

Contribution ID: **9** Type: **Parallel Talk**

Linking the Baryon Asymmetry of the Universe to Neutrino Masses through Leptogenesis

Monday, 30 November 2026 16:40 (20 minutes)

The observed baryon asymmetry of the Universe remains one of the central open questions in particle physics and cosmology. Leptogenesis provides a compelling explanation by relating the generation of the matter–antimatter asymmetry to new sources of lepton-number and (CP) violation beyond the Standard Model.

In this work, we investigate leptogenesis within effective descriptions and high-energy extensions of the Standard Model, in which the structures responsible for neutrino masses may also generate a lepton asymmetry in the early Universe. We discuss the main ingredients required for successful leptogenesis, including the out-of-equilibrium dynamics of heavy states, the generation of (CP) asymmetries, washout effects, and the subsequent conversion of the lepton asymmetry into a baryon asymmetry through electroweak sphaleron processes.

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Session Classification: Parallel Talks-SD:716

Track Classification: Beyond the Standard Model