Scientific session of the Division of General Physics and Astronomy, USSR Academy of Sciences (26–27 February, 1975)

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A scientific session of the Division of General Physics and Astronomy was held on 26 and 27 February, 1975 at the conference hall of the P. N. Lebedev Physics Institute of the USSR Academy of Sciences. The following papers were delivered:

1. G. I. Petrov, The Nature of the Tungusska Meteorite.

2. G. E. Kocharov, Nuclear Reactions on the Sun.

3. L. F. Vereshchagin, E. N. Yakovlev, and Yu. A. Timofeev, The Possibility of a Hydrogen Transition to a Conductive State.

4. A. V. Gurevich, The Artificial Ionospheric Mirror.

We publish below brief contents of the papers.

G. I. Petrov. The Nature of the Tunguska Meteorite. The event of 30 June 1908 that is known as the "Tunguska Meteorite" is considered. The uncommon nature and scale of this phenomenon attracted a great deal of merited attention. An extensive literature has been devoted to its study.

The main peculiarity of the event was the fact that when the large body plunged into the earth's atmosphere, only the shock wave reached the surface. This wave felled trees over an area of about 2000 square kilometers and set fires in the taiga. Estimates of the energy released in the atmosphere yield values on the order of $10^{23}-10^{24}$ erg.

The effect has been analyzed with reference to the laws of mechanics and gasdynamics.

All aspects of the phenomenon can be explained rationally if the motion of the large body was strongly nonstationary and if the shock wave could separate from the body to distances considerably greater than its characteristic dimension. This is possible if the Strouhal number $\mathrm{Sh} = v/l\tau > 0.1$, where v is the velocity of the motion, l is the characteristic dimension of the body, and τ is the characteristic time of velocity change. For the deceleration of a body in a gas, $\mathrm{Sh} = k\rho_g/\rho_b$, where k is a coefficient determined by the geometry of the body. Thus the body that entered the earth's atmosphere had a density considerably below 0.1 g/cm^3.

The rapid disintegration of the moving body in the atmosphere is discussed, and estimates of the heat fluxes are given.

It is shown that at very high rates of vaporization, the rate of mass loss by the entire body is lower than the rate of mass loss by its solid phase, a factor that must be taken into account in computing the motion of the body.

Estimates of the kinetic energy lost by the body when it reached the surface of the planet are submitted.

It is shown that large bodies with an initial kinetic energy greater than 10^{24} erg at a density greater than 0.1 g/cm^3 retain much of their initial kinetic energy at the surface of the planet, even if the planet has an atmosphere like that of Venus; consequently, the steep-walled depressions with diameters of 50 to 100 km that have been observed on the surface of Venus may be impact craters (the energy required to form them exceeded 10^{30} erg).

In conclusion, the paper points out the inconsistencies of explanations involving shattering, thermal-explosion, annihilation, or thermonuclear-explosion hypotheses.

E. L. Krinov, Tungusskiĭ meteorit (The Tunguska Meteorite), USSR Academy of Sciences Press, 1949.

M. A. Tsikulin, Meteoritika, No. 20, USSR Academy of Sciences Press, 1961, p. 87.

E. M. Kolesnikov, A. K. Lavrukhina and A. V. Fisenko, Geokhimiya, No. 8 (1973).

V. P. Stulov, Doctoral Dissertation, Moscow State University, 1974.

G. E. Kocharov. Nuclear Reactions on the Sun. The numerous attempts to explain the results of solar-neutrino experiments can be classified into three groups:

a) Hypotheses are introduced to lower the temperature in the interior of the sun and, accordingly, the fluxes of high-energy neutrinos.

b) Attempts are made to lower the velocity of light in the neutrino experiment by lowering the rate of generation of high-energy neutrinos in the interior of the sun or by losing the "necessary" neutrinos on the path from the sun to the earth.

c) It is assumed that the temperature in the central part of the sun varies with time and that the temperature is at present below the average.

All of the hypotheses encounter difficulties associated with the need to modify established conceptions.

Experiment now gives the value $\xi \leq 1$ cent $= 10^{-36}$ reaction event per second with one Cl^{37} atom for the rate of the Pontecorvo reaction. Analysis of the background sources shows that $\xi = (0.3 \pm 0.6)$ cent. If it is found that $\xi \leq 0.3$ cent on a further reduction of the background, only five of the numerous current hypotheses will still stand. In group (a), only the hypothesis of G. E. Kocharov and Yu. N. Starbunov concerning the possible combustion of helium-3 in the interior of the sun will

