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Mixed (Regular and Chaotic) Dynamics under the Channeling of the High Energy Positrons in [100] Direction of the Silicon Crystal and Podolskiy-Narimanov Distribution

The character of motion (regular or chaotic) on the quantum level manifests itself in the statistics of the set of the system's energy levels. The complete regular case generates the sequence of the levels with exponential (Poisson) level spacing distribution; the complete chaotic case generates one with Wigner distribution [1]. The most interesting case is the co-existence of the regular and chaotic motion domains in the phase space of the system under consideration. The assumption of independent generation of two level sequencies from one chaotic domain and from all regular domains leads to Berry-Robnik distribution [2]. However, the presence of the chaotic motion domain in the phase space affects the levels produced by the regular domains via the so-called chaos-assisted tunneling (CAT) [3] that leads to Podolskiy-Narimanov distribution of the level spacings [4]. This distribution needs the mean amplitude of the tunnel transition and the relative contribution of the regular domains to the mean level density as the parameters. Using their estimations obtained previously [5] we found that Podolskiy-Narimanov distribution demonstrates the best agreement with the level spacing distribution for the channeling positrons of the energy 20, 30 and 40 GeV.

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