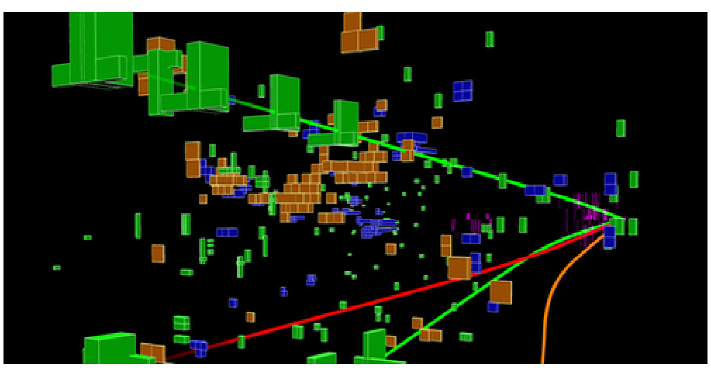
Additional Data Confirms Particle Anomaly

The LHCb Collaboration increases the statistical significance of a result relating to the decay rate of B^0 mesons that diverges from standard model predictions.

By **Katherine Wright**

In 2016, the Large Hadron Collider Beauty (LHCb) Collaboration at CERN reported an anomaly in their data—another result that conflicts with the standard model (see News Feature: The Era of Anomalies). While monitoring the decay of the B^0 meson (a neutral particle containing a beauty quark and a down quark) into a kaon (K^{*0}, comprising a down quark and strange quark) and two muons (μ^+ and μ^-), the team observed that the decay products spread out in a pattern that differed from standard model predictions. Now with additional data, the Collaboration confirms the anomaly, increasing the statistical significance of their finding from 3 standard deviations to 3.3.

Decays of particles containing beauty quarks are what the LHCb detector was specifically designed to measure. One way of doing that is to monitor the angular distribution of the decay products and extract so-called effective couplings, which relate to the forces experienced by the particles during the decay.



Credit: LHCb/CERN

In their 2016 analysis of the decay of $B^0 \rightarrow K^{*0}\mu^+\mu^-$, the collaboration obtained a value of around 3 for an effective coupling known as C^9. The standard model predicts a value closer to 4. Now, including data from additional experiments, they find this difference persists. Factoring in the uncertainties on the measured and predicted values of C^9, the researchers estimate a one-in-a-thousand chance that this mismatch is a statistical fluke.

One explanation for the anomaly is the existence of an undiscovered particle. Eluned Anne Smith of the LHCb Collaboration says that their results fit with this idea, but she cautions that uncertainties in the standard model may be bigger than thought. If so, the result could update the standard model without revealing new physics.

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