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Transverse Distributions of the Pion Cloud in a Chiral Light Cone Perturbation Theory Model[1] MACQUARRIE THOMSON, ETHAN PURCELL PURCELL, ENRIQUE SANCHEZ, Seattle University — Because of the Heisenberg uncertainty principle, protons are allowed to briefly fluctuate into a pion and a nucleon or a pion and a delta. Our goal is to calculate the splitting of the proton into these separate particles while the proton is moving at relativistic speeds, where its spatial extent becomes nearly two-dimensional, a disk of pion cloud. We use a pion 2D momentum distribution function $f_{\pi N}(y,t)$, derived from chiral light cone perturbation theory, in which y is the fraction of proton momentum carried by the pion and the momentum transfer t depends on y and $k_\perp$, the transverse momentum of the pion. To find transverse momentum distributions we calculate $f_{\pi N}$ as a function of y and $k_\perp$ for a range of physically reasonable values of the form factors and coupling constants on which it depends. We then use a 2D Bessel transform of $f_{\pi N}$ to calculate the transverse spatial probability distribution $\rho_{\pi N}(y,b)$ with b the transverse position coordinate. We compare our results to the expected spatial extent of the cloud, $\sim 1/m_\pi$, and to other theoretical transverse spatial distributions.

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