

Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector

Challenging and long-lived signatures are well motivated by Beyond Standard Model physics but require specifically targeted searches

Multi-Charged Particles

139 fb⁻¹ of pp collision data at $\sqrt{s} = 13$ TeV

- Anomalous high ionisation
- Long-lived spin- $\frac{1}{2}$ particles
- Mass range of 500 to 2000 GeV
- Electric charges from $|q| = 2e$ to $|q| = 7e$
- Drell-Yan (L) and Photon Fusion (R) production modes
- Muon-like signature
- Data-driven background

Full Result

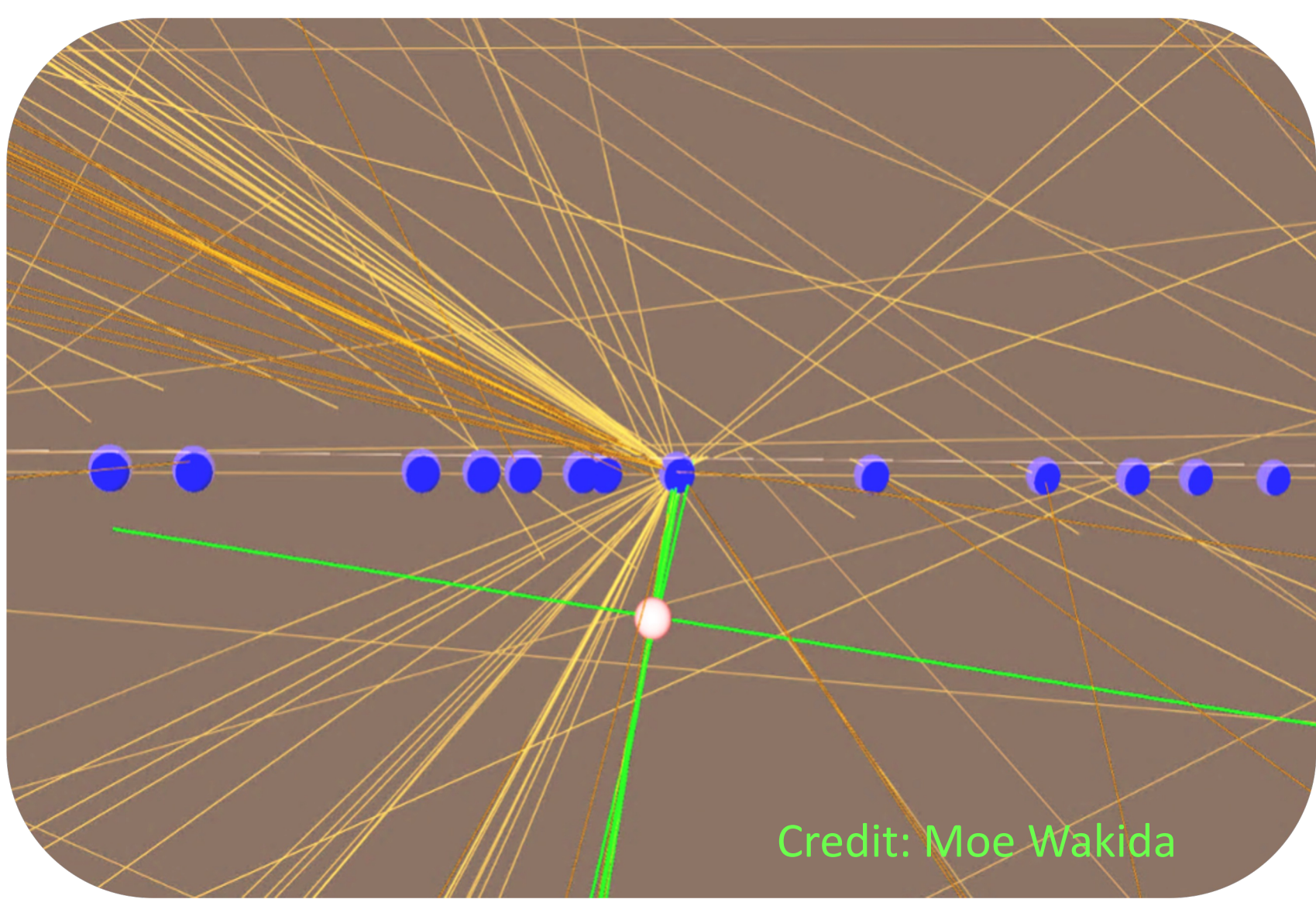
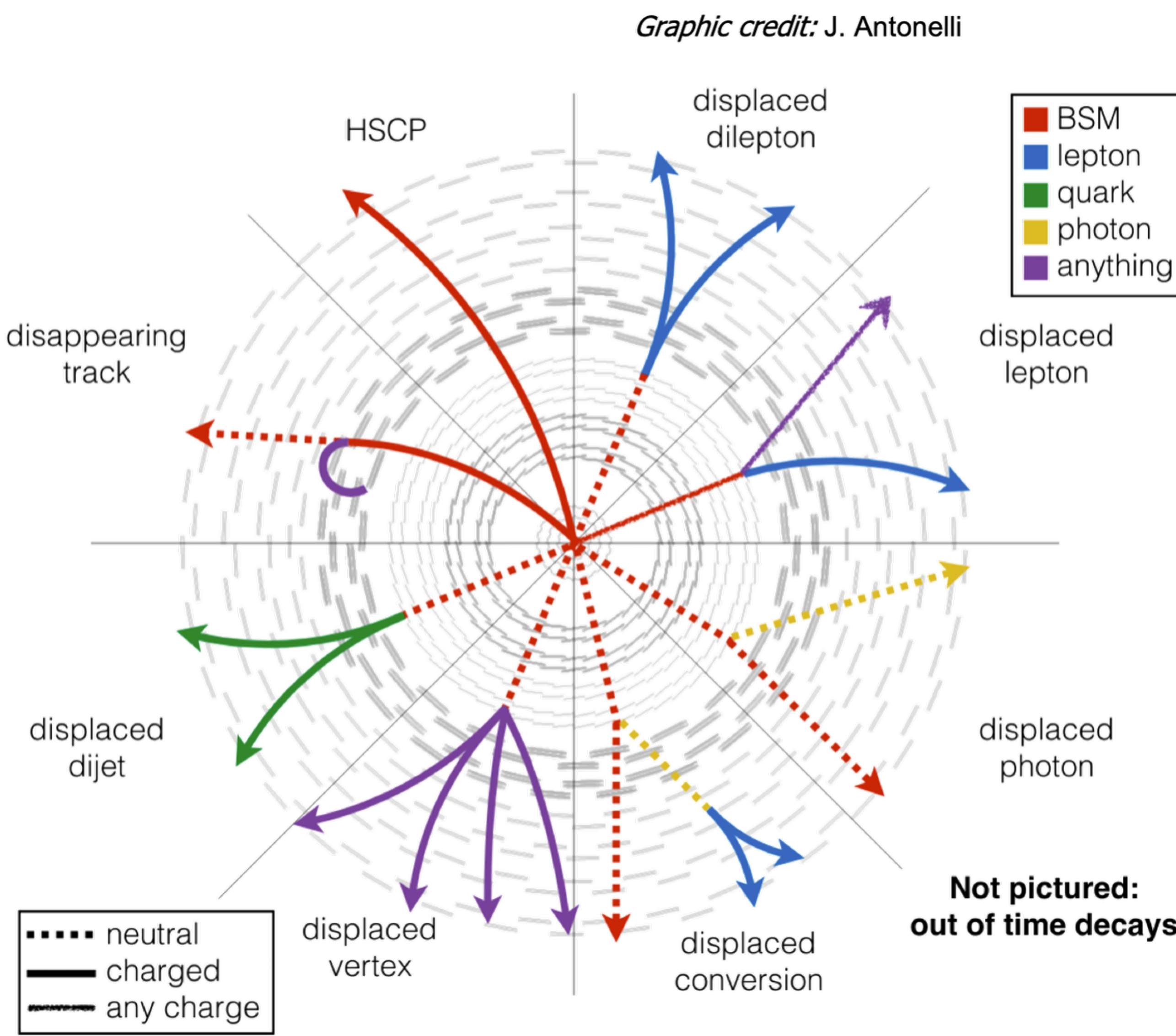
ATLAS
 $\sqrt{s} = 13$ TeV, 139 fb⁻¹

No evidence of multi-charged particles is observed. Obtained lower mass vs charge limit.

The ATLAS Detector in the transverse plane, perpendicular to proton-proton collisions, showing signatures of long-lived particles.

A particle is **LONG-LIVED** if it decays an observable distance from the interaction point

A signature is **CHALLENGING** if it has elements such as non-elementary charge, large ionisation, or out of time effects.



This ATLAS Detector event display shows a number of primary vertices along the proton-proton interaction point (blue) and a displaced vertex emanating from a long-lived particle (pink). Hits in the semiconductor tracker are orange while the tracks associated with the displaced vertex are green.

Displaced Vertices + Jets

139 fb⁻¹ of pp collision data at $\sqrt{s} = 13$ TeV

- EWK (L) and Strong (R) R-Parity Violating models
- Long-Lived particle with multi-track decay gives rise to a Displaced Vertex
- Multiple energetic jets increases sensitivity to various BSM topologies
- Fully data-driven background

Full Result

Reinterpretation material available!

