

# Quark Matter 2019 - the XXVIIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions



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## Collectivity in novel geometric configurations of proton-proton collisions and in photo-nuclear collisions with ATLAS

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Measurements of two-particle correlations in  $pp$  collisions have demonstrated long-range azimuthal correlations between charged particle pairs, commonly interpreted as arising from a single particle azimuthal anisotropy. To better illuminate the origin and nature of these collective signatures, ATLAS presents studies in proton-proton collisions with a novel handle on event geometry, and in photo-nuclear collisions. In proton-proton collisions, the impact-parameter dependence of these correlations are studied in events containing a Z-boson, which acts as an independent handle on the impact parameter. This talk presents updated measurements of the azimuthal anisotropy in such Z-tagged  $pp$  collisions at 8 and 13 TeV. The measurements include studies of the  $p_T$ , event-multiplicity, and collision energy dependence of the anisotropy as well as their comparisons to the inclusive  $pp$  collisions. In addition, two-particle correlations are presented in a qualitatively new collision system of ultra-peripheral Pb+Pb collisions. Even if the passing nuclei are well-separated and do not interact hadronically in these collisions, a quasi-real photon from the EM field of one nucleus can interact with the other nucleus. The photons may reach energies up to 80 GeV and readily fluctuate into vector meson configurations. Thus these photo-nuclear collisions may proceed as rho-nucleus collisions albeit at a significantly lower collision energy than the equivalent nucleon-nucleon energy. This talk presents new measurements of two-particle correlations and characterizes particle production in photo-nuclear collisions, which have multiplicities significantly smaller than  $pp$  collisions and center of mass energies between those available at RHIC and the LHC.

**Primary author:** COLE FOR THE ATLAS COLLABORATION, Brian (Columbia University (US))

**Presenter:** COLE FOR THE ATLAS COLLABORATION, Brian (Columbia University (US))

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