

# Moriond 2019 feels the strong force

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**Pentaquarks, charmed beauty particles and more from the Moriond conference's second week, which is devoted to studies of the strong nuclear force**

Last week, physicists from all over the world gathered in La Thuile, Italy, for the second week of the [Rencontres de Moriond](#) conference. This second week of the annual meeting features new and recent findings in all things related to quantum chromodynamics (QCD) – the theory of the strong force that combines quarks into composite particles called hadrons – and to high-energy particle interactions. This year, results from the main experiments at the Large Hadron Collider (ALICE, ATLAS, CMS and LHCb) included new pentaquarks, new charmed beauty particles, a more precise measurement of matter–antimatter asymmetry in strange beauty particles, and new results from heavy-ion collisions.

## **Discovery of new pentaquarks**

The LHCb collaboration announced the discovery of new five-quark hadrons, or “pentaquarks”. Quarks normally aggregate into groups of twos and threes, but in recent years the LHCb team has confirmed the existence of exotic tetraquarks and pentaquarks, which are also predicted by QCD. In a 2015 study, the LHCb researchers analysed data from the decay of the three-quark particle  $\Lambda_b$  into a  $J/\psi$  particle, a proton and a charged kaon and were able to see two new pentaquarks (dubbed  $P_c(4450)^+$  and  $P_c(4380)^+$ ) in intermediate decay states. After analysing a sample of nine times more  $\Lambda_b$  decays than in the 2015 study, the LHCb team has now [discovered](#) a new pentaquark,  $P_c(4312)^+$  as well as a two-peak pattern in the data that shows that the previously observed  $P_c(4450)^+$  structure is in fact two particles.