Scientific session of the Division of General Physics and Astronomy, Academy of Sciences of the USSR (31 May–1 June 1978)

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A Scientific session of the Division of General Physics and Astronomy of the Academy of Sciences of the USSR was held on May 31 and June 1 in the conference hall of the P. N. Lebedev Physics Institute. The following papers were delivered:

1. *I. D. Novikov*, Space-time in a black hole.

2. *P. V. Shcheglov and A. A. Tokovinin*, Prospects for the attainment of high angular resolution in ground-based optical astronomy.

3. *M. A. Liberman*. A contribution to the theory of ionizing shock waves in magnetic fields.

4. *V. A. Bazylev and N. K. Zhevago*, Electromagnetic radiation emitted by particles channeled in a crystal.

5. *M. A. Kumakhov*, Spontaneous and induced emission by relativistic particles in a crystal and possibilities for utilization of this effect in physics.

We publish below brief contents of four of the papers.

P. V. Shcheglov and A. A. Tokovinin. *Prospects for the attainment of high angular resolution in ground-based optical astronomy.*[1)] The resolving power of large first-quality ground-based telescopes in classical photographic work is now limited by atmospheric turbulence and seldom exceeds 1″; siting of such telescopes at places with good atmospheric conditions sharply improves their efficiency in the sense that they can operator for longer times with good resolution. Atmospheric conditions are now studied both by optical methods and by analysis of temperature fluctuations throughout the entire depth of the atmosphere; surface-layer (2–30 meters) turbulence is not detrimental to the images at night at good locations. The atmospheric aspect of securing good resolution in modern observational astronomy has definitely been neglected. Resolution may be much better in short-exposure visual observations than it is in photography, and sometimes reaches 0″.05. Visual observations of double stars are made systematically with 0″.15 resolution. It is also helpful to use short exposures in photographic observations.

Nonclassical methods of improving angular resolution and their sensitivity are discussed. It is shown that the sensitivity of the Michelson interferometer and speckle interferometry is limited in principle only by the atmosphere. Their limiting magnitude increases sharply with improvement of atmospheric conditions. Given modern techniques for recording and analysis of the images, these two observing methods should have magnitude limits of 15-20 under realistic atmospheric conditions and therefore appear highly promising. At the moment, the intensity interferometer gives higher resolution (0″.001), but it is much less sensitive, and therefore suitable only for measuring the diameters of comparatively bright stars (down to $2^m.5$ at present and perhaps down to 6^m in the near future). Active compensation of wavefront distortions with the aid of flexible mirrors is possible for stars no fainter than 10^m in a narrow field of view, so that this method will probably not find astronomical applications.

It would therefore seem expedient to develop speckle interferometry (which will be most productive in the study of double stars) and to build updated long-baseline Michelson interferometers, which will make possible record-high resolution of faint, including extragalatic, objects. The main components of such an interferometer (precision optics and mechanics, laser instruments for measuring distances, computers, and multielement light detectors) can be built even now on the basis of existing technology.

M. A. Liberman. *A contribution to the theory of ionizing shock waves in magnetic fields.* The development of high-power electro-magnetic shock tubes in which a dense hot plasma is formed behind the front of a strong ionizing shock wave (SW) in a magnetic field, has become a promising trend in the field of controlled thermonuclear fusion.[1] In nature, such waves are formed in the ionosphere and in outer space. In spite of more than twenty years of study of ionizing SW in magnetic fields, aspects of the problem still remain unclear. Moreover, the calculated structures of such waves disagree even qualitatively with observations.[2] Whereas theory[3,4] predicts that compression of the magnetic field should be observed behind the gas-dynamic discontinuity in the structure of the wave, the experimentally observed magnetic-field compression[5] leads the pressure pulse.[6]

[1)] A more detailed exposition of this problem will be found in the paper, which the authors have submitted to Uspekhi Fizicheskikh Nauk [Soviet Physics-Uspekhi].

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