gap indicated by the absence of directly transmitted rays. Since in this case some of them are deflected from the original direction by the dispersion zone of the plate and by the cut, the others are held by the opaque screen.

Figure 4 shows another method of covering the glancing rays around the plate. Here, the opaque screen is replaced by a plate 2 with a cut at an angle $\gamma = 18.2°$ which is also fabricated from NS6 glass. The latter is pressed tightly to the main plate 1 at the narrow edge with a width of 146 μm. In this arrangement the rays are first directed along ab into the dimethyl phthalate deflection zone, are refracted by the cut of plate 2, and then are reflected from the first plate. As a result, the line is attenuated by a factor of 1.85.

In conclusion, the author thanks Yu. D. Kopytin for criticism of the results.

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TOWARDS A MODEL OF DISCRETE SPACE – TIME

D. D. Ivanenko and G. A. Sardanashvili

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Discrete space–time (DS) continues to be one hypothesis explaining the structure of space in the microworld (see the reviews [1, 2]). It is characterized by the idea of elementary pairwise disconnected regions of space, the points inside of which are not separated into observables.

A model with DS was first considered in field theory by Ambartsumyan and Ivanenko (1930). In quantum theory DS emerges in models with a discrete spectrum of coordinate operators chosen in a definite manner (Snyder, 1947). The discreteness of space, and also of time, is inspired by the appearance in modern theory of various fundamental lengths, whose significance was especially emphasized by Heisenberg. First, there are the self-interaction constants of fields in nonlinear generalizations of electrodynamics, meson dynamics, and the Dirac spinor equation. Second, the use of cutoff factors leads to minimum lengths or time intervals. Various considerations suggest minimum lengths from 10^{-13}-10^{-16} cm up to the quantum-gravitational Planck length of 10^{-33} cm, and within these limits the usual concepts of space–time evidently lose their validity. In recent years, DS models have continued to be developed by Penrose, Weizsäcker, and Finkelstein [3].

However, the DS concept itself has not been put into a sufficiently clear mathematical formalism and often remains largely intuitive. If we disregard the less important details of different versions that have been proposed, the basic idea of DS, in our opinion, can be based on topological spaces Y, in which the connected component of every point $y \in Y$ is its closure $\bar{y}$, and in divisible Y it is this point itself (completely disconnected spaces) ([4], I.11.5). An example of such a space is a discrete topological space, and also a rational straight line ([5], IV.2.5). Among the Y spaces are all the possible topological groups with a topology determined by some family of subgroups ([5], III.1.2, Remark), and also vector spaces and analytic manifolds on complete nondiscrete fields with non-Archimedean absolute values $|a+b| \leq \max(|a|, |b|)$ ([6], XII.4). In axiomatic quantum theory the space Y can be the spectrum (the space of all irreducible representations) of some C* algebra of observables [e.g., the algebra of probability measures on a set ([7], I.9)]. In models, e.g., with differentiation of C* algebras [8] this spectrum plays the role of generalized coordinate space.

Recently, the development of different versions of DS has been stimulated by the promising, in our view, concept that under extremal conditions (inside particles, in cosmological and astrophysical singular regions) the topological properties of space (e.g., Betti numbers, the number of Möbius twists, etc.) can act as the dynamical characteristics of a physical system and change under the effect of some operations. From this viewpoint, spaces of type Y can be realized. Then the presence on Y of an indivisible uniform structure would correspond to the well-developed concepts of the presence of certain minimum or fundamental lengths. In particular, we think a promising approach is the use of DS of type Y to develop a model of a universal praspinor [9] to describe a hypothetical reality uniting space–time matter in systems with symmetry groups–Coxeter groups.

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GROUP-THEORETIC ANALYSIS OF THE BACKGROUND SPECTRUM OF THALLIUM SELENIDE

Dzh. A. Guseinov and M. A. Nizametdinova

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In [1] the reflection spectra of thallium selenide were measured in the residual ray region, some of the IR-active lattice vibration frequencies were determined, and the normal vibrations were analyzed for the center of the Brillouin zone. The literature does not contain a detailed group-theoretic analysis of the background spectrum of thallium selenide, although tables of the characters of irreducible representations of the wave vector groups of the corresponding space group D_{4h}^{18} are given in [2]. Such an analysis is needed both for calculations of the background spectrum and for an analysis of the different multibackground absorption and scattering processes.

In the present paper a complete analysis of the symmetry of normal lattice vibrations of thallium selenide at all the symmetric points of the Brillouin zone is given, and symmetrized atomic displacements are constructed for the center of the zone and the highly symmetric point on the boundary of the Brillouin zone.

The Brillouin zone of the bcc tetragonal lattice of thallium selenide, the coordinates of the symmetric points, and tables of the characters are given in [2]. Note, however, that in this paper a table of characters is not given for the symmetric point $R\left(0\,\frac{\pi}{2a}\,\frac{\pi}{2a}\right)$ with symmetry C_{2h}, where there is only one two-dimensional irreducible representation, and it is not explained that along the entire symmetric line PR the irreducible representations are doubly degenerate due to the symmetry of the time inversion. The irreducible representations (P_1, P_4) and (P_2, P_3) coalesce pairwise at point P. The latter result is obtained if we apply the Elliot criterion, which is suitable for the analysis of a space group containing an inversion [3].

To calculate the characters of the vibrational representation and expand it in irreducible representations, we use the appropriate equations from [4] and thus obtain:

$$\Gamma_{vib} = \Gamma_1 + 2\Gamma_2 + \Gamma_3 + 2\Gamma_4 + 3\Gamma_5 + \Gamma_6 + 3\Gamma_9 + 4\Gamma_{10};$$
$$T_{vib} = T_1 + T_2 + T_3 + 3T_4 + 3T_5 + T_6 + T_7 + 2T_9 + 4T_{10};$$
$$P_{vib} = 4(P_1 + P_4) + 2(P_2 + P_3) + 6P_5;$$
$$N_{vib} = 4N_1 + 3N_2 + 3N_3 + 2N_4 + 4N_5 + 3N_6 + N_7 + 4N_8;$$
$$R_{vib} = 12R_1;$$
$$\Lambda_{vib} = 4\Lambda_1 + 2\Lambda_2 + \Lambda_3 + 3\Lambda_4 + 7\Lambda_5;$$
$$\Delta_{vib} = 6\Delta_1 + 8\Delta_2 + 4\Delta_3 + 6\Delta_4;$$
$$\Sigma_{vib} = 7\Sigma_1 + 7\Sigma_2 + 3\Sigma_3 + 7\Sigma_4.$$

The degenerate representations are combined in the parentheses.

Finally, using the standard method for the construction of the basis functions of irreducible representations [4], we construct the symmetry coordinates at the symmetric points. Figure 1 gives the symmetry coordinates for the points $\Gamma(000)$ and $T\left(0\,\frac{\pi}{a}\,0\right)$. The latter are normal vibrations for the representations Γ_1, Γ_3, Γ_6 and T_1, T_2, T_3, T_6 and T_7.

Ch. Il'drym Azerbaidzhan Polytechnical Institute. Azerbaidzhan Construction Engineering Institute.
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