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Large isospin symmetry breaking in kaon production at high energies

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It is well known that isospin symmetry is fulfilled to a good approximation in strong interactions, as confirmed in low-energy scattering experiments and in mass spectra of both light and heavy hadrons. In collisions of nuclei with an equal number of protons and neutrons, isospin symmetry imposes that the number of produced charged kaons should equal the number of neutral ones. The NA61/SHINE experiment at CERN recently reported an excess of charged over neutral kaon production in high-energy nucleus-nucleus collisions. Here, we argue that the measured charge-to-neutral kaon ratio of about 1.2 indicates an unexpectedly large violation of isospin symmetry. Using well-established models for hadron production, we demonstrate that known symmetry-breaking effects and the initial nuclei containing more neutrons than protons lead only to a small (few per cent) deviation from unity at high energies. Thus, they cannot explain the measurements. The significance of the isospin symmetry violation beyond the known effects is 5.5·σ when errors quoted by the experiments are used and 8.1 ·σ for the PDG-like scaled errors. New systematic, high-precision measurements and theoretical efforts are needed to establish the origin of the observed large isospin-symmetry breaking.

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