

The investigation of quasi-characteristic radiation of electrons channeled along the charged axes in the crystals of zinc blende

M.V. Maksyuta*¹, V.I. Vysotskii*², S.V. Efimenko*³,
V.V. Syshchenko^{†4}, A.I. Tarnovsky^{†5}, A.Yu. Isupov^{‡6}

* Department of Radio Physics, Electronics and Computer Systems, Taras Shevchenko National University of Kyiv, 64/13, Volodymyrska Street, Kyiv 01601, Ukraine

† Belgorod State University, 85, Pobedy Street, Belgorod 308015, Russian Federation,

‡ Laboratory of High Energy Physics, Joint Institute for Nuclear Research, Dubna 14980, Russian Federation

Synopsis For slight relativistic electrons moving along the main charged [100] and [110] axes in the crystals of zinc blende there was made a numerical calculation of the transverse energy levels and corresponding wave functions. It was done the calculation and the comparison of quasi-characteristic radiation spectra for these axes.

In [1] it was shown that at electron channeling along the main charged [110] axes in the crystals of zinc blende type the potential wells become very non-unimodal due to a close position of oppositely charged axes. Note that potential wells in [100] axes in these crystals are unimodal. One may suppose that such structure differences in the interaction potentials must cause the essential difference of quasi-characteristic radiation (QCR) spectra.

In [2] there were investigated the peculiarities of slight relativistic electrons axial channeling at Lorentz-factors $\gamma=2$, 6 and 10 in ZnS, ZnSe and ZnTe crystals which are characterized by a various correlation between nuclei charges of positively and negatively charged ions. These investigations showed that the channeling along the charged [110] axes leads to great spectral intensities in broad spectral ranges and, in the long run, to great total intensities of QCR.

The given paper deals with the consideration of the channeling peculiarities of slight relativistic electrons in main charged [110] axes. The principle emphasis is made on a comparative analysis and a comparison of these results with the data of analogous theoretical and experimental investigations got at the study of the orientation motion of electrons in other crystallographic directions. For example, in Figure 1 QCR spectra originating at the channeling of electrons with Lorentz-factor $\gamma=10$ along [100] axes (the curve 1, $G_{\max} \approx 1 \text{ cm}^{-1}$) and along [110] axes (the curve 2, $G_{\max} \approx 40 \text{ cm}^{-1}$) are compared.

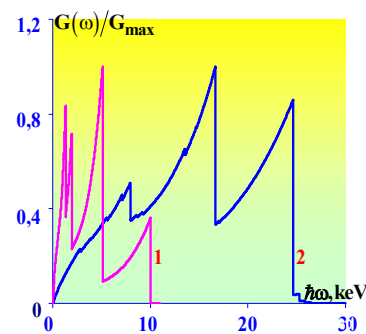


Figure 1. The spectral distribution of QCR energy by an electron per unit path at its motion at zero angle to the axes [100] – the curve 1 and [110] – the curve 2 of ZnS crystal (calculated in relative units at $\gamma=10$ and zero angular dispersion).

It is shown for the first time that the considered channeling regime allows to forecast the creation of much more effective sources of radiation. Besides, the paper studies the channeling of positively charged particles in non-unimodal directions.

References

[1] N. Maksyuta *et al* 2015 *Abstract of the XXIX International Conference on Photonic, Electronic and Atomic Collisions*, ICPEAC – Abstracts Available Online, TU – 152.

[2] N.V. Maksyuta *et al* 2016 *Theses of the Reports of VII International Conference Charged & Neutral Particles Channeling Phenomena*, Sirmione-Desenzano del Garda, Italy 68

¹ E-mail: maksyuta@univ.kiev.ua

⁴ E-mail: syshch@yanex.ru

² E-mail: vivvysotskii@gmail.com

⁵ E-mail: artur_tarnovsky@mail.ru

³ E-mail: svye@ukr.net

⁶ E-mail: isupov@moonche.jinr.ru