

# Origins II Planning Research Unit A

Which aspects of ORIGINS worked well and what were the highlights for you?

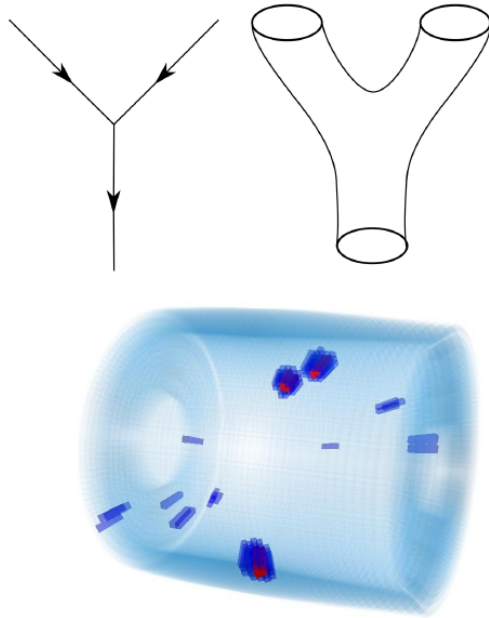
Are there any aspects that need improving? What are your suggestions?

Are there new directions or missing expertise that should be established?

# Research Unit A

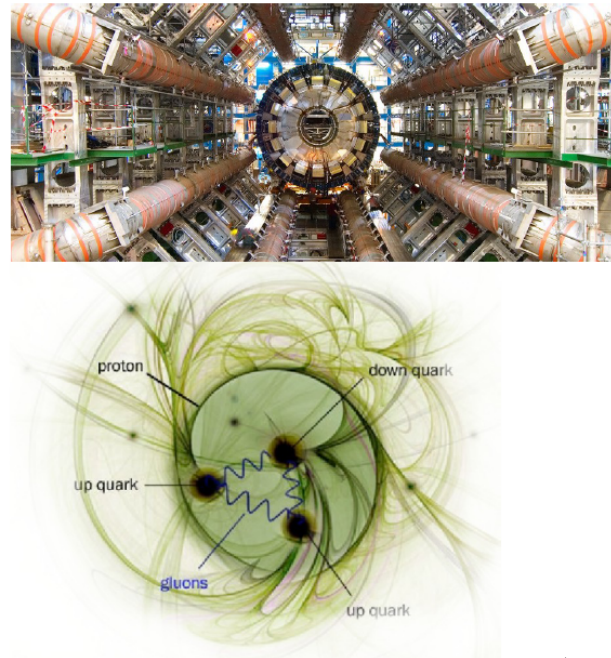
## “Fundamental Particles and Forces”

A.1: The Planck Scale



A.3: The Unknown Scale

A.2: The TeV Scale



A.4: The GeV Scale

# General Observations

- Seed fund programme perceived as working very well

Suggestion: Create seed programme for short-term start-up personnel funding to try new ideas

- Projects are running well on individual level. RU-A days work, but more communication would still be desirable – happens below the ORIGINS radar
- MIAPbP is a great success and internationally very well known. Must be preserved by all means.
- Breadth is our strength and our curse. Further topical diversification not obviously useful.

Did we / can we formulate more visible science initiatives beyond the outstanding work of individuals?

# Highlights

A large number of individuals who are key players in their field.  
A non-systematic selection

- Contribution to the ATLAS Higgs coupling measurements (Nature, 2022)
- Start-up and running of the BELLE-II experiment
- Leading the high-energy precision frontier with NNLO  $2 \rightarrow 3$  and N<sup>3</sup>LO  $2 \rightarrow 2$  processes
- Dark matter might still be primordial black holes
- .....

Successful hiring of two young stars: Tancredi (Theory – TUM, formerly Oxford), Heinrich (ODSL Data Science, ATLAS – TUM, formerly CERN)

Candidates for young new PIs (as are Thomas Kuhr and the MPP directors Henn, Kado, Zanderighi)

But ....

Critical backbone chairs still not replaced or advertised (Lüst, Paul Schaile)

From the proposal: “The two universities will strengthen this RU through a chair in fundamental physics, two new W2 hirings [...] and one early reappointment.”

Only one W2 (maybe 1 ½) realized so far.  
Important for the ORIGINS II proposal to provide a perspective on the first and last.

# Future directions

Result of a first brainstorming:

- More emphasis on Higgs particle properties, central theme for future particle physics
- Participate in future colliders development (detectors, physics), strengthen experimental high-energy physics
- Maintain flavour physics expertise
- Connections between particle physics and gravitation
- “Mathematics, Particle Physics and Cosmology” – exploit connections between scattering amplitudes, cosmology, string theory and pure math
- Strengthen numerical simulations of strongly interacting systems, machine learning for event reconstruction and formal theory

Possible connector: role of fundamental scalar particles (Higgs, axions, inflaton, ...)

# Future Structure of RU-A

## Split into two RUs

- Imbalance in size compared to other Rus

(approx. 30 permanent scientists, 20 research groups  
Proposal budget in yr 2023: 1.6 ME (A) / 0.4 ME (B) /  
0.4 ME (C) / 0.6 ME (D) / 0.7 ME (E)

- Helps to sharpen the focus and better visibility of results
- Possibility to highlight connections and establish connectors
- Better management