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The Search for the Schwinger Production of Magnetic Monopoles in Pb-Pb Collisions at the LHC

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The MoEDAL experiment deployed at IP8 on the LHC ring was the first dedicated search experiment to take data at the LHC in 2010. It was designed to search for Highly Ionizing Particle (HIP) avatars of new physics such as magnetic monopoles, dyons, Q-balls, multiply charged particles, and massive slowly moving charged particles in p-p and heavy-ion collisions. We will report on our most result, recently reported in Nature, of our search for magnetic monopole production via Schwinger production.

Schwinger showed that electrically-charged particles can be produced in a strong electric field by quantum tunnelling through the Coulomb barrier. By electromagnetic duality, if magnetic monopoles (MMs) exist, they would be produced by the same mechanism in a sufficiently strong magnetic field. Unique advantages of the Schwinger mechanism are that its rate can be calculated using semiclassical techniques without relying on perturbation theory, unlike magnetic monopole production via the Drell-Yan mechanism. Also, importantly, production of non-pointlike magnetic monopoles is not exponentially suppressed by the finite size of the monopole.

Pb-Pb heavy-ion collisions at the LHC produce the strongest known magnetic fields in the current Universe. This result is arguably the first at the LHC that relies directly on the unprecedented magnetic fields produced in heavy-ion collisions.

In-person participation

Yes

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