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Lepton number & flavor violation in realistic HNL models

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Heavy neutral leptons (HNLs) are hypothetical heavy states mixing with the Standard Model neutrinos. They were proposed to explain neutrino masses, dark matter and the baryon asymmetry of the Universe. HNLs have been searched for in numerous experiments, however most of them report their limits under the assumption of one HNL mixing with a single neutrino flavor. Although convenient, we will see that this assumption is inconsistent with neutrino oscillation data. This has important consequences for searches. First, an approximate lepton number symmetry between two HNLs (required in order to reproduce light neutrino masses with large mixing angles) may suppress lepton-number-violating signatures. Second, lepton-*flavor*-violating decays are a solid prediction of most realistic HNL models, but they are absent if HNLs are assumed to mix with only one flavor. In this talk I will present a reinterpretation of an existing ATLAS search for HNLs decaying promptly to three leptons, as well as the results from a recent ATLAS search for displaced HNLs, in which limits were interpreted from the start within realistic models. I will discuss the roadblocks encountered along the way, and propose a method that enables theorists to easily and accurately interpret the limits for any mixing pattern and any number of HNLs.

Author: TASTET, Jean-Loup (UAM-IFT)

Presenter: TASTET, Jean-Loup (UAM-IFT)

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