The quarks (up, down, strange, charm, beauty and top, called flavours) interact via the strong interaction. Quarks are the constituents of baryons, like proton (uud, u = up and d = down quark), and mesons (composed of quark and antiquark). The effective masses of u and d quarks are very similar and very low compared to other quarks. It makes the strong interaction preserving approximate isospin-symmetry between particles containing u and d quarks. As an example of this symmetry, mass of neutron (udd) is larger than proton (uud) only by $\sim 0.1\%$.

If the isospin symmetry were exact, equal number of isospin-symmetric particles would be produced in the collisions of isospin-symmetric atomic nuclei. This is the case of K-meson production (K^+ is $u\bar{s}$ while K^0 is $d\bar{s}$). The relative abundance of charged K^+ and K^- over neutral K^0 and $\bar{K^0}$ meson production in argon and scandium nuclei collisions at a center-of-mass energy of 11.9GeV per nucleon pair was measured by the NA61/SHINE Collaboration at the CERN SPS. We find that the production of charged K mesons at mid-rapidity is $18.4 \pm 6.1\%$ higher than that of the neutral K mesons. Earlier data are consistent with this result (but were not conclusive because of insufficient precision).

The models of hadron production, which include all known isospin-symmetry breaking effects can explain only a fraction of the observed excess. New systematic, high precision measurements and theoretical efforts are still needed to establish the origin of the observed large isospin-symmetry breaking.