MEETINGS AND CONFERENCES

Scientific Session of the Division of General Physics and Astronomy, USSR Academy of Sciences (28-29 November, 1973)

Usp. Fiz. Nauk 113, 707-713 (August 1974)

A scientific session of the Division of General Physics and Astronomy of the USSR Academy of Sciences was held on November 28 and 29 at the conference hall of the P. N. Lebedev Physics Institute. The following papers were delivered:

1. V. A. Krat, New Data for Solar Physics from Observations in the Stratosphere.

2. V. E. Zuev, Laser Sounding for Atmospheric Pollution.

3. G. A. Askar'yan, E. K. Karlova, R. P. Petrov, and V. B. Studenov, Vaporization, Burning Off, and Confinement of Oil and Other Films on Water Surfaces with the Aid of Powerful Laser Beams.

4. V. M. Agranovich, B. N. Mavrin, and Kh. E. Sterin, Effects of Strong Anharmonicity of Phonons and Their Damping in Polariton Raman Scattering Spectra.

5. I. M. Khalatnikov, Phase Transitions in He^3.

We publish below brief contents of the papers.

V. A. Krat. New Data for Solar Physics from Observations in the Stratosphere. The Soviet stratospheric solar observatory made its fourth flight on June 20, 1973. For this flight, the Cassegrain optical system of the telescope with 0.5-meter primary mirror was replaced by an optical train having a 1-meter primary. Scientific material of excellent quality (in regard to resolution of detail) was obtained.

Study of the scientific material of the first three flights and some of the material of the fourth flight permits the following conclusions:

1. There is practically no deuterium in the solar atmosphere.

2. The solar granulation can be traced down to objects approximately 100 km across. The average granule sizes are little more than half those determined from the best American stratospheric photographs. These facts, which were brought out by the record-high resolution obtained in our 1970–1973 photographs of the sun, indicate that it is not correct to identify the granules with autoconvection cells in the solar atmosphere. The manner in which the granules change with time, their shape, and their visibility at the limb of the solar disk indicate that they are of wave nature. They can only be combined magnetoacoustic waves and gravity waves.

3. Study of bright Secchi rings at the boundaries of the penumbra with the photospheric background and the sunspot nucleus indicates that they are extremely inhomogeneous (granularity with large discontinuities). The most probable cause of their appearance is dissipation of gravity waves on collision with the magnetic field of the spot.

4. Investigation of the fine structure of motions in the solar atmosphere on stratospheric spectrograms indicates not only the presence of strong shifts of the velocity grid with respect to the granulation, but also that the vertices of magnetic loops with their own energy sources are present in the atmosphere.

5. The magnetic loops broaden on emerging into the solar chromosphere, as evidenced by the observed existence of a lower size limit for chromospheric formations, on the order of 700 km. Facular elements (sizes 800 to 1000 km) are found to be even larger in the chromosphere.

The above does not by any means include all of the results obtained from processing of the stratospheric data; we have reported only those that can now be considered certain.

For purposes of synchronous analysis of photospheric processes at two levels (two effective temperatures) as the frequency of flights of the observatory is increased and its efficiency is improved, it will be necessary to complete, in the immediate future, the construction of a high-altitude stratospheric station that will photograph the sun from a height of 32 km in the 1800–2200 Å transparency window.

It is also necessary to exploit the advantages of observations in the height range from 1 to 20 km, in longer-wave regions of the spectrum, and in the submillimeter band for study of the sun, stars, and galactic and extragalactic infrared objects. The first step toward this goal would be to launch stations with telescopes having 1.5-meter-diameter primary mirrors with scanning mechanisms.

V. E. Zuev. Laser Sounding for Atmospheric Pollution. The wide variety of phenomena observed in the interaction of laser radiation with the atmosphere as a medium in which this radiation propagates forms an excellent basis for the development of laser sounding for atmospheric pollution by products of human industrial activity. These phenomena include aerosol and molecular scattering, resonant absorption by gases, Raman scattering, fluorescence, resonant scattering, the amplitude and phase fluctuations of the optical waves due to turbulent inhomogeneities, the Doppler effect, and various nonlinear effects.

The interaction cross sections for most of these phenomena are largest precisely in the optical band of the electromagnetic spectrum, and this opens up excellent opportunities for remote sounding of all physical parameters of the atmosphere, including the components that pollute it. Here it is easily understood that the higher the concentration of the pollutants, the more effectively can they be determined.

The significant advantages of laser pollution sounding methods are: 1) high spatial resolution (in the meter range when Q-switched lasers are used); 2) quick readout (the information is acquired in the form of a laser-pulse echo signal propagating at the velocity of light); 3) noise immunity, because of the high monochromaticity