Rare leptonic B-decays at the Belle II Experiment

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The Belle II experiment is designed to make precise measurements of weak interaction parameters and find New Physics beyond the Standard Model of particle physics. As a high luminosity experiment, it's ability to produce a large B-mesons dataset make it perfect for searches for rare, yet-to-be discovered leptonic B-decay modes, such as $B^+ \to \mu^+\nu$ or $B^0 \to \nu\bar{\nu}$. These decay modes have very small branching fractions according to the Standard Model, so detecting an excess number of events may point to New Physics contributions. Potential models include final states containing sterile neutrinos, invisible neutralinos and long-lived scalar dark matter in the decay products, or new intermediate boson states, such as charged Higgs and Z' candidates. Difficulties in identifying leptonic decay stem not only from their rarity, but also from the large amount of missing energy from neutrinos produced in rare leptonic decays, making it difficult to demarcate between when a particle fails to be registered by the Belle II detector and when a leptonic B decay takes place.

This presentation will summarise the current searches within Belle II to identify the rare, leptonic B-decays $B^+ \to \mu^+\nu$ or $B^0 \to \nu\bar{\nu}$. This takes place via an exclusive B-tagging algorithm, the *Full Event Interpretation*, which relies on machine learning to automatically identify plausible semileptonically-decaying B mesons that are created alongside our desired leptonic B channel. We exploit the fixed intial centre-of-mass energy of the Belle II experiment to reject other particle decays that may mimic leptonic B-decay signal. Thus, we will be able to present a first look at Belle II's ability to improve previous measurements of upper bounds on experimental branching fractions of rare leptonic B decays.