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Type: **Talk**

## Observation of quantum entanglement in top-quark pair production with the ATLAS detector

Monday 2 September 2024 12:40 (20 minutes)

A new sub-field has emerged in particle physics: borrowing techniques from quantum information science, we can now probe quantum mechanics in collider experiments. The ATLAS Collaboration recently reported the first observation of quantum entanglement between free quarks, in the first dedicated quantum information experiment at a hadron collider. Spin entanglement is observed by selecting  $t\bar{t}$  pairs produced close to their invariant mass threshold, and measuring a single angular observable related to the leptonic decay products of the top quarks. The entanglement observable is corrected back to particle-level using simulation; the result constitutes the highest energy measurement of quantum entanglement ever made. Differences between SM predictions and data motivate investigation into current modelling tools. This presentation will introduce the ATLAS measurement and show how it paves the way from further cross-pollination between high-energy physics and quantum information science.

### Internet talk

Maybe

### Is this an abstract from experimental collaboration?

Yes

### Name of experiment and experimental site

ATLAS

### Is the speaker for that presentation defined?

No

### Details

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