MY FAVOURITE DARK MATTER MODEL

Report of Contributions

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

Welcome

Monday 14 April 2025 09:45 (15 minutes)

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

Exploring new features of the Z2×Z2 3HDM with two component dark

Monday 14 April 2025 10:00 (30 minutes)

We discuss the constraints and phenomenology of the Z2×Z2 three Higgs doublet model (3HDM) with two inert scalars, originating two dark matter (DM) particles. We elucidate the competing vacua and we submit the model to all theoretical, collider and astrophysical constraints. We find unexplored regions of parameter space and investigate their experimental signatures. The whole mass range for a given component can be populated for the model, even for intermediate mass regions.

Presenter: ROMÃO, Jorge (Instituto Superior Tecnico, Lisbon)

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

Dark Hydrogen Atoms as Baryonic Dark Matter

Monday 14 April 2025 10:30 (30 minutes)

Dark Hydrogen Atoms as Baryonic Dark Matter
From the most detailed map of the cosmic microwave background at the end of the recombination epoch, the Plank Collaboration deduced the existence of the baryonic dark matter (DM) in the ratio 1:5 to the non-baryonic DM. So, the baryonic DM does exist. The explanation of a puzzling observation by Bowman et al (2018) of the redshifted 21 cm spectral line from the early Universe, where it was found that the absorption in this spectral line was about two times stronger than predicted by the standard cosmology and thus the primordial hydrogen gas was significantly cooler than predicted by the standard cosmology, required as the cooling agent, a baryonic DM with the mass of the order of baryon masses (Barcana, 2018; McGaugh, 2018). Initially, this narrowed candidates for baryonic DM to just dibaryons (hexaquarks). However, there was a strong criticism in the literature of the dibaryon hypothesis; plus, they were not discovered experimentally. Then in
paper (Oks, 2020) there was given both qualitative and quantitative explanation of the puzzling observation by Bowman et al (2018) based on the DM in the form of the second flavor of hydrogen atoms (SFHA), corresponding to the 2nd solution of the Dirac equation for hydrogen atoms. In distinction to dibaryons and to even more exotic hypothetical particles never discovered experimentally, the existence of the SFHA is evidenced by four different types of atomic experiments, which I will briefly describe. (More details can be found, e.g., in my reviews on DM published in New Astronomy Reviews in 2021 and in 2023.) The primary property of the SFHA is that, since they have only the S-states, then according to the selection rules they cannot emit or absorb the electromagnetic radiation: they remain dark (except for the 21 cm spectral line). One of
important applications of the SFHA is to solving the neutron lifetime puzzle and to its cosmological consequences. The discrepancy between the measured lifetime of trapped ultracold neutrons τtrap =
(877.75 ± 0.28stat + 0.22/-0.16syst) s and the measured lifetime of neutrons in the beam experiments (τbeam = 888.0 ± 2.0 s) remained unresolved for many years (the difference was well beyond the experimental error margins). There are two channels of neutron decay: in the primary channel the
outcome is a proton and an electron as free particles plus an antineutrino (three-body decay), while in the secondary channel the outcome is a hydrogen atom plus an antineutrino (two-body decay). In
1990 an idea was brought up that the two-body decay of neutrons, producing hydrogen atoms rather
than protons, affects the measured lifetime of neutrons in the beam experiment because in these experiments only the resulting protons are counted. However, the Branching Ratio (BR) for this process, known at that time, was 4x10-6
, thus lacking over 3 orders of magnitude for the quantitative
explanation of the neutron lifetime puzzle. In our paper of 2024, it was demonstrated that in the two-body decay of neutrons the resulting hydrogen atoms with the overwhelming probability are the
SFHA. As a result, the corresponding BR increased to ˜ 1% in the excellent agreement with the "experimental"BR of ˜ 1% necessary for resolving the puzzle. We also showed that the two-body

decay of neutrons has profound cosmological implications. Namely, it is the mechanism by which neutron stars, in three different situations, are slowly but continuously producing baryonic DM in the form of the SFHA. There is an indirect astrophysical evidence of this process. It is important to
emphasize that the discovery of the SFHA was based on the standard Dirac equation of quantum mechanics without going beyond the Standard Model and without any change of physical laws – in
distinction to the overwhelming majority of hypotheses on DM.

Presenter: Prof. OKS, Eugene (Auburn University, USA)

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

Dark matter in the Lorentz gauge theory

Monday 14 April 2025 11:30 (30 minutes)

The Lorentz gauge theory of gravity with a spontaneous symmetry breaking field, sometimes dubbed "khronon", provides a successful description of the ΛCDM model in which the dark matter candidate arises as a geometric effect. A chiral formulation of this theory has been found to be an extension of General Relativity, and this theory is being studied in phenomenological contexts of black holes and cosmology. While cosmological study supports that this model aligns with how ideal dust would behave, problems arise when formulating their interaction with black holes, as the khronon gauge only allows synchronous frame and an alternative gauge leads to the mimetic black hole solution. This talk presents how dark matter is formulated in this theory and discusses recently developed phenomenological results, including generalised black hole solutions and cosmological perturbation.

Presenter: ZHENG, Luxi (University of Tartu)

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

Probing dark matter properties through the morphology of the intergalactic medium in emission

Monday 14 April 2025 12:00 (30 minutes)

The properties of dark matter affect its distribution in the universe. In particular, the mass of dark matter defines a characteristic free streaming length under which structure formation is suppressed. While this length is negligible for standard cold dark matter, it can be of the order of galactic sizes for warm dark matter with mass ˜ 1keV, and thus have observational effects. Current constraints from astrophysical probes set a lower limit around 2-6 keV, but they depend on assumptions about the thermal history of the universe or galaxy formation. In this talk I will present a promising new probe to constrain dark matter properties: fluorescent emission from the intergalactic medium (IGM) around bright quasars in the young universe (z˜3), in particular at the Lyman-alpha (Lya) wavelength. This emission is produced by the cold (T<10ˆ5K) diffuse gas in the IGM, which represents the fraction of cosmic gas that has been minimally impacted by galactic processes, making it an optimal tracer of the underlying dark matter. It is however very faint, and observations only revealed it very recently on intergalactic scales. Before being able to exploit these, it is necessary to study similar structures in numerical simulations with different dark matter implementations. I will present our new suite of high resolution zoom-in hydrodynamical simulations. We use these to create mock observations of the Lya surface brightness in cold and warm dark matter scenarios. Using topological tools, I will then show that the nature of dark matter impacts the morphology of the intergalactic Lya emission, making it more clumpy in the cold dark matter case. These results constitute the first steps towards new constraints on the nature of dark matter complementary to, and competitive with existing ones.

Presenter: LAZEYRAS, Titouan (Università degli Studi di Milano Bicocca)

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

Gravitational lensing, and stability properties of Bose-Einstein condensate dark matter halos

Monday 14 April 2025 14:30 (30 minutes)

The possibility that dark matter, whose existence is inferred from the study of the galactic rotation curves, and from the mass deficit in galaxy clusters, can be in a form of a Bose-Einstein Condensate, has been recently extensively investigated. In this talk, we consider a detailed analysis of the astrophysical properties of the Bose-Einstein Condensate dark matter halos that could provide clear observational signatures that help discriminate between different dark matter models. In the Bose-Einstein condensation model dark matter can be described as a non-relativistic, gravitationally confined Newtonian gas, whose density and pressure are related by a polytropic equation of state with index n=1. The mass and gravitational properties of the condensate halos are obtained in a systematic form, including the mean logarithmic slopes of the density and of the tangential velocity. The lensing properties of the condensate dark matter are investigated in detail. In particular, a general analytical formula for the surface density, an important quantity that defines the lensing properties of a dark matter halos, is obtained in the form of series expansions. This enables arbitrary-precision calculations of the surface mass density, deflection angle, deflection potential, and of the magnification factor, thus giving the possibility of the comparison of the predicted lensing properties of the condensate dark matter halos with observations. The stability properties of the condensate halos are also investigated by using the scalar and the tensor virial theorems, respectively, and the virial perturbation equation for condensate dark matter halos is derived.

Presenter: LOBO, Francisco

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

Electroweak phase transition in a vector dark matter scenario

Monday 14 April 2025 15:00 (30 minutes)

This study explores the parameter space of a minimal extension of the Standard Model with a non-abelian SU(2) group, in which the gauge bosons are stable and acquire mass through a mechanism of spontaneous symmetry breaking involving a new scalar doublet which interacts with the Higgs boson through a quartic coupling. The exploration aims to assess whether it is possible to obtain a first-order phase transition while ensuring that the gauge bosons are viable dark matter candidates. Theoretical, astrophysical and collider bounds are considered. The results are then tested against the sensitivity of future experiments for the detection of gravitational wave signals.

Presenter: BENINCASA, Nico

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

The Layzer–Irvine equation in Non–Minimally Coupled Weyl Connection Gravity

Monday 14 April 2025 16:00 (30 minutes)

In this project we will analyse a theory with non-minimal matter–curvature coupling, considering non–metricity properties with a Weyl connection. This model has the advantage of an extra force term which can mimic dark matter and dark energy, and simultaneously follow Weyl's idea of unifying gravity and electromagnetism. Indeed, we can show astrophysical results like Schwarzschild and Reissner–Nordstrøm black hole solutions and the Layzer–Irvine equation for an homogeneous and isotropic Universe, in order to understand the important role that this non-metricity property can play in several astrophysical systems.

Presenter: LIMA, Maria Margarida (CAMGST - IST & Okeanos - UAç, Portugal)

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

Random news from the dark world

Monday 14 April 2025 16:30 (30 minutes)

I will report on some recent results on simple extensions of the Standard Model with scalar Dark matter candidates.

Presenter: SANTOS, Rui (ISEL and CFTC-UL)

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

A New Perturbative Method for Systems of Algebraic Equations

Monday 14 April 2025 17:00 (30 minutes)

—We present a new perturbative method to find the solutions of systems of equations in the neighbourhood
of known solutions. Given a known solution to a system of equations, the proposed method allows one to find both the
dimension of the solution space around it and to construct a power series for the set of solutions in its neighbourhood –
and it does provide as many such answers as there may be discontinuous sets of solutions. It is in principle suited both
for numerical methods (by generating approximate solutions around a known solution) and for analytical methods (by
providing the dimension and topology of the set of solutions around that point).

Presenter: BARROS E SÁ, Nuno (Universidade dos Açores)

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

DM model buildings along the SM construction

Tuesday 15 April 2025 09:30 (30 minutes)

The SM for particle physics is surprisingly successful. It is based on symmetry principles of various types. I will first recapitulate basic assumptions and key aspects of the SM, emphasizing differences between global vs. local gauge symmetries. Then I will apply similar assumptions and aspects to the DM model buildings.
I will discuss a few exemplary DM models and demonstrate theoretical/phenomenological importances of my approach, in particular unitarity and theoretical consistency.

Presenter: Prof. KO, Pyungwon (KIAS (Korea Institute for Advanced Study))

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

A Relativistic Explanation for the Darkness of Galactic Halos

Tuesday 15 April 2025 10:00 (30 minutes)

In the Cold Dark Matter (CDM) paradigm, galaxies form when gas within dark matter (DM) halos cools and collapses toward the centre of the DM potential well, creating a rotating disc structure that triggers star formation. Dark matter candidates span over 90 orders of magnitude in mass, from ultralight bosons to massive black holes. However, despite extensive large-scale underground experiments (e.g., LUX-ZEPLIN, XENON, PANDA-X) and particle accelerator experiments at CERN's LHC, no confirmed detection of a dark matter particle has been made. In this paper, we demonstrate that the observed features of galactic halos, typically attributed to dark matter particles, can be explained by a simple relativistic model, without invoking the notion of dark particles. We apply a recently proposed theory of relativity of information (1-3) to a rotating thin disk and derive predictions for the radial density distributions of luminous and nonluminous matter, and their mass fractions in disk galaxies, based solely on their measured velocity curves. We utilized these predictions to infer about the distributions and fractions of luminous and nonluminous components in 52 disk galaxies from the SPARC database. In all galaxies tested, the nonluminous density component is predicted to dominates over the luminous component starting at a radial velocity of Vmax /3, where Vmax is the maximum measured velocity. The build-up of the nonluminous density and the simultaneous decrease in the luminous component density are predicted to be continuous and depend only on the dimensionless velocity β(r)= v(r)/Vmax. The proposed relativistic model avoids the cusp-core problem and successfully accounts for several empirical results unexplained by the CDM model, including the strong coupling between luminous and nonluminous matter (e.g., the RAR, the BTFR), and the flat circular velocity of isolated galaxies. We conclude that the darkness of galactic halos is likely a relativistic phenomenon, governed by rotational velocities rather than the presence of exotic dark matter particles. If this conclusion is corroborated, the considerable resources devoted to the search for dark matter particles could be redirected toward more beneficial scientific endeavours. Keywords: Dark matter, nonluminous matter, dark matter in galaxies, matter-dark matter coupling, rotation curve, SPARC, Radial Acceleration Relation, Baryonic Tully-Fisher Relation. (1) Suleiman, R. A model of dark matter and dark energy based on relativizing Newton's physics. WJCMP 2018, 8, 130-155. (2) Suleiman, R. Relativizing Newton (Nova Science Publishers. N.Y, 2019). (3) Suleiman, R. A local-deterministic alternative to quantum gravity. Paper presented at the XII International Conference on New Frontiers in Physics (ICNFP), OAC, Kolymbari. Crete, Greece, 10-23 July, 2023. DOI: 10.13140/RG.2.2.14347.67365.

Presenter: SULEIMAN, Ramzi

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

Predictive freeze-in

Tuesday 15 April 2025 11:00 (30 minutes)

Non-thermal dark matter models suffer from the ever-present gravitational particle production background, which mars predictivity of the framework altogether. I will discuss a class of freeze-in dark matter models with a low reheating temperature that are free of such problems and are directly testable.

Presenter: LEBEDEV, Oleg

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

The Layzer-Irvine equation: a cosmic tool for dark matter and dark energy

Tuesday 15 April 2025 11:30 (30 minutes)

We shall review the cosmic generalisation of the virial theorem, known as the Layzer-Irvine equation, also independently derived by Dmitriev and Zeldovich. This equation has been studied in the literature for both dark matter and dark matter-dark energy interaction models, as well as in the context of alternative theories of gravity. We shall discuss some results of the previous scenarios and point out future directions.

Presenter: GOMES, Cláudio (Centro de Física das Universidades do Minho e do Porto, FCUP)

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

RelExt - A New Tool for Dark Matter Parameter Searches

Tuesday 15 April 2025 14:00 (30 minutes)

We present the C++ program RelExt for Standard Model (SM) extensions that feature a Dark Matter (DM) candidate. The tool allows to efficiently scan the parameter spaces of these models to find parameter combinations that lead to relic density values which are compatible with the measured value within the uncertainty specified by the user. The code computes the relic density for freeze-out (co-)annihilation processes. The user can choose between several pre-installed models or any arbitrary other model featuring a discrete Z_2 symmetry, by solely providing the corresponding FeynRules model files. The code automatically generates the required (co-)annihilation amplitudes and thermally averaged cross sections, including the total widths in the s-channel mediators, and solves the Boltzmann equation to determine the relic density. It can easily be linked to other tools like e.g. ScannerS to check for the relevant theoretical and experimental constraints, or to BSMPT to investigate the phase history of the model and possibly related gravitational waves signals.

Presenter: MÜHLLEITNER, Milada Margarete

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

Dark Matter and Dark Energy from first principles of precanonical quantum gravity

Tuesday 15 April 2025 14:30 (30 minutes)

Precanonical quantum gravity posits a quantum geometry of spacetime characterized by a fluctuating spin connection foam (SCF). This framework naturally yields a characteristic acceleration scale, $a_* = 8\pi G\hbar$
$varkappa$, which is related to the cosmological constant, $\Lambda \sim (8\pi G\hbar$
$varkappa)^2$ Here,
$varkappa \sim (\Delta m)^3$ represents a parameter inherent to the theory, demonstrated to correlate with the mass gap of the Yang-Mills sector of the Standard Model. The hadronic scale of
$varkappa$ renders a_* and Λ consistent with the observed magnitudes of the Milgromian acceleration and the cosmological constant, respectively. Furthermore, an analysis of a nonrelativistic test particle, moving within the gravitational field of a mass M and immersed in the static approximation of the SCF, results in a modified Newtonian potential. The asymptotic behaviour of this potential, at both small and large distances, aligns with the potential derived from approaches to flat galactic rotation curves based on conformal gravity. It also reproduces the modified Newtonian dynamics (MOND) proposed by Milgrom as an alternative to dark matter. Both results are derived from the first principles of precanonical quantum gravity. We discuss their consequences across scales, from the outer Solar System to the large-scale structure of the Universe, and their implications for research in 'dark sectors' and modifications of classical General Relativity.

Presenter: KANATCHIKOV, Igor (Natl Center of Quantum Information. Gdansk)

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

Dark sector to the rescue of large cosmological neutrino masses

Tuesday 15 April 2025 15:30 (30 minutes)

We consider an extended seesaw model which generates active neutrino masses via the usual type-I seesaw and leads to a large number of massless fermions as well as a sterile neutrino dark matter (DM) candidate in the O(10−100) keV mass range. The dark sector comes into thermal equilibrium with Standard Model neutrinos after neutrino decoupling and before recombination via a U(1) gauge interaction in the dark sector. This suppresses the abundance of active neutrinos and therefore reconciles sizeable neutrino masses with cosmology. The DM abundance is determined by freeze-out in the dark sector, which allows avoiding bounds from X-ray searches. Our scenario predicts a slight increase in the effective number of neutrino species Neffat recombination, potentially detectable by future CMB missions.

Presenter: VATSYAYAN, Drona

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

LambdaCDM-like evolution in Einstein-scalar-Gauss-Bonnet gravity

Tuesday 15 April 2025 16:00 (30 minutes)

Recently, a Modified Gravity Theory named Einstein-scalar-Gauss-Bonnet (EsGB) gravity, a string-inspired theory that admits a coupling between an extra scalar field and the Gauss-Bonnet invariant, has been gaining some attention due to its rich phenomenology. Motivated by its theoretical advancements, we explored the cosmology of the theory in a model-independent manner by using the dynamical systems formalism. We show that this theory admits LambdaCDM-like solutions, that is, solutions that are consistent with the Planck data and the weak-field solar system dynamics while keeping both the extra scalar field and the coupling term finite and regular throughout the entire cosmological evolution. As a result, EsGB gravity may appear indistinguishable from the standard LambdaCDM model at the background level, and, therefore, its differences from General Relativity emerge only under certain conditions, which we will briefly discuss.

Presenter: PINTO, Miguel (Institute of Astrophysics and Space Sciences)

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

Black Holes in f(T) gravity

Wednesday 16 April 2025 11:00 (30 minutes)

We extend the black hole holography to the case of an asymptotically anti-de Sitter (AdS) rotating charged black holes in f (T) = T + αT2 gravity, where α is a constant. We find that the scalar wave radial equation at the near-horizon region implies the existence of the 2D conformal symmetries. We show that choosing proper central charges for the dual CFT, we produce exactly the macroscopic Bekenstein-Hawking entropy from the microscopic Cardy entropy for the dual CFT. These observations suggest that the rotating charged AdS black hole in f (T) gravity is dual to a 2D CFT at finite temperatures.

Presenter: GHEZELBASH, Masoud (University of saskatchewan)

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

Hunting axions with the James Webb Space Telescope

Wednesday 16 April 2025 10:00 (30 minutes)

Axions with a mass around 1 eV can decay into near-infrared photons. Utilising blank-sky observations from the James Webb Space Telescope, I search for a narrow emission line due to decaying dark matter and derive leading constraints on the axion-photon coupling in the eV-scale mass range.

Presenter: PINETTI, Elena

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

Even SIMP miracles are possible

Wednesday 16 April 2025 09:30 (30 minutes)

Strongly interacting massive particles π have been advocated as prominent dark matter candidates when they regulate their relic abundance through odd-numbered 3π⟶2π annihilation. We show that successful freeze-out may also be achieved through even-numbered interactions XX⟶ππ once bound states X among the particles of the low-energy spectrum exist. In addition, X-formation hosts the potential of also catalyzing odd-numbered 3π⟶2π annihilation processes, turning them into effective two-body processes πX⟶ππ. Bound states are often a natural consequence of strongly interacting theories. We calculate the dark matter freeze-out and comment on the cosmic viability and possible extensions. Candidate theories can encompass confining sectors without a mass gap, glueball dark matter, or ϕ3 and ϕ4 theories with strong Yukawa or self-interactions.

Presenter: PRADLER, Josef (University of Vienna & Austrian Academy of Sciences (AT))

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

Cosmological Production of ROMP Dark Matter

Wednesday 16 April 2025 11:30 (30 minutes)

Rapidly Oscillating Massive Particles (ROMPs) arise in quantum systems with non-diagonal interaction Hamiltonians. This misalignment between flavor and mass eigenstates leads to oscillations between flavor states, such as those between electron and muon neutrinos in the Standard Model, or between active and sterile neutrinos in Beyond the Standard Model frameworks to name just a few examples. In this talk, I will discuss the general framework for particle production of dark matter via mixing, showing how oscillations, scatterings, thermal masses, and resonances all play a role to give ROMPs a rich cosmology.

Presenter: DUNSKY, David

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

Gravitation dark matter production

Thursday 17 April 2025 09:30 (30 minutes)

In this talk, I address the gravitational production of dark matter in two distinct scenarios:
first, when reheating is driven by gravitational particle production, and second, when reheating is dominated by the decay of the inflaton field.
I establish a relationship between the reheating temperature and the mass of dark matter, and by leveraging the constraints on reheating,
I demonstrate how to determine the range of viable dark matter mass values. This analysis provides a framework for understanding the
interplay between reheating dynamics and the properties of dark matter in the early universe

Presenter: HARO CASES, Jaime

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

Dark matter stabilized by a non-abelian group

Thursday 17 April 2025 10:00 (30 minutes)

When building dark matter (DM) models, one often imposes conserved discrete symmetries to stabilize DM candidates. The simplest choice is Z2 but models with larger stabilizing groups have also been explored. Can a conserved non-abelian group lead to a viable DM model? Here, we address this question within the three-Higgs-doublet model based on the group $\Sigma(36)$, in which DM stabilization by a non-abelian group is not only possible but inevitable. We show that the tight connections between the Higgs, fermion, and DM sectors repeatedly drive the model into conflict with the LHC results and DM observations, with the most recent LZ results playing a decisive role.

Presenter: TEIXEIRA BOTO, Rafael Filipe (Instituto Superior Técnico)

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

Dark matter as bound states in asymptotically safe quantum gravity

Thursday 17 April 2025 11:00 (30 minutes)

Many dark matter models become unviable when embedded into the framework of asymptotically safe quantum gravity. In this work, we investigate dark matter arising as bound states of fundamental fermions in the strongly-coupled regime of a gauge theory. Modeling the self-interactions of dark baryons via the effective-range approach, we perform a multi-scale analysis in which we combine phenomenological constraints with the theoretical requirements imposed by consistent embedding into asymptotically safe quantum gravity. We find a regime in parameter space that is compatible with all constraints, indicating that this theory may account for dark matter while being ultraviolet complete and predictive. Additionally, we discover a generic feature: kinetic mixing between visible and dark photons is dynamically driven towards tiny values within the ultraviolet complete setting; a crucial condition to prevent an overabundance of dark matter produced via the kinetic mixing portal in the freeze-in mechanism.

Presenter: Mr CHIKKABALLI, Abhishek (National Center for Nuclear Research, Warsaw)

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

Dark matter annihilation and the termination of the Martian geodynamo

Thursday 17 April 2025 11:30 (30 minutes)

In this work we derive limits on the WIMP-nucleon scattering cross-section by comparing the potential heat flow within the Earth from Dark Matter capture and subsequent annihilation to the observational value. This effect has been argued previously in the literature to provide a potential link to mass extinction phenomena on Earth. However, we focus on whether additional heat-flux from dark matter annihilations within the Martian core could have affected the decay of its geodynamo, and thus precipitated its magnetic field loss. We determine that Xenon1T limits on the WIMP nucleon cross-sections do not allow sufficient heating to significantly affect either Earth or Mars. We then use this to determine the local dark matter density and the density of a dark matter sub-halo that would support a significant effect given these limits. In addition, we have extended previous work on this topic by including resonant collisional effects, considering the impact of Xenon1T limits, and by considering possible effects on the evolution of the Martian geodynamo. We have lastly presented the possibility of Mars coming into contact with such a sub-halo.

Presenter: MAKDA, Javeria

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

Freeze-in at stronger coupling and the highest temperature in the Universe

Thursday 17 April 2025 12:00 (30 minutes)

When the Dark Matter (DM) mass is higher than the maximal temperature of the thermal bath, DM can produced via the freeze-in mechanism with coupling as high as O(1). This leads to an observationally attractive scenario compared to the standard freeze-in couplings that are O(10ˆ−10). In fact, it can be probed by direct detection experiments and at LHC.
We display this mechanism in the scalar DM case. We then present a UV-completed framework where the maximal SM temperature coincides with or is approximately the reheating temperature. We exemplify this in the case of the inflaton primarily decaying into feebly interacting right-handed neutrinos.

Presenter: COSTA, Francesco