IBS-ICTP Workshop on Axion-Like Particles

Report of Contributions

https://indico.ibs.re.kr/e/445

Contribution ID: **6** Type: **not specified**

Storage ring axion-EDM experiment using an RF Wien Filter

Wednesday, 27 October 2021 16:00 (1 hour)

A hypothetical particle axion, or axion-like particles, may couple to nucleons to induce an oscillating electric dipole moment (EDM).We propose a novel method of probing the axion-induced oscillating EDM in storage rings, using an RF Wien Filter.The Wien Filter at the frequency of the sidebands of the axion and g-2 frequency generates a spin resonance, as confirmed both by an analytical estimation of the spin equations and independently by simulation.We briefly show the projected experimental sensitivity and systematic effects related to the field imperfection.

Presenter: KIM, On (IBS-CAPP)

Contribution ID: **7** Type: **not specified**

The NASDUCK collaboration: using quantum magnetometers to look for ultralight dark matter

Wednesday, 27 October 2021 17:10 (1 hour)

When DM bosons have an ultra-light mass, they can act as a classical, coherent field. In many cases, and specifically in some ALP models, this field has magnetic properties, and it can therefore be measured by quantum magnetometers. The Noble and Alkali Spin Detectors for Ultralight Coherent darK matter (NASDUCK) collaboration, was formed last year in order to measure such DM. Recently, the collaboration released its first results from the "NASDUCK-Floquet" experiment, which looks for DM roughly in the femto to pico eV mass range. The new experiment places the most stringent terrestrial constraints to date on ultra-light axion-like particles coupled to neutrons. The constraints are comparable to those from stellar cooling, providing a complementary probe. In my talk I will discuss the theory behind the NASDUCK-Floquet experiment. I will also discuss future prospects of the NASDUCK collaboration, and some of our planned experiments.

Presenter: BLOCH, Itay (Tel-Aviv U)

Contribution ID: **8** Type: **not specified**

Terrestrial Signals from Axion Star Explosions

Thursday, 28 October 2021 16:00 (1 hour)

Axions form gravitationally-bound structures called axion stars, which are astrophysical objects with unique observational signatures. When an axion star grows enough in mass, it collapses gravitationally, and in its final moments it emits a large fraction of its mass in relativistic axions; we show that these axions are detectable in current and near-future axion DM experiments. Unlike the cold DM signal, the signal from axion star explosions is not suppressed by the axion decay constant $\propto 1/f$, due to a cancellation with the energy emission $\propto f$, making this a promising avenue to detect even (nearly) Planck-scale axions. Our calculation is easily extendable to other sources of relativistic bursts of axions, including superradiant cloud collapse or collision / merger processes.

Presenter: EBY, Joshua (IPMU)

Contribution ID: **9** Type: **not specified**

Supernovae as axion factories: the latest developments

Thursday, 28 October 2021 17:10 (1 hour)

Feebly interacting particles are copiously produced in extreme astrophysical phenomena. A remarkable example is the production of axions and Axion-Like Particles (ALPs) in Supernovae (SNe). The production of exotic particles in SNe leaves imprints in some astrophysical observables as the duration of the SN neutrino burst or the photon cosmic backround. Thanks to the most recent developments in astrophysics it is possible to constrain the properties of axions and ALPs with an unprecedented precision.

Presenter: CARENZA, Pierluca (Bari U, INFN)

Contribution ID: **10** Type: **not specified**

Axions, Dark Matter, and Primordial Density Perturbations

Friday, 29 October 2021 16:00 (1 hour)

I will present new ideas about how the QCD axion or axion-like particles can make up the dark matter of our universe, and/or explain the origin of the primordial density perturbation. For axion dark matter, I will introduce a novel production mechanism that invokes a kinetic mixing between the axion and the inflaton. I will show that this mechanism opens up new windows in the axion parameter space, where conventional scenarios such as vacuum misalignment cannot work. The impact of primordial electromagnetic fields on the axion window will also be discussed. For the density perturbation, I will demonstrate that an axion-like particle coupled to a new confining gauge group is a perfect candidate of a curvaton, and that the resulting density perturbation has distinct signatures that are testable in upcoming experiments.

Presenter: KOBAYASHI, Takeshi (SISSA)

Contribution ID: **11** Type: **not specified**

Axion-like particles from primordial black holes shining through the Universe

Friday, 29 October 2021 17:10 (1 hour)

We consider a cosmological scenario in which the very early Universe experienced a transient epoch of matter domination due to the formation of a large population of primordial black holes (PBHs) with masses M . 109 g, that evaporate before Big Bang nucleosynthesis. In this context, Hawking radiation would be a non-thermal mechanism to produce a cosmic background of axion-like particles (ALPs). We assume the minimal scenario in which these ALPs couple only with photons. In the case of ultralight ALPs (with masses less than 10^-9 eV), the cosmic magnetic fields might trigger ALP-photon conversions, while for masses heavier than 10 eV spontaneous ALP decay in photon pairs would be effective. We investigate the impact of these mechanisms on the cosmic X-ray background, on the excess in X-ray luminosity in Galaxy Clusters, and on the process of cosmic reionization.

Presenter: SCHIAVONE, Francesco (Bari U)