

## Transverse momentum distributions of hadrons in the Tsallis-3 statistics

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We have derived the exact and approximate hadron transverse momentum distributions for the Fermi-Dirac, Bose-Einstein and Maxwell-Boltzmann statistics of particles in the framework of the Tsallis statistics with escort probabilities (the Tsallis-3 statistics). We have revealed that the classical approximate phenomenological Tsallis distribution in the framework of the Tsallis-3 statistics corresponds to the zeroth term approximation and to the unphysical condition of zero entropy of the system in the whole range of state variables. The quantum approximate phenomenological Tsallis distribution does not correspond to the quantum transverse momentum distribution obtained in the Tsallis-3 statistics. We have revealed that the transverse momentum distributions in the zeroth term approximation and in the factorization approximation of the zeroth term approximation are the same in the Tsallis-3, Tsallis-2 and  $q$ -dual statistics. The exact Tsallis-3 classical distribution and the classical approximate phenomenological Tsallis distribution have been applied to describe the experimental spectra of the charged pions produced in the proton-proton collisions at high energies. We have found that the classical approximate phenomenological Tsallis distribution approximates the exact Tsallis-3 classical distribution unsatisfactory in the whole energy range.

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