGal/yr. The total variations of world ocean level could also shift the earth's center of mass and change the force of gravity at its surface by up to 0.6 μGal/yr. The global movement of air masses could cause variations of up to 1.3 μGal/yr.

The world literature offers many communications reporting observed variations of the force of gravity.

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However, owing to the inadequate metrological base for these measurements, many of them can not be regarded specifically as variations of the force of gravity in time. Nevertheless, their authors identify the observed discrepancies with time variations of the gravitational field. These experimental estimates often disagree with theoretical estimates by two or more orders of magnitude. It is therefore necessary to conduct special experiments oriented to studying the stability of the gravitational field in time.

Relative gravimeters developed by the USSR Academy of Sciences Institute of Earth Physics (IFZ) in 1955 and 1967 were used at the same stations to determine the force of gravity with respect to Potsdam on a chain of stations from Riga to Petropavlovsk-Kamchatskii. These measurements showed that if relative variations of the force of gravity exist at all, they do not exceed 0.02 mGal/yr.

Similar measurements were made with even more sensitive apparatus in Eastern Europe. They established that the variations of the force of gravity with respect to Potsdam in Eastern Europe are small and cannot exceed 3 μGal per year. Finnish specialists obtained somewhat similar results for Finland and Scandinavia.

Late in the 1960s, an enormous breakthrough was made in the field of instrumental gravimetry. Absolute ballistic gravimeters of very high sensitivity were developed. In the Soviet Union, one such instrument, which was given the designation GABL, was built at the USSR Academy of Sciences Siberian Division Institute of Automation and Electrometry. This instrument can be used to measure the absolute value of the force of gravity with an accuracy of the order of magnitude of ±6 to ±8 μGal and its variations accurate to about ±2–3 μGal.

With this instrument, it became possible within a comparatively short time to solve several rather important problems of global nature: to determine the correction to the Potsdam system with respect to the new IGSN-71 system; to check the reliability of the IGSN-71 system; to detect variations of the force of gravity due to variations in the earth's rotation; to establish the shift of the zero of the IGSN-71 system by an amount of 44 ± 4 μGal.

Moreover, measurements made in Australia and in the equatorial belt led to complete rejection of Barth's notion that major changes in the force of gravity could result from displacement of the earth's core.

Further, repeated measurements of the force of gravity at Potsdam, Moscow, and Novosibirsk detected quasiperiodic irregular variations of the force of gravity that correlate with variations of the earth's velocity of rotation.

The contents of the paper have been published as follows: Yu. D. Boulanger, Bull. D. Inform. BGI, Paris, May 1979; No. 44, p. 1-D-1. Yu. D. Boulanger, and S. N. Scheglov, Bull., Geod., 1978, No. 100, p. 175. Measurement of the Absolute Value of Acceleration of Gravity. In: Collected Papers Edited by Yu. E. Nesterikhin, Novosibirsk, 1972. G. P. Arnautov, Yu. D. Boulanger, *et al.*, BMR J. Austral. Geol. and Geophys. 4, 383 (1979).

Yu. D. Boulanger, N. N. Parisky, and L. P. Pellinen, Use of Gravity Measurement in Defining and Realizing Reference Systems for Geodynamics. In: Proc. of 56th Colloquium. Warsaw, 86, 217 (1980).