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Light Cone Model of the Transverse Distributions of the Pion Cloud[1] ENRIQUE SANCHEZ, MACQUARRIE THOMSON, ETHAN PURCELL, Seattle University — The Heisenberg time-energy uncertainty principle allows a proton to briefly fluctuate into a πN or a $\pi\Delta$ state. This fluctuation phenomenon creates a cloud of pions, which we investigate for protons moving at relativistic speeds. We describe the pion cloud in a Fock state expansion, in which we use two-body Gaussian wave functions in a Light Cone model to determine the probabilities of each proton fluctuation. The wave functions $\Psi_{\pi B}(y, k_\perp)$, with $B = N, \Delta$, depend on y, the pion momentum fraction, and $k_\perp$, the transverse momentum, in which we are interested. To normalize these wave functions we first calculated the probability that the proton will fluctuate into a πN or $\pi\Delta$ state by integration over $k_\perp$ and y, and set our results equal to values determined by experiment. Our normalization constants depended on a parameter α in the wave functions, related to the width of the distribution in momentum space. We made 3D plots to study the dependence on y of the transverse distributions in $k_\perp$. We then used a 2D Bessel transform to determine the transverse spatial distributions of the pions, which we expect to be $\sim 1/m_\pi$. We compare our results to other theoretical calculations.

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