BIANISOTROPICS OF QUASICRYSTALS. SYMMETRY ASPECTS.

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Symmetry of physical tensor quasicrystal properties has been discussed. Rules of selection for tensors of natural optical activity for different classes of quasicrystal symmetry have been determined.

Recently quasicrystal-anisotropic solids with infracted translational symmetry have been discovered by experiment [1]. There are "prohibited" axes of 5, 8, 10 and 12 fold symmetry in them. The paper seeks to carry out symmetrical analysis of quasicrystal optical properties.

For phenomenological description of macroscopic physical properties of quasicrystals in accordance with Neuman principle [2] we will use the following point symmetry groups: 5, 5/2, $\bar{5}$, $\bar{5}$m, 532, m5m, 8, 8/2, $\bar{8}$, 8mm, 8/m, $\bar{8}$2m, 8/mmm, 10, 10/2, $\overline{10}$, 10mm, 10/m, $\overline{10}$2m, 10/mmm, 12, 12/2, $\overline{12}$, 12mm, 12/m, $\overline{12}$2m, 12/mmm.

By way of example consider the linear optical properties of quasicrystals.

It should be kept in mind that due to high symmetry of quasicrystals many properties characterized by 1-4 th rank tensors will be uniaxial and even isotropic [3,4]. It follows from hermann theorem [2], according to which axis of n-fold symmetry for r<n rank tensor would be also an axis of infinite order.

That's why symmetrical tensors of rank 2 of dielectric and magnetic permeability in media of classes 532 and m5m would be isotropic and in the rest classes of quasicrystals would be unia-

xial.

By natural optical properties (NOA), characterized by nonsymmetric pseudotensor of rank 2, quasicrystals are divided into 5 types. Symmetry classes 5, 8, 10, 12 are characterized by three independend components: 11=22, 33, 21=-12. in groups 5/2, 8/2, 10/2, 12/2 are nonzero components 11=22, 33. In quasicrystals of symmetry: 5m, 8mm, 10mm, 12mm NOA tensor is purely antisymmetric: 21=-12. in the samples of symmetry 532 NOA is isotropic. The rest point groups of quasicricrystals symmetry prohibit NOA.

Due to frequency dispersion physical properties depend on the frequencies. That's why there are frequency regions of electromagnetic radiation, where optical properties are characterized by tensors ε and μ, i.e. quasicrystal is bianisotropic medium.

Besides many quasicrystals coutain rare-easth.

Components and at low temperatures they may have magnetic structure. In such case their physical properties should be characterized by groups of magnetic symmetry

References

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