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Quantum expression for frequency of coherent radiation of charged particle moving through a periodic medium

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Properties of Vavilov-Cherenkov radiation were obtained by Frank and Tamm in classic approach. Shortly after, Ginzburg described these properties in quantum approach. Later, expressions for frequencies of coherent bremsstrahlung and parametric X-ray radiation in

periodic medium were obtained by Ter-Mikaelian in classic approach neglecting transverse components of pulses. In present paper, we derive the general expression for frequency of coherent radiation of charged particle moving through a periodic medium in quantum

approach with account of the transverse components of pulses. Classic expressions for frequencies of coherent bremsstrahlung and parametric X-ray radiation are derived from the general expression. Quantum and classic expressions for radiation frequency are compared and analyzed. The research was supported by the Ministry of Education and Science of the Russian Federation, project 3.2009.2014/K.

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