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Charge splitting of directed and elliptic flow in heavy ion collisions

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We investigate the effect of the Coulomb field of the spectator matter on the directed and elliptic flow of charged pions. By means of a numerical Monte Carlo simulation, we find that the spectator charge induces sizeable values of directed flow. At beam and target rapidities, these can reach v_1=0.2 which is comparable to values reported by the WA98 collaboration in the corresponding kinematical range [1].

This effect is opposite for positive and negative pions, resulting in a *charge splitting of directed flow*. In the range of lower RHIC and SPS energies, the charge splitting extends down to midrapidity where our predicted values are in good agreement with very recent measurements reported by the STAR collaboration [2]. This effect appears to be strongly sensitive to the position of the pion formation zone with respect to the spectator system. Therefore, it provides *new, independent information* on the expansion of participant matter in the course of the collision.

By comparing the results of our predictions with the STAR and WA98 data, we investigate the *geometrical features* characterizing pions at freeze-out as they appear from our study of electromagnetic effects. We discuss the possibility to use the spectator-induced electromagnetic interaction as a new source of information on the space-time evolution of particle production at high energies.

Finally, for the first time, we present our new results on the *charge splitting of elliptic flow* which we discuss in the context of measurements reported by the STAR collaboration [3]. Additionally, we stress the complementarity of our study to the very recent analysis by Gursoy, Kharzeev and Rajagopal [4].

Most of this work was previously published in Ref. [5].

References:

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