MULTIPLE COHERENT COMPONENTS IN RELATIVISTIC HEAVY-ION COLLISIONS

E. Ikonen

Metrology Research Institute, Helsinki University of Technology and Centre for Metrology and Accreditation, P.O. Box 3000, FI-02015 TKK, Finland
e-mail: erkki.ikonen@tkk.fi

High-energy nuclear collisions are conventionally analyzed using a chaotic source component and a single coherent source component of the emitted pions. However, three-pion correlations from S+Pb collisions [1,2] provide experimental data, where the analysis using a single coherent component leads to inconsistent results (see Fig. 1). As described in this contribution, the inconsistency can be removed by a small, but significant, change in the theoretical description of the three-pion correlations allowing multiple coherent source components [3]. The new theoretical description is equivalent to such an extension of the conventional chaotic source current model where the amplitudes of the elementary current terms are allowed to vary.

The new theory is inspired by research on partially coherent pulsed photon sources, which have interesting similarities with the pion source provided by a relativistic heavy-ion collision. When the present knowledge on such pulsed synchrotron radiation sources is used in the analysis nuclear collisions, a lot of detailed information can be extracted from the results of three-pion correlation experiments.

Fig. 1. Zero-momentum-difference intercept of the two-pion correlation function \( \lambda \) as a function of the normalized three-pion correlator \( r_3/2 \) for different values of the intensity distribution parameter \( \gamma \) [3]. For the S+Pb collisions, a value of \( r_3/2 \sim 0.2 \) has been measured while \( \lambda_{\text{exp}} \geq 0.4 \) is determined from two-pion correlation experiments [1]. The conventional analysis (curve labeled \( N = 1 \)) with a single coherent component can be used to derive from \( r_3/2 \sim 0.2 \) a value of \( \lambda \sim 0.1 \), which is much less than the lower limit \( \lambda_{\text{exp}} \). The result with multiple coherent components is \( \lambda \sim 0.5 \), corresponding to rectangular intensity distribution of pion-bursts (\( \gamma = 9/8 \)).