

Mini-workshop on "Particle physics, astrophysics and cosmology"

Series "Particles, gravitation and cosmology"

TIME & DATE

9:00 AM - 4:00 PM
10 August 2019 (Saturday)

VENUE

Conference hall
8th floor, building 2H
Institute of physics, VAST
18 Hoàng Quốc Việt, Hà Nội

PROGRAM

Morning

(starting from 9:00 AM):

Misao Sasaki

(IPMU, Tokyo, Japan):

"Primordial black holes from inflation and gravitational waves".

Alexander Vikman

(CEICO, FZU ASCR Prague, Czechia):

"Cosmological bounces and time crystals: superluminality and UV-completion".

Afternoon

(starting from 1:30 PM):

Patrick Aurenche

(LAPTH, Annecy, France):

"Cosmic rays, photons, neutrinos and astrophysics".

Đào Tiến Khoa

(Institute for nuclear science and technology, VINATOM, Hanoi):

"Nuclear fusion, neutron radiative capture, neutron star, and origin of elements"

(abstracts attached below)

All people interested are welcome to attend the workshop!

ABSTRACTS

"Primordial black holes from inflation and gravitational waves",
by Misao Sasaki

Primordial black holes (PBHs) may be copiously produced from large-amplitude curvature perturbations from inflation. We present one of such models of inflation and argue that the thus produced PBHs can be the cold dark matter (CDM) of the Universe. Then we point out that future space-based gravitational wave detectors such as LISA will provide a unique test of the PBH-as-CDM scenario.

"Cosmological bounces and time crystals: superluminality and UV-completion"
by Alexander Vikman

First, I will discuss which theories can allow for a "healthy" bounce: a smooth evolution of a spatially flat Friedmann universe from contraction to expansion without ghosts and gradient instabilities. Further, I will consider cosmological time-crystals recently introduced by Wilczek. The latter are systems with limit cycles and can represent vacuum with minimally broken time-translation invariance. In particular, these systems can model Dark Energy with rapidly oscillating equation of state. I will argue that all such theories which allow for bounces or time-crystals not only violate the Null Energy Condition, but also necessarily possess states with superluminality. Even though the bouncing solution or the limit cycle solution can be completely subluminal per se. This superluminality indicates that these theories cannot have a standard Wilsonian, local, Lorentz-invariant UV completion.

"Cosmic rays, photons, neutrinos and astrophysics"
by Patrick Aurenche

A brief review is given of the data on high energy astrophysical messengers: cosmic rays, photons and neutrinos. The implications of the observation by the IceCube collaboration of a high energy neutrino from blazar TXS 0506+056 is discussed and the consequences for models of AGN are mentioned. Since the emission of photons and neutrinos by extragalactic sources are correlated it is important to carry out multimessenger searches to understand the dynamics of sources.

"Nuclear fusion, neutron radiative capture, neutron star, and origin of elements"
by Dao Tien Khoa

This talk highlights the central role of nucleosynthesis processes like nuclear fusions or neutron induced reactions in the formation of stable and radioactive elements. We also illustrate the birth of a neutron star, formed instantly after the death of a massive star as the gravitational collapse giving rise to a supernova explosion. Then the discussion is focused on the first ever observation of a merger of two neutron stars (Kilonova) by the detection of both gravitational waves and gamma rays on August 17, 2017 by the LIGO-Virgo Gravitational-wave detectors, Fermi Gamma-ray Space Telescope, and International Gamma-ray Astrophysics Laboratory, and the later detection of the X-ray, infrared radiations as well as the visible light by more than 70 telescopes in the world. The gamma spectra seen in this event confirms unambiguously that a neutron-star merger is a site of formation of heavy elements like gold and platinum, and solves, therefore, a long debated puzzle on the origin of heavy elements. The talk may be interesting and inspiring for anyone with some general knowledge in nuclear physics.

Organizers:

- Đinh Nguyễn Đình
- Nguyễn Anh Kỳ
- Dương Thị Mân
- Nguyễn Thị Hồng Vân

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