ICCUB School 2023: Primordial Black Holes

Report of Contributions

Contribution ID: **1**   Type: **not specified**

Pre-school: Basics of cosmological perturbation theory

Monday, 26 June 2023 09:30 (2 hours)

Primary author: GARRIGA, Jaume (ICCUB)

Presenter: GARRIGA, Jaume (ICCUB)

Contribution ID: **2**   Type: **not specified**

Constraints on primordial black holes

Monday, 26 June 2023 12:00 (1 hour)

Primary author: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

Presenter: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

Contribution ID: **3**   Type: **not specified**

Enhancement mechanisms for cosmological perturbations

Monday, 26 June 2023 14:30 (2 hours)

Primary author: ACHUCARRO, Ana (Leiden University)

Presenter: ACHUCARRO, Ana (Leiden University)

Contribution ID: **4**   Type: **not specified**

Constraints on primordial black holes

Monday, 26 June 2023 17:00 (1 hour)

Primary author: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

Presenter: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

Contribution ID: **5** Type: **not specified**

Enhancement mechanisms for cosmological perturbations

Tuesday, 27 June 2023 09:30 (2 hours)

Primary author: ACHUCARRO, Ana (Leiden University)

Presenter: ACHUCARRO, Ana (Leiden University)

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

Constraints on primordial black holes

Tuesday, 27 June 2023 12:00 (1 hour)

Primary author: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

Presenter: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

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

Selected talks

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

Constraints on primordial black holes

Tuesday, 27 June 2023 17:00 (1 hour)

Primary author: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

Presenter: KUHNEL, Florian (Ludwig-Maximilians-Universitaet)

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

PBHs from highly non-Gaussian tails of the probability distribution

Wednesday, 28 June 2023 09:30 (1 hour)

It has now become fully realized that the PBH formation depends crucially on the tails of the probability distribution function (PDF) of the curvature perturbation. In this talk, I will review some recently proposed models of inflation in which highly non-Gaussian tails appear in the PDF that can only be computed non-perturbatively, and discuss their implications.

Primary author: SASAKI, Misao (IMPU)

Presenter: SASAKI, Misao (IMPU)

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

The statistics of primordial black holes

Wednesday, 28 June 2023 11:00 (2 hours)

Primary author: SHETH, Ravi (University of Pennsylvania)

Presenter: SHETH, Ravi (University of Pennsylvania)

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

Primordial black holes formation, theory and simulations

Wednesday, 28 June 2023 15:15 (2 hours)

Primary author: ESCRIVÀ, Albert (Nagoya University)

Presenter: ESCRIVÀ, Albert (Nagoya University)

Contribution ID: **12** Type: **not specified**

Selected Talks

Contribution ID: **13**   Type: **not specified**

Gravitational waves signatures of primordial black holes

Thursday, 29 June 2023 09:30 (2 hours)

Primary author: DOMÈNECH, Guillem (Leibniz University)

Presenter: DOMÈNECH, Guillem (Leibniz University)

Contribution ID: **14** · Type: **not specified**

The statistics of primordial black holes

Thursday, 29 June 2023 12:00 (1 hour)

Primary author: SHETH, Ravi (University of Pennsylvania)

Presenter: SHETH, Ravi (University of Pennsylvania)

Contribution ID: **15**   Type: **not specified**

LISA capabilities in the context of PBH physics

Thursday, 29 June 2023 14:00 (2 hours)

Primary author: KORSAKOVOA, Natalia (APC)

Presenter: KORSAKOVOA, Natalia (APC)

Contribution ID: **16**   Type: **not specified**

Primordial black holes formation, theory and simulations

Thursday, 29 June 2023 16:30 (2 hours)

Primary author: ESCRIVÀ, Albert (Nagoya University)

Presenter: ESCRIVÀ, Albert (Nagoya University)

Contribution ID: **17**   Type: **not specified**

Gravitational waves signatures of primordial black holes

Friday, 30 June 2023 09:30 (2 hours)

Primary author: DOMÈNECH, Guillem (Leibniz University)

Presenter: DOMÈNECH, Guillem (Leibniz University)

Contribution ID: **18**   Type: **not specified**

LISA capabilities in the context of PBH physics

Friday, 30 June 2023 12:00 (1 hour)

Primary author: KORSAKOVA, Natalia (APC)

Presenter: KORSAKOVA, Natalia (APC)

Contribution ID: **19**   Type: **not specified**

The statistics of primordial black holes

Friday, 30 June 2023 14:30 (2 hours)

Primary author: SHETH, Ravi (University of Pennsylvania)

Presenter: SHETH, Ravi (University of Pennsylvania)

Contribution ID: **20** Type: **not specified**

LISA capabilities in the context of PBH physics

Friday, 30 June 2023 17:15 (1 hour)

Primary author: KORSAKOVA, Natalia (APC)

Presenter: KORSAKOVA, Natalia (APC)

Contribution ID: **21**   Type: **not specified**

Numerical simulations of stochastic inflation using importance sampling

Tuesday, 27 June 2023 14:30 (20 minutes)

Primordial black holes are expected to form from large, but rare, cosmological fluctuations in the tail of the probability distribution arising from inflation. I will present how importance sampling can be used to efficiently investigate the far, numerically expensive, probability tail of these fluctuations, finding non-perturbative deviations from Gaussianity. This is done by solving the first-passage time problem in the Langevin processes to find the distribution of the local duration of inflation in e-folds. By the stochastic-δN formalism, these are related to the curvature perturbation at the end of inflation. What previously would take supercomputers weeks, or in principle even years, can be done in hours with just a single CPU using this approach.

Presenter: JACKSON, Joseph (University of Portsmouth)

Session Classification: Selected Talks

Contribution ID: **22** Type: **not specified**

Towards a non-perturbative description of inflation

Tuesday, 27 June 2023 14:50 (20 minutes)

In recent years, primodrial black holes (PBHs), i.e. black holes produced in the very early universe, have attracted much attention because of their important cosmological consequences. One of the mechanisms that can produce PBHs is the collapse of superhorizon large density inhomogeneities whenever they enter the horizon. These large inhomogeneities can be generated during inflation, reason why a non-perturbative (in terms of the amplitude of the inhomogeneities) description of inflation is of crucial importance in order to correctly describe the abundance of PBHs. In this talk I will explore some of the attempts to achieve such a non-perturbative description of inflation such as the \deltaN or stochastic formalism and their difficulties.

Presenter: CRUCES, Diego (ICCUB)

Session Classification: Selected Talks

Contribution ID: **23**

Type: **not specified**

Balancing the medium response in minimal warm inflation

Tuesday, 27 June 2023 15:10 (20 minutes)

Axion-like inflation models have for long been discussed as the radiative corrections that spoil many single-field models are avoided by virtue of its shift symmetry. In addition, the inflaton can generically have an axion-like coupling to non-abelian gauge bosons. It has been shown that this interaction automatically induces a non-diluting thermal bath during inflation leading to a warm-inflation scenario. The peculiarity of a medium response with two physical origins, vacuum and thermal dynamics, leads into interesting phenomenology to describe the early and later stages of inflation. In this work we will study the conditions where these models satisfy Planck constrains, and possibly generate the amplification of scalar and tensor perturbations at the later stages of inflation whenever the thermal contribution dominates.

Presenter: TORRES MANSO, António (Universidad Granada)

Session Classification: Selected Talks

Contribution ID: **24**   Type: **not specified**

New method to detect continuous gravitational waves from inspiraling light primordial black holes

Tuesday, 27 June 2023 15:30 (20 minutes)

Primordial black holes can span a large range of masses depending on their time of formation. In particular, they can have subsolar masses and form binary systems in an efficient way. The inspiral phase can last for long periods of time (from hours to years) with a slow increase of frequency and, therefore, these signals are well suited to be searched with continuous gravitational waves methods. We present a new method based on the band sampled data (BSD) framework to specifically target this kind of signals. Additionally, we show an estimation of the sensitivity of the search and the computational cost associated to it.

Presenter: ANDRÉS CARCASONA, Marc (IFAE)

Session Classification: Selected Talks

Contribution ID: **25**   Type: **not specified**

Superradiant pion clouds around primordial black holes

Tuesday, 27 June 2023 15:50 (20 minutes)

We show that highly spinning primordial black holes of mass M ~ 10^12 kg, potentially born in a matter-dominated era after inflation, can produce clouds of pions in their vicinity via the superradiant instability, with densities up to that of nuclear matter. We discuss the electromagnetic signatures of this process, via neutral pion decay and charged pion annihilation into photons, computing in particular their contribution to the isotropic gamma-ray background. This allows us to place upper bounds on the abundance of such primordial black holes that are comparable to the ones obtained from Hawking evaporation. We also discuss the possibility of directly observing such clouds in high-redshift superclusters.

Presenter: FERRAZ, Paulo (University of Coimbra)

Session Classification: Selected Talks

Contribution ID: **26**   Type: **not specified**

Diffuse emission from black hole remnants

Tuesday, 27 June 2023 16:10 (20 minutes)

At the end of its evaporation, a black hole may leave a remnant where a large amount of information is stored. We argue that the existence of an area gap as predicted by loop quantum gravity removes a main objection to this scenario. Remnants should radiate in the low-frequency spectrum. We model this emission and derive properties of the diffuse radiation emitted by a population of such objects. We show that the frequency and energy density of this radiation, which are measurable in principle, suffice to estimate the mass of the parent holes and the remnant density, if the age of the population is known.

Presenter: PASCUAL, Mateo (Western University, London)

Session Classification: Selected Talks

Contribution ID: **27**   Type: **not specified**

The ultraviolet limit of the power spectrum and Lagrangian perturbation theory

Wednesday, 28 June 2023 14:20 (20 minutes)

Understanding the non-linear evolution of Large Scale Structure (LSS) is a key challenge in contemporary cosmology. To this end, it is important to combine both numerical simulations and analytical approaches, such as perturbation theory of LSS. Recently, it has been understood that the power spectrum in a cold dark matter dominated Universe can be investigated via an expansion in inverse powers of the wavenumber. In this talk, I will discuss various aspects of this novel expansion. In particular, I will show how it relates to Lagrangian perturbation theory and use it to derive powerful constraints on the structure of the effective field theory of LSS.

Presenter: BERSINI, Jahmall Matteo (Kavli IPMU)

Session Classification: Selected Talks

Contribution ID: **28**   Type: **not specified**

Primordial black holes as dark matter candidates in braneworld cosmology

Wednesday, 28 June 2023 14:40 (20 minutes)

In this talk I will present my current research on primordial black holes in (4+1) dimensional models. I will discuss how black hole properties - such as temperature, accretion rate and evaporation - change when one introduces an extra dimension. We are currently studying how these changes affect the range of masses in the dark matter window (f_PBH~1) and other observational signatures.

Presenter: ALDECOA TAMAYO, Itziar (University of Sussex / ICCUB)

Session Classification: Selected Talks

Contribution ID: **29**

Type: **not specified**

The latest updates from the pulsar timing array community

Presenter: PORAYKO, Nataliya (Milano Bicocca University)

Contribution ID: **30** Type: **not specified**

The latest updates from the pulsar timing array community