Contribution ID: **13** Type: **Talk**

Hyperons - a strange key to the strong interaction

Wednesday 4 September 2019 09:00 (35 minutes)

The Standard Model has been successful in describing the elementary particles and their interactions. However, a missing piece is a coherent description of the strong interaction in the confinement domain. This puzzle manifests itself in the non-perturbative properties of the proton: neither its mass, its spin nor its radius are straight-forward to understand from first principles. Furthermore, our Universe consists of matter (e.g. nucleons), not anti-matter (e.g. anti-nucleons). What is the origin of this asymmetry?

One approach to shed light on a system one does not understand is to replace one of its building blocks and see how the system reacts. This leads to the central question in hyperon physics: what happens if we replace one of the light quarks in a proton, with a heavier one? Hyperons have an advantage with respect to nucleons: thanks to the weak, self-analysing decay of the hyperons, their spin is traceable. This provides a unique opportunity to study the role of spin in non-perturbative strong interactions. Experiments with various probes in different energy regimes show that hyperons often are produced polarised, even when the initial state is unpolarised.

In this talk, I will discuss the hyperon as a diagnostic tool for some of the most challenging questions in contemporary physics. The focus is on the strong interaction, in particular hyperon structure where non-perturbative effects are quantified by electromagnetic form factors. Recent results from modern detector facilities like BaBar, CLEO-c, Belle and BESIII, will be presented. I will also outline how hyperon decays can give clues to the matter-antimatter asymmetry of the Universe. Results from dedicated studies within the BESIII experiment will be reviewed. Finally, I will discuss the hyperon physics prospects at the future PANDA experiment at FAIR.

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Session Classification: Plenary Session 1 Wednesday

Track Classification: Plenary