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Search for collective effects in small systems obtained in ep collisions at HERA

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Measurements of two- and multi-particle angular correlations are presented in both ep deep-inelastic scattering at $\sqrt{s} = 319$ GeV and in photoproduction off protons at energies $W_{\gamma p} = 270$ GeV, as a function of charged-particle multiplicity. No long-range ridge structure is observed in the correlation functions. The second-order (V_2) and third-order (V_3) azimuthal anisotropy Fourier harmonics are extracted. Further, $C_2\{4\}$ signals are extracted from four-particle correlations for the first time in ep collisions and are found to be positive or consistent with 0. In summary, collective behavior has not been observed in collisions of protons with virtual or quasi-real photons at HERA energies.

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