

Addressing Dark Matter and B-physics anomalies in the context of R-parity violating SUSY

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In recent years, significant experimental indications that point towards Lepton Flavor Universality violating effects in B-decays, involving $b \rightarrow c\tau\nu$ and $b \rightarrow s\ell^+\ell^-$ have been accumulated. A possible New Physics explanation can be sought within the framework of R-parity violating Supersymmetry, which contains the necessary ingredients to explain the anomalies via both leptoquark, tree-level exchange and one-loop diagrams involving purely leptonic interactions. In addition, an approximate $\mathcal{G}_f = U(2)_q \times U(2)_\ell$ flavour symmetry successfully controls the strength of these interactions. Nevertheless strong constraints from leptonic processes and Z boson decays exclude most of the relevant parameter space at 2σ level. Moreover, R-parity violation deprives Supersymmetry of its Dark Matter candidates. Motivated by these deficiencies, we introduce a new gauge singlet superfield, charged under the flavour symmetry and show that its third-generation, scalar component may alleviate the above-mentioned tensions, while at the same time reproduce the observed relic abundance. Remarkably, we obtain an exact solution to both anomalies that is also fully consistent with the numerous bounds from Flavour and Dark Matter phenomenology. Finally, we assess the prospect to probe the model at future experiments.

Author: Mr TRIFINOPOULOS, Sokratis (Universität Zürich)

Presenter: Mr TRIFINOPOULOS, Sokratis (Universität Zürich)

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