Unfortunately, it cannot be stated a priori that the lifetime will be rather large because of the large difference between the energies of the metastable phase and the molecular phase at p = 0 (the metallic phase is found to be stable against decay to atomic hydrogen) and because of the small mass of the hydrogen or deuterium ions. A factor that contributes appreciably to stabilization is the large difference between the densities of the two phases. Accordingly, the question as to the real density dependence of the molecular-phase energy may become critical.

The basic results set forth in the paper will be found in[4].

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V. B. Braginskiĭ and V. I. Panov. The Equivalence of Inertial and Gravitational Masses.

The general theory of relativity was based on a fundamental experimental fact—the equality of the ratio of the inertial and gravitational masses for different bodies (the equivalence principle). The authors repeated the experiment in which this equality was determined for aluminum and platinum. The experimental setup of Dicke, Krotkov, and Roll[1] was preserved in the experiment. A torsion pendulum, falling with the earth into the gravitational field of the sun, should be acted upon by a mechanical torque proportional to the expected difference between the accelerations of the substances of which the pendulum consists (if the equivalence principle is violated). Owing to the earth's rotation, this torque should vary sinusoidally with a period of 24 hours. The sensitive element in the experiment was a torsion pendulum with an oscillating period of 2×10^4 sec (5 hours 20 minutes) and a relaxation time greater than 6×10^7 sec.

It was shown in[2] that an oscillator with a large relaxation time can be used to measure a disturbance far below the level of stationary thermal fluctuations corresponding to an energy kT. The setup made it possible to resolve an acceleration difference smaller than 1×10^{-13} cm/sec^2 during a measurement time of 6×10^5 sec against the thermal-fluctuation background. Recognizing that the acceleration difference between aluminum and platinum was measured in the gravitational field of the sun (g = 0.62 cm/sec^2) in the experiment, the thermal fluctuations could simulate violation of the equivalence principle at a level below 5×10^{-13}.

The pendulum was placed in a vacuum chamber in which the pressure ($<1 \times 10^{-8}$ Torr) did not change during the time of the experiment. The arm of the pendulum was suspended on an annealed tungsten wire 2.8×10^2 cm long and 5×10^{-4} cm in diameter. To reduce the influence of local variable gravitational-field gradients, the pendulum was built in the form of an eight-pointed star with a radius of 10 cm and equal masses at the points. Two groups (four each) of these masses were made from specially purified aluminum and platinum. The total mass of the weights was 3.9 g. The setup was placed in a thermostat. The temperature around the setup was stabilized to within 5×10^{-4}°C. The arm of the pendulum was protected by a magnetic shield. The pendulum's oscillations were registered on photographic film by a flying spot. A helium-neon laser was used as the light source. The length of the optical lever was 5×10^3 cm. Violation of the equivalence principle at the 1×10^{-12} level would have produced a harmonic in the motion of the pendulum with a one-day period and an amplitude of 1.8×10^{-7} rad, which would correspond to a 9×10^{-4} cm displacement of the spot on the film. After reduction of the measured data, the average amplitude of the pendulum's diurnal oscillations was found to be $(-0.55 \pm 1.65) \times 10^{-7}$ rad (at the 0.95 confidence level). It can therefore be stated that the ratios of the inertial and gravitational masses for aluminum and platinum are equal to within 0.9×10^{-12}. It is seen from the results that the expected sensitivity was not attained. This means that the principal disturbing factors operating during the measurements were simulating effects, including primarily the following:

1) The influence of local variable gravitational-field gradients.

2) Variations of the radiometric pressure.

3) Variations of the magnetic field in the laboratory.

4) Light pressure from the registration-system source.

5) Seismic jolts.

Analysis of the experiment and control measurements make it possible to state that the basic contribution to the error of measurement comes from seismic jolts combined with the light pressure of the laser.

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Ya. B. Zel'dovich, L. P. Pitaevskiĭ, V. S. Popov, and A. A. Starobinskiĭ. Pair Production in a Field of Heavy Nuclei and in a Gravitational Field.

As quantum mechanics developed, it became clear very quickly that it not only changed the laws of particle motion, but also implies a theory of their production. In principle, this became clear when Einstein showed that light consists of quantum particles or photons. The quantum theory of systems with variable numbers of particles was developed in the classical works of V. A. Fock. The processes of particle production and annihilation have been thoroughly studied. Why, then, should we return to this problem today?

1. To this day, the production of pairs by photons has been possible in experiment only with high-frequency quanta ($\hbar\omega \geq 2mc^2$). The day is approaching when it will be possible to accomplish experimentally a process of a qualitatively different kind—the production of pairs