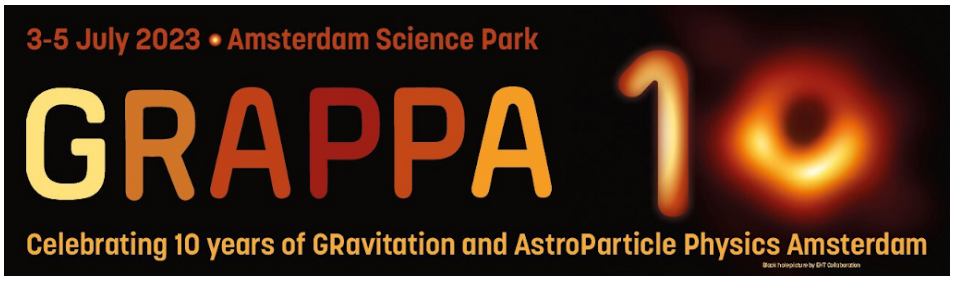
GRAPPA10



Report of Contributions

https://indico.nikhef.nl/e/4325

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

Probing Hidden Sector Dark Matter Using Early Matter Domination

Wednesday, 5 July 2023 10:30 (15 minutes)

The absence of dark matter signals in direct detection experiments and collider searches has prompted interest in models in which dark matter belongs to a hidden sector minimally coupled to the Standard Model. In these scenarios, a long-lived massive particle might come to dominate the energy density of the early universe temporarily, causing an early matter-dominated era (EMDE) prior to the onset of nucleosynthesis. During an EMDE, matter perturbations grow more rapidly than they would in a period of radiation domination, which leads to the formation of microhalos much earlier than they would in standard cosmological scenarios. These microhalos generate observable signatures, but the constraints on these signatures are highly sensitive to the small-scale cut-off in the matter power spectrum. We discuss the effects of an EMDE on the matter power spectrum, focusing on cases where the particle that dominates the Universe during the EMDE was initially relativistic, and the small-scale cut-off in the power spectrum is set by its pressure support. We relate the power spectrum cut-off to the hidden sector properties and the particle mass and discuss avenues for constraining such scenarios using dark matter annihilation signals, gravitational microlensing and pulsar timing arrays.

Primary author: GANJOO, Himanish (Perimeter Institute)

Co-authors: ERICKCEK, Adrienne (University of North Carolina - Chapel Hill); LIN, Weikang (Shanghai Jiao Tong University); MACK, Katherine (Perimeter Institute)

Presenter: GANJOO, Himanish (Perimeter Institute)

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

Cosmological implications of the Higgs vacuum metastability during inflation

Wednesday, 5 July 2023 10:45 (15 minutes)

According to the current experimental data, the Higgs vacuum appears to be metastable due to the development of a second lower ground state in its potential. Consequently, vacuum decay would induce the nucleation of true vacuum bubbles with catastrophic consequences for our Universe and therefore we are motivated to study possible stabilising mechanisms in the early universe. In our latest investigation (2207.00696), we studied the electroweak metastability in the context of the observationally favoured model of Starobinsky inflation. Following the motivation and techniques from our first study (2011.037633), we obtained constraints on the Higgs curvature coupling ξ, while embedding the SM on the modified gravity scenario $R + R^2$, which introduces Starobinsky inflation naturally. This had significant repercussions for the effective Higgs potential in the form of additional negative terms that destabilize the false vacuum. Another important aspect lay in the definition for the end of inflation, as bubble nucleation is most prominent during its very last moments. Our results dictated that these stronger lower ξ-bounds are very sensitive to the final moments of inflation, where spacetime deviates increasingly from de Sitter.

Primary author: MANTZIRIS, Andreas (University of Warsaw)

Co-authors: Prof. RAJANTIE, Arttu (Imperial College London); Dr MARKKANEN, Tommi (Solita Oy)

Presenter: MANTZIRIS, Andreas (University of Warsaw)

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

Quantum fields in compact stars.

Tuesday, 4 July 2023 14:45 (15 minutes)

Very compact stars seem to be forbidden in General Relativity. While Buchdahl's theorem sets an upper bound on compactness, further no-go results rely on the existence of two light rings, the inner of which is associated to gravitational instabilities. However, little is known about the role of QFT in these strong gravity regimes. We show that the renormalized stress tensor for CFTs diverges faster than the classical source as the star's surface approaches the Buchdahl radius rather than the Schwarzschild radius. The backreaction of quantum fields in this regime therefore cannot be ignored.

Primary authors: TOMASELLI, Giovanni Maria (GRAPPA); REYES, Ignacio (University of Amsterdam)

Presenter: REYES, Ignacio (University of Amsterdam)

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

The colliding wind binary Eta Carinae as a cosmic ray factory

Monday, 3 July 2023 14:00 (15 minutes)

The binary stellar system Eta Carinae is one of very few established astrophysical hadron accelerators and one of only two colliding wind binary systems detected in the gamma-ray regime. At the shocks in the wind collision region, particles are accelerated beyond TeV energies. It seems likely that at least some fraction of the accelerated particles escape from the system. Copious target material for hadronic interactions and associated gamma-ray emission exists on a wide range of spatial scales outside the binary system. This material creates a unique opportunity to trace the propagation of particles into the interstellar medium. Here we analyse gamma-ray data from Fermi-LAT of Eta Carinae and surrounding molecular clouds and investigate the many different scales on which escaping particles may interact and produce gamma rays. We find that interactions of escaping cosmic rays from Eta Carinae in the wind region and the Homunculus Nebula could produce a significant contribution to the gamma-ray emission associated with the system. Furthermore, we detect excess emission from the surrounding molecular clouds. The derived radial cosmic-ray excess profile is consistent with a steady injection of cosmic rays by a central source. However, this would require a higher flux of escaping cosmic rays from Eta Carinae than provided by our model. Therefore it is likely that additional cosmic ray sources contribute to the emission from the clouds.

Primary authors: Dr REVILLE, Brian (Max Planck Institute for Nuclear Physics); Dr BREUHAUS, Mischa (Max Planck Institute for nuclear physics); Prof. HINTON, James (Max Planck Institute for Nuclear Physics); Dr WHITE, Richard (Max Planck Institute for Nuclear Physics); Mr STEINMASSL, Simon (Max Planck Institue for Nuclear Physics)

Presenter: Dr BREUHAUS, Mischa (Max Planck Institute for nuclear physics)

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

Superradiance and binary inspirals

Wednesday, 5 July 2023 14:45 (15 minutes)

Ultralight bosons may be spontaneously produced by a rotating black hole through a process known as superradiance. This creates a "cloud" around the black hole that can manifest its presence in a variety of ways. In the past few years, scientists in Amsterdam and at GRAPPA have lead the effort of understanding the imprint left by such a cloud in a black hole binary inspiral. In this talk, I will review the main results of this endeavor, as well as present new developments that will allow a more realistic and general description of these systems.

Primary authors: BERTONE, Gianfranco; TOMASELLI, Giovanni Maria; Mr SPIEKSMA, Thomas

Presenter: TOMASELLI, Giovanni Maria

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

CR antinuclei predictions and their detectability in the next years

Monday, 3 July 2023 17:00 (15 minutes)

The creation of anti-nuclei in the Galaxy has been has been discussed as a possible signal of exotic production mechanisms such as primordial black hole evaporation or dark matter decay/annihilation, in addition to the conventional production from cosmic-ray (CR) interactions. Tentative observations of CR antihelium by the AMS-02 collaboration have re-energized the quest to use antinuclei to search for physics beyond the standard model.
In this talk, we show state-of-art predictions of the antinuclei spectrum from both astrophysical and standard dark matter annihilation models obtained from combined fits to high-precision antiproton data as well as CR nuclei measurements (specially B, Be, Li). Astrophysical sources are capable of producing $\mathcal{O}(1)$ antideuteron event and $\mathcal{O}(0.1)$ antihelium events over 15˜years of AMS-02 observations. Standard dark matter models could potentially produce $\mathcal{O}(1)$ antihelium event, while the production of a larger antihelium flux would require more novel dark matter model building. We also discuss that annihilation/decay of a QCD-like dark sector could potentially explain the AMS-02 preliminary observations of antihelium-3 and antihelium-4.

Primary author: DE LA TORRE LUQUE, Pedro (Oskar Klein Centre, Stockholm University)

Presenter: DE LA TORRE LUQUE, Pedro (Oskar Klein Centre, Stockholm University)

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

Cosmology and Multi-Messenger Astrophysics with Gamma-Ray Bursts

Monday, 3 July 2023 13:15 (15 minutes)

The huge luminosity, the redshift distribution extending at least up to z˜10 and the association with the explosive death of very massive stars make long GRBs extremely powerful probes for investigating the early Universe (pop-III stars, cosmic re-ionization, SFR and metallicity evolution up to the “cosmic dawn”) and measuring cosmological parameters. At the same time, as demonstrated by the GW170817 event, short GRBs are the most prominent electromagnetic counterpart of gravitational-wave sources like NS-NS and NS-BH merging events, and both long and short GRBs are expected to be associated with neutrino emission. Moreover, the combination of extreme distances, huge number of photons emitted over wide photon energy range and the variability down to few ms makes these phenomena a promising tool for performing tests of fundamental physics like Lorentz Invariance Violation (LIV). My review will include the status, concepts and expected performances of space mission projects in which INAF and the Italian astronomical community are
heavily involved, aiming at fully exploiting these unique potentialities of the GRB phenomenon, thus providing an ideal synergy with the large e.m. facilities of the future like LSST, ELT, TMT, SKA, CTA, ATHENA in the e.m. domain, advanced second generation (2G++) and third generation (3G) GW detectors (ET, CE) and future large neutrino detectors (e.g., Km3NET).

Primary author: AMATI, Lorenzo (INAF - OAS Bologna (Italy))

Presenter: AMATI, Lorenzo (INAF - OAS Bologna (Italy))

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

Welcome

Monday, 3 July 2023 09:00 (5 minutes)

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

Rector's Welcome

Monday, 3 July 2023 09:05 (10 minutes)

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

Dean's Welcome

Monday, 3 July 2023 09:15 (15 minutes)

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

The future of astroparticle physics - the next 10 years

Monday, 3 July 2023 09:30 (45 minutes)

Primary author: STEGMANN, Christian

Presenter: STEGMANN, Christian

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

TeV gamma-ray highlights during the first decade of GRAPPA

Monday, 3 July 2023 10:45 (45 minutes)

Primary author: BERGE, David

Presenter: BERGE, David

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

Gamma-ray Astronomy: Current status and future outlook

Monday, 3 July 2023 11:30 (45 minutes)

Primary author: MITCHELL, Alison

Presenter: MITCHELL, Alison

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

5 Contributed Talks

Primary authors: AMATI, Lorenzo (INAF - OAS Bologna (Italy)); MACIAS, Oscar (University of Amsterdam); GEBAUER WERNER, Lucia; BREUHAUS, Mischa (Max Planck Institute for nuclear physics); ANAU MONTEL, Noemi (GRAPPA)

Presenters: AMATI, Lorenzo (INAF - OAS Bologna (Italy)); MACIAS, Oscar (University of Amsterdam); GEBAUER WERNER, Lucia; BREUHAUS, Mischa (Max Planck Institute for nuclear physics); ANAU MONTEL, Noemi (GRAPPA)

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

High Energy Cosmic Rays

Monday, 3 July 2023 14:30 (45 minutes)

Primary author: BLASI, Pasquale

Presenter: BLASI, Pasquale

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

From the Higgs Discovery to Simulation-based Inference

Monday, 3 July 2023 15:45 (45 minutes)

Presenter: CRANMER , Kyle

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

3 Contributed Talks

Primary authors: GUPTA, Vikas; KRUISWIJK, Karlijn (UCLouvain); DE LA TORRE LUQUE, Pedro (Oskar Klein Centre, Stockholm University)

Presenters: GUPTA, Vikas; KRUISWIJK, Karlijn (UCLouvain); DE LA TORRE LUQUE, Pedro (Oskar Klein Centre, Stockholm University)

Contribution ID: **23** Type: **not specified**

Tanja Hinderer

Tuesday, 4 July 2023 09:00 (45 minutes)

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

Manuela Campanelli

Tuesday, 4 July 2023 09:45 (45 minutes)

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

2 Contributed Talks

Primary authors: COLE, Philippa (University of Amsterdam); DE JONG, Eloy (King's College London)

Presenters: COLE, Philippa (University of Amsterdam); DE JONG, Eloy (King's College London)

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

How to build the Einstein Telescope

Tuesday, 4 July 2023 11:30 (45 minutes)

Primary author: FREISE, Andreas

Presenter: FREISE, Andreas

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

4 Contributed Talks

Primary authors: GANJOO, Himanish (Perimeter Institute); MANTZIRIS, Andreas (University of Warsaw); MULLER, Rasa; LI, Youyou (GRAPPA)

Presenters: GANJOO, Himanish (Perimeter Institute); MANTZIRIS, Andreas (University of Warsaw); MULLER, Rasa; LI, Youyou (GRAPPA)

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

Quantum Gravity, Chaos, Complexity, and Statistical Physics

Tuesday, 4 July 2023 14:00 (45 minutes)

Presenter: DE BOER, Jan

Contribution ID: **29** Type: **not specified**

3 Contributed Talks

Primary authors: REYES, Ignacio (University of Amsterdam); DAS, Santuna (Imperial Colege London); MEAD, James (UvA)

Presenters: REYES, Ignacio (University of Amsterdam); DAS, Santuna (Imperial Colege London); MEAD, James (UvA)

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

Direct detection of dark matter

Tuesday, 4 July 2023 16:00 (45 minutes)

Primary author: MARRODAN UNDAGOITIA , Teresa

Presenter: MARRODAN UNDAGOITIA , Teresa

Contribution ID: **31** Type: **not specified**

2 Contributed Talks

Primary authors: LINDEN, Tim (Stockholm University); HERTOG, Thomas (KU Leuven)

Presenters: LINDEN, Tim (Stockholm University); HERTOG, Thomas (KU Leuven)

Contribution ID: **32** Type: **not specified**

Towards EeV Neutrino Astronomy

Wednesday, 5 July 2023 09:45 (45 minutes)

Primary author: KOTERA, Kumiko

Presenter: KOTERA, Kumiko

Contribution ID: **33** Type: **not specified**

Primordial Black Holes After 50 Years: A Positivist Perspective

Tuesday, 4 July 2023 12:15 (45 minutes)

Primary author: CARR, Bernard

Presenter: CARR, Bernard

Contribution ID: **34** Type: **not specified**

2 Contributed Talks

Primary authors: MULLER, Rasa; LI, Youyou (GRAPPA)

Presenters: MULLER, Rasa; LI, Youyou (GRAPPA)

Contribution ID: **35** Type: **not specified**

Gravitational Wave Signatures of Dark Matter around Black Holes

Wednesday, 5 July 2023 12:00 (45 minutes)

Primary author: KAVANAGH, Bradley

Presenter: KAVANAGH, Bradley

Contribution ID: **36** Type: **not specified**

Model-agnostic analysis of large-scale structure surveys and implications for cosmology

Wednesday, 5 July 2023 12:45 (45 minutes)

Primary author: VERDE, Licia

Presenter: VERDE, Licia

Contribution ID: **37** Type: **not specified**

The era of precision Cosmology and its surprises

Wednesday, 5 July 2023 14:00 (45 minutes)

Primary author: SILVESTRI , Alessandra

Presenter: SILVESTRI , Alessandra

Contribution ID: **38** Type: **not specified**

2 Contributed Talks

Primary authors: TOMASELLI, Giovanni Maria; DE SWART, Jaco (MIT)

Presenters: TOMASELLI, Giovanni Maria; DE SWART, Jaco (MIT)

Contribution ID: **39** Type: **not specified**

Prospects for understanding the physics of the Universe

Wednesday, 5 July 2023 15:15 (45 minutes)

Primary author: PEIRIS, Hiranya

Presenter: PEIRIS, Hiranya

Contribution ID: **40** Type: **not specified**

Conclusion - GRAPPA - The Next 10 years

Wednesday, 5 July 2023 16:00 (30 minutes)

Primary author: BERTONE, Gianfranco

Presenter: BERTONE, Gianfranco

Contribution ID: **41** Type: **not specified**

Diffuse Emission Models for the TeV Sky

Tuesday, 4 July 2023 16:45 (15 minutes)

Primary author: LINDEN, Tim (Stockholm University)

Presenter: LINDEN, Tim (Stockholm University)

Contribution ID: **42** Type: **not specified**

PTOLEMY: resolving relics from the early universe

Tuesday, 4 July 2023 15:00 (15 minutes)

Though their imprint upon the CMB and large-scale structure of the universe remains to this day, Big Bang relic neutrinos (the CνB) have never been directly observed. This remains an outstanding test of the Standard Model in ΛCDM cosmology and, carrying a signal from only one second after the Big Bang, relies upon messengers predating any previously observed. PTOLEMY aims to make the first direct observation of the CνB by resolving the β-decay endpoint of atomic tritium to O(10meV) precision. If achieved, this first observation would also reap at least the lowest neutrino mass. The project is in its prototyping phase and looks to begin physics runs in the 2030s.

Primary author: MEAD, James (UvA)

Presenter: MEAD, James (UvA)

Contribution ID: **43** Type: **not specified**

Spinning primordial black holes in a matter dominated universe

Tuesday, 4 July 2023 10:45 (15 minutes)

Interest in primordial black holes (PBHs) has spiked since the first detection of gravitational waves, and a few mass windows remain in which PBHs may still make up an appreciable part of dark matter. In a matter dominated universe, e.g. in the case of a first-order QCD phase transition, PBH production is enhanced and PBHs may have large dimensionless spins. We investigate the re-entry and collapse of superhorizon perturbations with initial dimensionless spins of $\chi_0^\xi \sim 0.1$ in this setting using full 3+1D numerical relativity simulations. We find that PBHs are formed with dimensionless spins $\chi_{\rm PBH}$ smaller than but the same order of magnitude as χ_0^ξ and argue this suggests no PBHs with $\chi_{\rm PBH} > 0.5$ are produced. Furthermore, we find that the addition of angular momentum only has a minor effect on the PBH mass and accretion rate. Additionally, we discuss apparent black hole horizons and cosmological horizons in the context of numerical relativity simulations of expanding spacetimes.

Primary author: DE JONG, Eloy (King's College London)

Presenter: DE JONG, Eloy (King's College London)

Contribution ID: **44** Type: **not specified**

Studying neutrinos with DUNE

Monday, 3 July 2023 16:30 (15 minutes)

The Deep Underground Neutrino Experiment (DUNE) is a near-future neutrino oscillation experiment in the U.S.A. consisting of a high-intensity neutrino beam produced and characterized at Fermilab, Illinois before it travels 1300 km to reach the DUNE Far Detector site in SURF, South Dakota. The DUNE experiment features a wide range of neutrino beam energies, long baseline length, and excellent energy resolution with the novel Liquid Argon Time Projection Chamber (LArTPC) technology for the Far Detector.

In this talk, I will first give an overview of the primary physics program of DUNE. The program includes precision measurement of neutrino oscillation to measure the PMNS matrix, resolve the neutrino mass ordering problem, and study CP violation in the leptonic sector. Furthermore, DUNE will also search for proton decay and detect neutrinos from supernova core collapse in our galaxy. I will also briefly summarize the current status and timeline of the experiment.

Lastly, I will give an overview of my work on ProtoDUNE, the far detector prototype program at CERN, aimed at developing and testing the necessary technology required for building the four 17 kt LArTPC modules planned for the DUNE Far Detector.

Primary author: Mr GUPTA, Vikas (NIKHEF)

Presenter: Mr GUPTA, Vikas (NIKHEF)

Contribution ID: **45** Type: **not specified**

Discovering the Millisecond Pulsar population responsible for the Gamma-Ray excess in the Sagittarius Dwarf Spheroidal galaxy with Radio Telescopes.

Monday, 3 July 2023 13:45 (15 minutes)

Observations of the Sagittarius dwarf spheroidal galaxy with the Fermi Gamma-Ray Space Telescope have revealed an excess of extended emission likely originated by an emerging population of millisecond pulsars in the core of this dwarf. In this talk, I will discuss the sensitivity of current and upcoming radio telescopes to this putative population of millisecond pulsars. I will show that the Square Kilometer Array (SKA) will be the most sensitive instrument for detecting these objects. With about 20 minutes of exposure per pointing, the SKA will be capable of identifying approximately ˜20 millisecond pulsars in the Sgr dSph. This would confirm the hypothesis that the Sgr dSph galaxy excess is due to an unresolved population of millisecond pulsars and would decisively exclude a dark matter explanation for the excess.

Primary author: GEBAUER WERNER, Lucia

Presenter: GEBAUER WERNER, Lucia

Contribution ID: **46** Type: **not specified**

Sequential simulation-based inference for strong gravitational lensing images

Monday, 3 July 2023 14:15 (15 minutes)

Galaxy-galaxy strong gravitational lenses are a unique laboratory for probing the smallest self-bound dark matter structures in our Universe and testing the ΛCDM paradigm. However, performing precise statistical analysis of such observations is extremely challenging, since it requires disentangling the source galaxy's light from the lens' mass distribution and marginalizing over different substructure configurations. Research in this field can be broadly separated into works that aim to directly detect individual perturbers and works that aim to statistically constrain the matter distribution by looking at collective perturbations caused by an unresolved population of perturbers.
In this talk, I will present recent advances in both of these approaches using a new multi-stage *neural* simulation-based inference method. I will also show the first application of machine learning to a real strongly lensed observation by reanalyzing JVASB1938+666 system, one of the few examples so far of substructure detection using traditional gravitational imaging techniques. These first results demonstrate that this method is imminently applicable to existing lensing data and to the large sample of very high-quality observational data that will be delivered by near-future telescopes.

Primary authors: WENIGER, Christoph (University of Amsterdam); ANAU MONTEL, Noemi (GRAPPA)

Presenter: ANAU MONTEL, Noemi (GRAPPA)

Contribution ID: **47** Type: **not specified**

Distinguishing environmental effects on gravitational waveforms

Tuesday, 4 July 2023 10:30 (15 minutes)

LISA, the space-based gravitational wave detector, is due to fly in the mid 2030s. An entire new frequency range will be opened up for discovering gravitational wave sources, including intermediate and extreme mass ratio black hole binaries which will remain in band for up to weeks, months or even years. This offers an exciting new avenue for fundamental physics discoveries because the environment of the binaries will have an effect on the gravitational waveform over this long period of time, and we will be able to measure the properties of the environments from the gravitational wave observations alone.

I will show that we can measure the parameters of not only baryonic environments such as accretion disks, but also the properties of dark matter spikes or clouds of scalar fields if they are present around the binaries. I will demonstrate that we can distinguish between different environments with a Bayesian model comparison approach and argue the importance of including environmental effects in waveform modelling. This is so that we don't miss the opportunity to learn about the nature of dark matter or the structure of accretion disks, but crucially also so that we don't infer biased parameters by assuming that the system is inspiralling through vacuum.

Primary author: COLE, Philippa (University of Amsterdam)

Presenter: COLE, Philippa (University of Amsterdam)

Contribution ID: **48** Type: **not specified**

IceCube search for neutrinos from GRB 221009A

Monday, 3 July 2023 16:45 (15 minutes)

Gamma-ray bursts (GRBs) have long been a promising candidate for neutrino emission, with different theoretical models predicting neutrino fluxes across a large range of energies. While correlations between GRBs and neutrinos have yet to be found, GRB 221009A is an exceptionally interesting target for neutrino searches. As the brightest GRB ever observed and the first with >10 TeV photons, GRB 221009A gives us a unique opportunity to probe GRB neutrino emission. Using a variety of methods, applying different time windows and specializing for the different energy ranges, IceCube has been able to search for neutrinos ranging from MeV to PeV energies from GRB 221009A. These methods include looking for the photo-multiplier rates scalars usually reserved for MeV supernova neutrinos, to looking for an increase in GeV event rates inside DeepCore, to using traditional point source methods for searches from 10 GeV to 1 TeV with DeepCore and > 1 TeV with the full IceCube detector. With these different methods of neutrino observation it is possible to cover 9 orders of magnitude in neutrino energy, placing stringent limits on the neutrino emission of the brightest ever observed GRB.

Primary authors: KRUISWIJK, Karlijn (UCLouvain); VALTONEN-MATILA, Nora (Uppsala University); THWAITES, Jessie (University of Wisconsin - Madison); BRINSON, Bennett (Georgia Tech); PROCTER-MURPHY, Rachel (University of Maryland)

Presenter: KRUISWIJK, Karlijn (UCLouvain)

Contribution ID: **49** Type: **not specified**

Galactic Cosmic Ray accelerators and Their multi-messenger Signals

Wednesday, 5 July 2023 11:15 (15 minutes)

The origin and acceleration mechanisms of Galactic cosmic rays (CRs) are still unknown. Gamma-ray observations have been crucial in identifying potential sites of CR acceleration. However, understanding these observations is challenging because both hadronic and leptonic processes can produce gamma rays, and different mechanisms may be responsible for accelerating various CR species. A multi-messenger approach that includes current and potential observations of radio, X-ray, gamma-ray, and neutrino signals is necessary to disentangle these complex acceleration mechanisms and emission processes. In this talk, I will present the latest findings from our research involving semi-analytical methods and accurate numerical simulations to study the multi-messenger emissions produced by nearby very-high-energy astrophysical accelerators.

Primary author: LI, Youyou (GRAPPA)

Co-authors: MACIAS, Oscar (University of Amsterdam); ANDO, Shin'ichiro (University of Amsterdam); PERETTI, Enrico (Niels Bohr Institute); AHLERS, Markus (Niels Bohr Institute)

Presenter: LI, Youyou (GRAPPA)

Contribution ID: **50** Type: **not specified**

Neutrinos in the Mediterranean Sea

Wednesday, 5 July 2023 11:00 (15 minutes)

Neutrino astronomy is a rapidly evolving discipline probed by large-volume neutrino detectors such as those being built by the KM3NeT collaboration in the Mediterranean Sea, instrumenting a cubic kilometre of seawater. KM3NeT focuses on the detection of cosmic high-energy neutrino sources as well as measurements of the atmospheric neutrino oscillations to expand our understanding of fundamental physics.
The transparency of the seawater allows accurate reconstructions of events achieving <0.1 degree angular resolution for neutrinos with energies >100TeV with great potential to locate cosmic high-energy neutrino sources. The location of KM3NeT offers an excellent view of the Southern Hemisphere with the interesting galactic center region.
The construction of KM3NeT is ongoing with ˜10% of the detector already deployed in the sea. The talk presents the first results and prospects of KM3NeT.

Primary author: MULLER, Rasa

Presenter: MULLER, Rasa

Contribution ID: **51** Type: **not specified**

Understanding the dark universe through Mach's principle and modified gravity

While the standard LCDM model containing dark matter and dark energy can explain the observational data accurately, the possibility that the general theory of relativity (GR) fails to explain the true nature of gravity on a kilo-parsec scale and needs a modification can also not be overruled. In this talk, I will discuss a modified gravity model based on Mach's principle. I will discuss how this modified gravity model provides some additional fields that behave like dark matter and dark energy. This can fit the galactic velocity profile, galaxy cluster mass profile, and different other cosmological data without requiring any dark components in the universe.

Primary author: DAS, Santuna (Imperial Colege London)

Presenter: DAS, Santuna (Imperial Colege London)

Contribution ID: **52** Type: **not specified**

Gamma-ray emission from the Sagittarius Dwarf Spheroidal galaxy due to millisecond pulsars

Monday, 3 July 2023 13:30 (15 minutes)

The Fermi Bubbles are giant, gamma-ray emitting lobes emanating from the nucleus of the Milky Way discovered in ˜1-100 GeV data collected by the Fermi Gamma-Ray Space Telescope. Previous work has revealed substructure within the Fermi Bubbles that has been interpreted as a signature of collimated outflows from the Galaxy's super-massive black hole. In this talk, I will show that much of the gamma-ray emission associated to the brightest region of substructure – the so-called cocoon – is likely due to the Sagittarius dwarf spheroidal (Sgr dSph) galaxy. This large Milky Way satellite is viewed through the Fermi Bubbles from the position of the Solar System. As a tidally and ram-pressure stripped remnant, the Sgr dSph has no on-going star formation, but I will demonstrate that the dwarf's millisecond pulsar (MSP) population can plausibly supply the observed gamma-ray signal. This finding plausibly suggests that MSPs produce significant gamma-ray emission amongst old stellar populations, potentially confounding indirect dark matter searches in regions such as the Galactic Centre, the Andromeda galaxy, and other massive Milky Way dwarf spheroidals.

Primary author: MACIAS, Oscar (University of Amsterdam)

Presenter: MACIAS, Oscar (University of Amsterdam)

Contribution ID: **53** Type: **not specified**

Cleaning a Dark Matter Detector

Wednesday, 5 July 2023 15:00 (15 minutes)

In dark matter detection experiments, Xenon tanks are being used to find traces of dark matter particles that are hypothesised to crisscross the universe. For such detection to succeed, the Xenon in the tanks has to be clean. But what is clean? In this context, it means that no background mimics the signs of dark matter particles, and when there are no electronegativities that might erase such signs. In practice, such cleanliness is difficult to achieve – as soaps may be radioactive, steel may spread electronegativity, and humans are altogether dangerously filthy. In this talk, I discuss the idiosyncratic cleaning practices of the XENONnT experiment that aims find WIMP dark matter. What does ensuring a detector's cleanliness entail? And how does one know whether a detector is, in fact, adequately clean?

Primary author: DE SWART, Jaco (Massachusetts Institute of Technology)

Presenter: DE SWART, Jaco (Massachusetts Institute of Technology)

Contribution ID: **54** Type: **not specified**

Novel constraints on inflation from quantum cosmology

Tuesday, 4 July 2023 17:00 (15 minutes)

TBD

Primary author: HERTOG, Thomas (KU Leuven)

Presenter: HERTOG, Thomas (KU Leuven)