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Electroweak baryogenesis in the three-loop radiative seesaw model with dark matter

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The Standard Model successfully describes particle physics but cannot explain neutrino oscillations, the baryon asymmetry of the universe (BAU), and dark matter. The Aoki-Kanemura-Seto (AKS) model is a new physics model that can explain these three phenomena simultaneously at TeV scale testable by future experiments. However, in the original model published in 2009, the baryon number was not evaluated. In the present work [Enomoto, Kanemura, Taniguchi, JHEP06(2025)036 and Aoki, Enomoto, Kanemura, Taniguchi in preparation], we introduced CP violation to the original AKS model for evaluating the baryon number and found a benchmark scenario to avoid the current constraint on the electron electric dipole moment while keeping a large enough CP-violating phase for electroweak baryogenesis. In this talk, we evaluate the baryon number in this model, using the previously found viable parameter regions. Furthermore, we present benchmark points that can simultaneously explain neutrino masses, dark matter, and BAU, under various experimental and theoretical constraints. We also discuss prospects for testing the model at future experiments. The new particles predicted by the AKS model, including the charged singlet scalar $S^{\pm}$ and the additional Higgs bosons H_2 and H_3, could be produced at future collider experiments such as the High-Luminosity LHC and electron-positron Higgs factories, and are expected to be tested there. In addition, since electroweak baryogenesis requires a strong first-order electroweak phase transition, which can generate characteristic gravitational wave signals, we also explore the potential for detection of such signals by future space-based observatories such as DECIGO.

Primary authors: Dr ENOMOTO, Kazuki (National Taiwan University); Prof. AOKI, Mayumi (Kanazawa University); Prof. KANEMURA, Shinya (The University of Osaka); TANIGUCHI, Sora (The University of Osaka)

Presenter: TANIGUCHI, Sora (The University of Osaka)

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