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New physics searches with the PIONEER experiment

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Pions are fantastic tools to look for new physics. The PIENU experiment at TRIUMF (data completion in 2012) has provided, to date, the most precise experimental determination

of $R^{\pi}_{e/\mu}$, the ratio of pions decaying to positrons relative to muons. While more than an order of magnitude less precise that the Standard Model (SM) calculation, the PIENU result is a precise test of the universality of charged leptons interaction, a key principle of the SM, constrains a large range of new physics scenario, and allows dedicated searches for exotics such as sterile neutrinos. I will present a short overview of the new physics constraints provided by $R^{\pi}_{e/\mu}$ measurements and introduce the next generation precision pion decay experiment in the making: PIONEER. This newly proposed experiment aims at pushing the boundaries of precision on $R^{\pi}_{e/\mu}$ and expanding the physics reach by improving on the measurement of the very rare pion beta decay $\pi^+ \to \pi^0 e^+ \nu$. This will provide a new and competitive input to the determination of $|V_{ud}|$, an element of the Cabibbo- Kobayashi-Maskawa (CKM) quark-mixing matrix.

Keyword-1

pion rare decays

Keyword-2

lepton flavour universality

Keyword-3

new physics searches

Author: MALBRUNOT, Chloe (TRIUMF)

Presenter: MALBRUNOT, Chloe (TRIUMF)

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