Contribution ID: **945** Type: **Oral presentation**

Measurements of the azimuthal anisotropy and substructure of jets in Pb+Pb collisions with the ATLAS detector

Wednesday, April 6, 2022 9:00 AM (20 minutes)

It has been shown that high-energy partons lose energy when traversing the hot, dense medium produced in heavy-ion collisions. However, the mechanism of the energy loss, including its dependence on the path-length of the shower in the medium and sensitivity to the jet substructure, is not fully understood. This talk presents a new measurement of single jet yields as a function of the azimuthal angle with respect to the event plane in Pb+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. Because partons produced at different angles with respect to the event plane traverse, on average, different path lengths of the medium, this measurement gives insight into the path-length dependence of parton energy loss. The azimuthal angle dependence of the yields is characterized by the parameter v_n^{jet}, which quantifies the magnitude of the modulation of the azimuthal angle distribution with respect to the n^{th} order event plane. While ATLAS has previously reported the v_2^{jet} in Pb+Pb at $\sqrt{s_{NN}} = 2.76$ TeV, this is the first ATLAS measurement of higher-order v_n^{jet}. The v_2, v_3, and v_4 are measured for jets with $p_T = 71 - 398$ GeV as a function of p_T and collision centrality. A nonzero value of v_2 is observed in all but the most central collisions. A smaller nonzero value of v_3 is measured, suggesting that fluctuations in the initial state play a small but distinct role in jet energy loss.
This talk also presents measurements of jet substructure performed using various jet (de)clustering and grooming techniques. Measurements of inclusive jet suppression (R_{AA}) in heavy-ion collisions are presented for the first time as a function of the jet substructure using both nominal ($R = 0.4$) and large-radius ($R = 1.0$) jets in Pb+Pb and *pp* collisions at $\sqrt{s_{NN}} = 5.02$ TeV. The jet substructure is characterized using the Soft-Drop grooming procedure in order to identify subjects corresponding to the hardest parton splitting in the jet. The dynamics of jet quenching is measured and presented as a function of the transverse momentum scale ($\sqrt{d_{12}}$) and the angle of the hardest splitting in the jet. These measurements provide new information about the path-length dependence of jet quenching and the sensitivity of jet suppression to its substructure.

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Session Classification: Parallel Session T04: Jets, high-pT hadrons, and medium response

Track Classification: Jets, high-pT hadrons, and medium response