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Unlocking the Thermal Secrets of High-Energy Collisions with Non-Extensive Thermodynamics

Tuesday, 24 March 2026 19:17 (1 minute)

I present a comprehensive investigation of hadron production dynamics in high-energy collisions, ranging from proton-proton to lead-lead, utilizing a non-extensive statistical framework and data from the ALICE experiment at the LHC. Analyzing identified hadron spectra –including light and charmed species –we demonstrate the power of the Tsallis thermometer to map out the thermal characteristics of collision systems [1,2]. Our findings reveal a striking connection between hadron mass and effective temperature, hinting at a common timescale for spectrum formation. Furthermore, we observe a distinct sensitivity of non-extensivity to event shape and constrain the heat capacity of the evolving hot system [3]. This work highlights the ability of non-extensive thermodynamics to connect soft and hard processes, providing new insights into the thermal properties and complex dynamics of high-energy collisions.

Refs:
[1] L. Gyulai, G. Bíró, R. Vértesi, G.G. Barnaföldi: Int.J.Mod.Phys.A 40 (2025) 09, 2444010
[2] L. Gyulai, G. Bíró, R. Vértesi, G.G. Barnaföldi: J. Phys. G: Nucl. Part. Phys. 51 085103 (2024)
[3] L. Gyulai, G. Bíró, R. Vértesi, G.G. Barnaföldi: Effect of event classification on the Tsallis-thermometer (in preparation)

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