

Abstract Submitted  
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**Partonic Orbital Angular Momentum and Lorentz Invariance Relations** ABHA RAJAN, SIMONETTA LIUTI, University of Virginia, MICHAEL ENGELHARDT, New Mexico State University — We show that Generalized Transverse Momentum Distributions (GTMDs) and twist three Generalized Parton Distributions (GPDs) can be connected through Lorentz Invariant Relations. The equations of motion along with the Lorentz Invariance Relations allow one to explicitly write the separate contributions to twist three GPDs from leading twist GPDs, a quark gluon quark correlation term and, in some cases, a mass term. In particular, the GTMD  $F_{14}$  or the correlation of an unpolarized quark in a longitudinally polarized proton, is known to describe the quarks Orbital Angular Momentum (OAM). In a separate approach, the twist three GPD  $\tilde{E}_{2T}$  was also shown to connect to OAM. We show that these two definitions are connected by a Lorentz Invariance Relation. A similar relation is found for the GTMD  $G_{11}$  which describes quark spin orbit correlations in the proton can be connected to the twist three GPDs  $E'_{2T}$  and  $\tilde{H}'_{2T}$ . These relations show how twist three GPDs through an implicit quark gluon interaction reproduce the effects of intrinsic transverse momentum in the GTMDs.

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