This is explained by saturation of magnetoresistance in the transverse mannetic field when the current is parallel to one of the bisector axes and $B \parallel C_2$. A band model of bismuth-antimony alloys at 77°K was constructed from the calculated energy spectra of bismuth[15] and antimony[16] and the experimental data that were obtained.

The causes of the noninteger concentration efficiency of the impurity in bismuth and bismuth-antimony alloys and the pronounced individuality of the effects of impurity atoms in these materials are discussed[17]. It is assumed that the phenomenon is due to the complexity of the energy spectrum which causes the impurity atoms to form quasilocal states that act as "traps" of a sort for free carriers. This lowers the effective carrier concentration. The efficiency of the impurities changes on realignment of the energy spectrum.

The results of a study of size effects on transfer phenomena in bismuth in the case of thin films and whiskers are also submitted[18].

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V. V. Sobolev. Spectroscopy of Intrinsic Energy Levels of Solids. A new and important field of solid-state physics has been developing rapidly since about 1960: the spectroscopy of solids in a broad intrinsic absorption band, i.e., the spectroscopy of interband transitions and exciton states at various points and in various directions of the Brillouin zone with participation of many valence and conduction bands.

The Optics Laboratory of the Moldavian Academy of Sciences Institute of Applied Physics has devoted ten years of study to solution of certain problems in this area. Initially, the reflection spectra of about 150 different crystals of the groups A^4, A^3B^5, A^2B^6, $A^2B^4C_2^5$, PbS, Mg_2Si, Se, A^2B^5, MoS_2, and others, as well as those of glasses of arsenic chalcogenides and strongly doped crystals of the groups A^4 and A^3B^5, were studied[1] over the entire vital range of interband transitions from 1 to 12.5 eV. As a result, the electronic spectra of the above solids were determined through the entire vital range of interband transitions, basic relationships in the spectra of related compounds were established, the first explanations of their specific nature in the scheme of the interband transitions and in various directions and at various points of the Brillouin zone were proposed, as yet unobserved transitions and the electron spectra of unstudied compounds were predicted, and the limits of validity of known theoretical energy-band calculations were determined. The fundamentally important questions as to the prevalent role of close-range order (as compared to long-range order) of the structure of the solid in determining the structure of the intrinsic energy levels and as to the applicability of the basic concepts of band theory to strongly doped crystals were solved experimentally.

Later, in 1966—1970, greatly improved theoretical calculations of the bands of many semiconductors were published, with prediction of the complex fine structures of the previously observed spectra that result from transitions in the volume regions of the Brillouin zone and relativistic effects. As before, the fundamantal problems of band and exciton optics remained undeveloped: 1) the possibility of appearance of excitons with discrete spectra and the theory of excitons in the energy range $E \gg E_g$; 2) the interaction of excitons with a continuous background of interband transitions; 3) the interaction of interband transitions and excitons with photons, and others.

To attempt experimental verification of these band-theory predictions and to develop a basis for filling the above blanks in band and exciton theory, it was necessary first of all to use much more accurate experimental methods. The optics Laboratory therefore designed and built a set of automatic high-precision spectral units for registration of reflection and differential spectra in a broad range of self-absorption energies.

The Laboratory recorded a first in world optical-instrumentation practice by developing and building high-precision spectral instruments based on the SPM-2 and DFS-12 monochromators. The UDFS-12 instrument can measure reflection coefficients accurate to 0.02%, i.e., ten times more accurately than known units, in the 1—5 eV range at T = 77 and 293°K and with high dispersion (0.5 nm/mm). Below we shall briefly discuss the most interesting recent results that represent new progress[2].

The UDFS-12 and USPM-2 instruments were used to measure the reflection spectra of Si, Ge, ZnS, ZnSe, CdTe, HgSe, HgTe (sphalerite), ZnO, CdS, CdSe (wurtzite), and HgS (trigonal modification), and the USPM-2 to measure those of GaP, GaAs, GaSb, InP, InAs, and InSb in the range 1 – 5 at 77 and 293°K; with the UDFS-12, this was accomplished with high accuracy over the entire spectrum. The positions of all peaks, their contours, and the average temperature coefficients of their shifts were determined with high accuracy. This permits calculation of much more accurate spectral curves of the fundamental opitcal constants (ϵ_1, ϵ_2, etc.) of Si and Ge crystals and the ten A^2B^6 compounds.

Dobulet structure was convincingly established for the two principal reflection peaks of Si at 77°K (4.50 and 4.31 eV, 3.423 and 3.370 eV). New transitions were observed in the spectra of many A^3B^5 and A^2B^6 compounds. The complex structure of 10 – 15 strongly and partially polarized peaks was brought out in the 1 – 5 eV range in polarized spectra of α-HgS; some of the peaks have distinct excitonic features. At room temperature, the reflection spectra R(%) showed exciton states of ZnS($A_1 + B_1$, C_1) (sphalerite), ZnO($A_1 + B_1$, C_1), ZnTe($A_1 + B_1$), CdTe($A_1 + B_1$, C_1) (sphalerite), ZnO($A_1 + B_1$, C_1), CdS(A_1, B_1, C_1), and CdSe(A_1, B_1, C_1). The R(%) spectra of excitons were measured with high reproducibility and spectral resolution in the energy range E $\approx$ E$_g$ at T = 293 and 77°K for crystals of CdS, CdSe, ZnSe, and ZnTe, and also for ZnO and ZnS at 293°K.

Use of an empirical model for the transition energies of related compounds as functions of their lattice parameters established relationships for the variations of the transition energies in two series of A^3B^5 compounds and three series of A^2B^6 compounds and prediction of transitions that have not been observed experimentally for many of the compounds considered. A more convincing proposal was submitted to explain the nature of the reflection peaks of A^3B^5 and A^2B^6 compounds.

Complex structures of interband transitions and excitons, which were explained on the basis of known band-theory data, were observed in the reflection spectra of strongly anisotropic compounds—molybdenum chalcogenides and cadmium and zinc phosphides, arsenides, and antimonides—in the range 1 – 12.5 eV[3].

Over the next few years, the Optical Laboratory will make precision measurements of the reflection spectra of many crystals and compute their fundamental optical functions (ϵ_1, ϵ_2, h, k, α, β, and others) from the Kramers-Kronig relations for a broad energy range. This will greatly facilitate precise comparisons of theory with experiment for reflection and differential spectra.

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