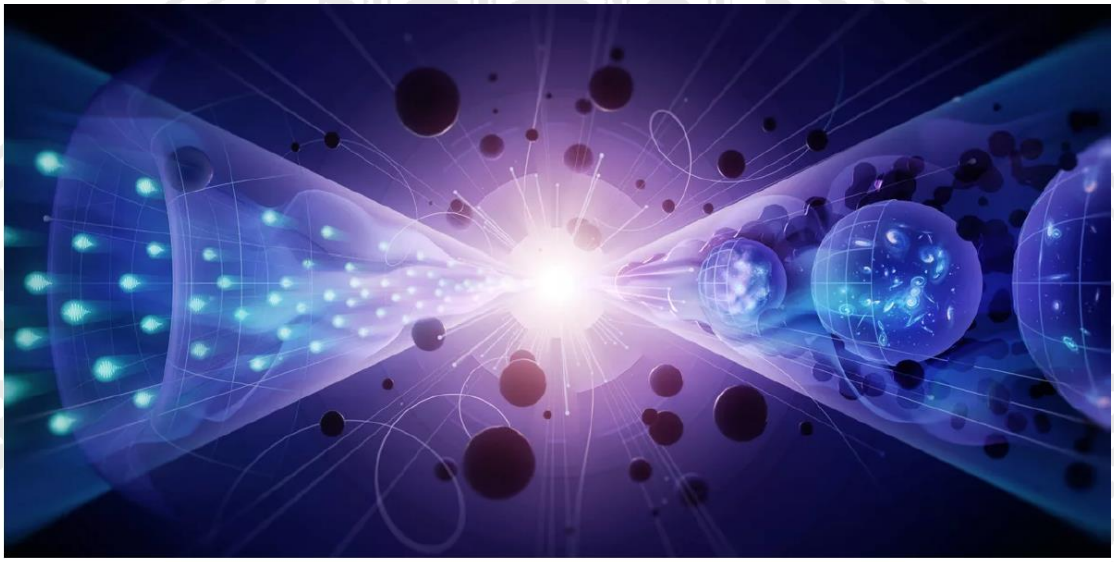
Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

SONDERKOLLOQUIUM

AM 11. JULI 2024 UM 11:00 UHR

BIBLIOTHEK, WESTBAU PHYSIK



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Novel Signatures of Particle Production in Cosmology and Astro-particle Physics

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Dark energy, dark matter, and hypothetical dark radiation live beyond the Standard Model of particle physics. My research seeks to illuminate these building blocks of the hidden Universe, by quantifying their properties, and their interactions with one another as well as the visible Universe. In this talk, I will introduce a research advancement produced by my work, the realization of a simple mechanism emerging from quantum field theory, that allows for efficient energy transfer between dark energy-like phenomena and dark radiation. This mechanism, recently dubbed *sphaleron heating*, has intriguing consequences on cosmological and direct-detection observables, across several cosmological epochs. For example, sphaleron heating provides a viable model for warm inflation. Warm inflation postulates that the early Universe expands at finite temperature, and the fluctuations that seed structure are of classical nature, a compelling alternative to the usual cold inflation scenario with vastly different predictions for inflationary observables such as the tensor-to-scalar ratio, and non-gaussianities. At the other end of cosmic time, sphaleron heating in the context of the current period of accelerated expansion leads to the prediction of non-gravitational dark energy signatures, discoverable in direct detection experiments. I will give an overview of my breakthroughs in these burgeoning directions, the open questions, and how my research program will tackle them in the next few years.