Scientific session of the Division of General Physics and Astronomy and the Division of Nuclear Physics of the Academy of Sciences of the USSR (23–24 January 1980)

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A joint scientific session of the Division of General Physics and Astronomy and the Division of Nuclear Physics of the Academy of Sciences of the USSR was held on January 23 and 24, 1980 at the P. N. Lebedev Physics Institute of the Academy of Sciences of the USSR. The following papers were delivered:

January 23

1. *V. M. Agranovich*, Spectroscopy of surface polaritons and the properties of the surface.

2. *Yu. A. Osip'yan*, Dislocational (quasi-one-dimensional) electrical conductivity in semiconductors.

January 24

3. *D. G. Lominadze, G. Z. Machabeli, A. B. Mikhaĭlovskiĭ, Yu. P. Ochelkov, and V. V. Usov*, The nature of the high-frequency radiation of pulsars, and the activity of supernova remnants.

4. *A. A. Galeev and V. V. Krasnosel'skikh*, Plasma mechanisms of the magnetospheric radio bursts of Jupiter.

5. The last paper was accompanied by the following demonstrations: a film entitled "Dynamics of the Jovian Atmosphere from Voyager-1 Data."

6. A recording of "Sounds of Jupiter."

Brief contents of four of the papers are published below.

V. M. Agranovich. *Spectroscopy of surface polaritons and the properties of the surface.* With the development of research in surface physics, much attention has been given in recent years to study of various properties of surface electromagnetic waves—surface polaritons (SP). Waves of this kind are capable of propagation along the surfaces and interfaces of media, and their dispersion law is determined not only by the dielectric permittivities of the contacting media, but also by features in the elementary-excitation spectrum in the transitional layer.[1] Since the properties of the medium near the surface are, generally speaking, different from its properties in bulk, transitional layers are always present and, depending on the nature of the interaction, have thicknesses that vary within rather wide limits for different materials: $d \approx 10$ Å to $d \approx 100-1000$ Å. The presence of a transitional layer influences the SP spectrum, and this, by itself, opens rather broad possibilities for study of the elementary-excitation spectra of surfaces, interfaces, and thin films. The transitional layer of a thin film has its strongest influence on the SP spectrum in the case (see Refs. 1 and 2) in which the frequency ω_0 of the oscillations in the transitional layer falls in the range of SP-frequency realignment. A gap $\Delta \sim \omega_0\sqrt{d/\lambda_0}, \lambda_0 = 2\pi c/\omega$ then forms in the SP spectrum, and is also observed in experiment. The gap may be particularly wide for an electron-transition region. Abeles *et al.*[3] observed this effect in a study by the partial internal reflection method (see Ref. 1) of the influence of extremely thin films on the SP spectra of metallic substrates. Thus, $\Delta \approx 0.5$ eV when a film of silver of thickness $d \approx 20-60$ Å was sputtered onto an Al surface. The frequency of the plasma oscillations in the silver is $\omega_0 \approx 3.7$ eV/$\hbar$. On the other hand, the SP spectrum on Al extends all the way to $\omega_s \approx 10$ eV/$\hbar$, so that the frequency ω_0 falls in the range of the SP spectrum found when the delay is taken into account.

It has been shown[4] that at resonance with the SP oscillations in the transitional layer, an additional surface wave also appears as well as the gap, and with it the problem of additional boundary conditions for surface waves.

The problems indicated above have been discussed previously only for isotropic transitional layers. Accordingly, the anisotropy of the gap that arises in the presence of an anisotropic transitional layer was studied in Ref. 5. Several studies have been made recently of the spectra of monolayers deposited on metallic bases.[6,7] The dependence of the absorption coefficient for the SP on its frequency was determined in these experiments. The oscillations of a monolayer of chemadsorbed hydrogen on tungsten were first observed in Ref. 7. The frequency of the oscillation, $\omega_0 = 1046$ cm^{-1}, was measured with high resolution. The linewidth found was $\delta \approx 14$ cm^{-1}, i.e., almost an order of magnitude smaller than the width determined by the method of characteristic electron losses. The same group[8] made the first observations of effects of interference between surface waves and volume waves that arise on diffraction of SP on an impedance step. Measurements of this kind may also prove helpful for observation of additional SP.

The paper also discussed possibilities of SP self-focusing and other problems of the nonlinear spectroscopy of SP.

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[8] Z. Schlesinger and A. J. Sievers, Infrared Surface Wave Interferometry, Cornell University, Ithaca, Report No. 4177, November 1979.