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Generation of Twisted Photons by Bent Crystals

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At the present moment, the bent crystals are employed as an effective tool for deflection of particle beams. There are also promising prospects for their use as alternative inexpensive sources of x-ray photons [1]. We develop this idea to apply the bent crystals for production of the so-called twisted photons, i.e., the photons with definite the energy, the longitudinal projection of momentum, the projection of the total angular momentum, and the helicity. Such photons are used in fundamental science and technology for the high-density information transfer, for the manipulation of rotational degrees of freedom of irradiated objects, for the high-contrast microscopy, and in radio-astronomy (see, for review, [2-5]). The detectors of twisted photons are also elaborated [6,7].

Employing the recently developed general formalism [8], we study the production of twisted photons by bent Si crystals. We find that the bent crystals can be used as an efficient and sufficiently pure source of twisted photons in the x-ray spectrum domain. Several schemes of how to realize such sources are proposed.

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