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Towards a Direct Measurement of the Quark Orbital Angular Momentum Distribution

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We discuss the canonical (J_i) and kinetic/mechanical (Jaffe and Manohar) definitions of partonic orbital angular momentum (OAM). It was recently shown by Hatta and Burkardt that the two definitions correspond to the second moment in intrinsic k_T of the same generalized transverse momentum distribution (GTMD), while they differ in their gauge link structure. At the same time, as first observed by Polyakov, canonical orbital angular momentum can be independently described in terms of a twist three generalized parton distribution, which only a straight type of gauge link is allowed for. Here we provide further insight into this problem by showing that the second moment in k_T of the OAM twist two GTMD and twist three GPD, are connected through a Wandzura Wilzcek type relation which generalizes the one originally developed for the polarized twist three distribution, g_T . An important outcome of the picture we provide is that the two different mechanisms for generating partonic OAM can be both tested experimentally and validated by lattice calculations. Additional calculations using the Reggeized Diquark model are shown that provide an initial guidance for assessing the size of the various contributions.

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