64th OMEG-SSANP Workshop

일 시: 2022년 12월 12일(월) 14:00~18:30
장 소: 숭실대학교 백마관 219호

시 간	제 목	발 표 자
14:00~14:50	MC generator for neutrino (the perspective of an experimentalist)	JiYoung Choi (SeoYeong Univ.)
14:50~15:40	Neutrino interaction with dark matter	Ki Young Choi (SungKyunKwan Univ.)
15:40~16:00	Coffee Break	
16:00~16:50	Reheating and Dark Matter Freeze-in in the Higgs-R^2 Inflation Model	Kimiko Yamahita (ChungAng Univ.)
16:50~17:40	Neutrino physics at the collider	YuSeon Jeong (ChungAng Univ.)
17:40~18:30	The neutrino process in core-collapse supernova	HeaMin Ko (SoongSil Univ.)

OMEG
Origin of Matter and Evolution of Galaxies
우주 물질 중점연구소

[1] 14:00~14:50

Speaker : JiYoung Choi

Affiliation : SeoYeong Univ.

Title : MC generator for neutrino (the perspective of an experimentalist)

Abstract :

The strength (or cross-section) of the weak interaction is much less than the fundamental interaction strength, except for gravity. Also, the interaction cross-section of neutrinos is well-known theoretically. Since neutrinos only respond to weak interactions and gravity, neutrino beams are produced as secondary particles. Because it is challenging to experimentally create and control neutrino beams, flux estimation involves many uncertainties. Neutrinos are suitable probes for nuclear structures, but because of the many uncertainties in the flux of neutrino beams, neutrino beam studies are essential to understand and reduce those uncertainties. Off-axis beam techniques and simulation-based neutrino beam-related estimating multivariate factors are briefly mentioned. The neutrino event generator is primarily used as an external source generator to simulate detectors such as the GEANT4. Particle interaction and detector simulations for hadron interactions are model dependent. Therefore, it compares them to experiments to ensure and choose a reliable simulation package.

The results are compared to previous studies within the shell model. Their implication for the CVC hypothesis of the Standard Model is discussed.

[2] 14:50~15:40

Speaker : Ki Young Choi

Affiliation : SungKyunKwan Univ.

Title : Neutrino interaction with dark matter

Abstract :

The mysterious dark matter may interact with the neutrinos. Those interaction may result in some interesting phenomena in the physics of neutrino and dark matter. In the medium of dark matter, the dispersion relation of the neutrino can be modified and affect the oscillation of neutrino. The cosmic neutrino background may affect the evolution of the dark matter halo and make the ceteral density of the halo cored.

[3] 16:00~16:50

Speaker : Kimiko Yamahita

Affiliation : ChungAng Univ.

Title : Reheating and Dark Matter Freeze-in in the Higgs-R^2 Inflation Model

Abstract :

We study the post-inflationary dynamics for reheating and freeze-in dark matter in the Higgs-R^2 inflation model.

Taking the perturbative approach for reheating, we determine the evolution of the temperature for radiation bath produced during reheating and determine the maximum and reheating temperatures of the Universe.

Adopting a singlet scalar dark matter with a conformal non-minimal coupling and a vanishing Higgs-portal coupling, we discuss the freeze-in production of dark matter both from the non-thermal scattering during reheating and the thermal scattering after reheating.

We find that thermal scattering is dominant for dark matter production in our model due to the high reheating temperature.

The reheating temperature in our model is determined dominantly by the Higgs condensate to be up to about 10^14 GeV and dark matter with masses up to about 10^9 GeV can be produced with a correct relic density.

[4] 16:50~17:40

Speaker : YuSeon Jeong

Affiliation : ChungAng Univ.

Title : Neutrino physics at the collider

Abstract :

Recently, new experiments to detect neutrinos produced from a collider have just launched at the LHC. These experiments, FASER$₩nu$ and SND@LHC will operate during the Run 3 stage, and a further developed experiment, Forward Physics Facility was additionally proposed for the High-Luminosity LHC era. These experiments will probe neutrinos at high rapidity region, where a large number of neutrinos are expected, in particular from heavy flavor hadron decays. In this talk, I will introduce the forward experiments at the LHC and discuss some physics potential that can be studied with neutrino measurements at such experiments.

[5] 17:40~18:30

Speaker : HeaMin Ko

Affiliation : SoongSil University

Title : The neutrino process in core-collapse supernova

Abstract :

In a core-collapse supernova, neutrinos carry a large amount of explosion energy, 10^53 erg. Despite the small cross-section of weak interaction, such energetic neutrinos enable the elements produced by neutrino-induced reactions. Most of the elements in our solar system have been explained by s-, r-, and p-processes. However, still, the origin of some elements has not been explained. In particular, the elements of 92Nb, 98Tc, and 138La are rarely produced by beta decay because their neighboring nuclides in the nuclear chart are stable. The neutrino process has explained the production of those elements. And also, in this process, the neutrino interacts with the neutrino itself and the electron in the star. This leads to a change in neutrino energy distribution and affects the neutrino-induced reactions. In this talk, I would like to explain how to describe this neutrino interaction in SN environments, focusing on the Mikheyev–Smirnov–Wolfenstein effect and collective neutrino oscillation. Finally, the effects of such interactions on neutrino-process yields will be presented.