MORSELLI *

Dark Matter Signals in the gamma-ray sky

Detection of gamma rays and cosmic rays from the annihilation or decay of dark matter particles is a promising method for identifying dark matter, understanding its intrinsic properties, and mapping its distribution in the universe. I will review recent results from the Fermi Gamma-ray Space Telescope and other space-based experiments, and highlight the constraints these currently place on particle dark matter models. I will also discuss the prospects for indirect searches to robustly identify or exclude a dark matter signal using upcoming data.

MUNOZ *

Dark Matter constraints from Fermi-LAT inner galaxy measurements

We derive stringent constraints on parameters of generic dark matter candidates in the likely case that the collapse of baryons to the Galactic Center is accompanied by the contraction of the dark matter. By comparing theoretical predictions with the gamma-ray emission observed by the Fermi-LAT from the region around the Galactic Center, we find that for $b\bar b$, $\tau^+\tau^-$ and W^+W^- annihilation channels, the upper limits on the annihilation cross section imply that the thermal cross section is excluded for a dark matter mass smaller than about 1.8, 0.8 and 1.4 TeV, respectively. For the $\mu^+ \mu^-$ channel, where the effect of the inverse Compton scattering is important, depending on models of the Galactic magnetic field the exclusion of the thermal cross-section is for a mass smaller than about 0.3 to 1 TeV. Our analysis is conservative since it simply requires that the expecteddark matter signal does not exceed the observed gamma-ray emission by the Fermi-LAT in a region around the Galactic Center. The upper limits on the annihilation cross section of dark matter particles obtained are two orders of magnitude stronger than without contraction.

Csaba Balazs *

Dark matter, Higgs boson and supergravity

Dark matter can be an admixture of neutralinos, axions, and axinos in a Peccei-Quinn extension of supergravity. To assess the viability of these Peccei-Quinn extensions of minimal supergravity we perform a Bayesian analysis on three such scenarios. The main experimental constraints on these models come from the properties of the currently observed Higgs boson at the Large Hadron Collider and from the implications of the Wilkinson Microwave Anisotropy Probe 9 year observations on the dark matter abundance. Our comparative study reveals that under these (and various other astrophysical, collider and low energy) constraints the Peccei-Quinn violating scenarios with axino dark matter are clearly preferred over the minimal supergravity model where the lightest neutralino is the dark matter candidate.

EVOLI

Unveiling the nature of Dark Matter from the high-redshift Universe

The nature of dark matter (DM) is one of the crucial open questions in cosmology. DM constitutes 85 per cent of all the matter in the Universe. More importantly, we know today that DM cannot be made of ordinary matter, so particles outside the standard model of particle physics must exist. The most popular candidates as DM particles are: Cold Dark Matter (CDM) in the form of weak interacting massive particles (WIMPs) with particle mass 10-1000 GeV and Warm Dark Matter (WDM) with particle mass ~keV. In the context of structure formation, the difference between the CDM and the WDM scenario is represented by the minimum halo size can be formed. A potential crucial test for DM searches is looking for departure from standard reionization history in the early universe due to DM annihilation or decay. To this end it has been proposed to derive the properties of DM by using the modifications on the CMB power-spectrum induced by secondary particles ionizations. Recently, the PLANCK collaboration released extremely precise measurements of the CMB temperature power-spectrum and, although no evidence of DM induced re-ionization has been detected, stringent constraints on light DM annihilation candidates have been set. In the near future, observations of the redshifted

21cm line of neutral hydrogen with upcoming radio telescopes promise to transform our understanding of the early Universe. This cosmological probe will be particularly relevant in unveiling the nature of DM. In fact, the fluctuations in 21 cm intensity (or fluctuations of brightness temperature) are expected to trace the thermal and ionization history of the IGM and the secondary particles produced by DM annihilation or decay can dramatically modify the temperature evolution. Finally, this signal is very sensitive to the small-scale power spectrum of structures, and it will be possible to discriminate between WDM and CDM cosmologies.

In my talk I will review the results obtained by using recent CMB data to constrain popular DM models and I will show how near-future observations of the cosmological 21cm might be the "smoking-gun" evidence for DM as beyond the SM particle.

Taylor

Direct Shear Mapping: using IFU data to measure weak gravitational lensing

We have developed a new way of studying galaxy-scale dark matter concentrations, by using IFU data of a background source. Numerical experiments with synthetic data suggest that our technique is exquisitely sensitive - in principle, we believe that we can measure shear to a precision of better than 0.005 using a single background galaxy. I will present our first test case, in which we have a ~8sigma shear detection from a single log M* ~ 10 galaxy at z ~ 0.05. I will also describe our plans to explore this technique further using the SAMI IFU galaxy survey.

Spaans

A topological extension of GR: Black holes induce dark energy

General Relativity is extended into the quantum domain. The presented arguments are inspired by Feynman''s path integral for superposition and Wheeler''s quantum foam of mini black holes/wormholes. Paths are fundamental and prime 3-manifolds like T^3, S^1\times S^2 and S^3 are used to construct quantum space-time. It is found that the dark energy density depends linearly on the number of macroscopic black holes in the universe and is time dependent in a manner consistent with current astrophysical observations, having an equation of state w~-1.1 for redshifts smaller than unity.

ExiriFard

Local test of MOND in the Solar system

Modified theories of gravities aim to resolve the missing mass problem change the dynamics of the space-time geometry in the solar gravitational saddle points. I show how this change can be observed through measuring the local frame dragging, the behavior of gravity in short distances and the ring resonators/interferometers. Measuring any of these effects within the solar MOND windows shall provide the first direct experimental constraints on the dynamics of the space-time geometry with very low gravitational field, proving or refuting the MOND or dark matter paradigms.

Gondolo

Halo-independent analysis of direct detection data

We will present a halo-independent method to analyze direct dark matter searches including an arbitrary energy dependence in the form factors, experimental energy resolutions, acceptances, and efficiencies with arbitrary energy depen- dence. energy resolution and efficiency. Then I will show the result of applying this method to the measurements and upper limits on the direct detection of low mass (~10 GeV) weakly interacting massive particles.

Meehan

Dark Matter relic abundance in non-standard cosmologies

Dark matter (DM) relic abundance calculations are extremely sensitive to the conditions of the very early universe and therefore provide an excellent probe of physics before Big-Bang Nucleosynthesis (BBN) which is not otherwise accessible. In this work we consider a number of alternate cosmological scenarios in which the pre-BBN expansion rate is modified from the standard expansion history, thereby leading to enhanced relic abundance predictions. Calculations are performed for a range of DM annihilation expressions and the results are compared to the latest astronomical datasets in order to evaluate the viability of each scenario.

Gammaldi

Indirect search of heavy WIMPs

We have studied the spectral features of the HESS J1745-290 gamma ray source as possible dark matter signal. The early model independent study of this source has also been extended to the particular case of branon dark matter, where W+W; and Z+Z; appear as preferred DM annihilation channel into Standard Model particles. Next works will be addressed to test such dark matter origin, both in a model dependent and independent way. The heavy dark matter that may originate this signal could be detected by other indirect detection experiments, not only with photons, but also with neutrinos and antimatter. In this sense, new analyses for Antares, IceCube or AMS are necessary.

Fatizza

An exact Jacobi map in the Geodetic Light-Cone Gauge

The remarkable properties of the recently proposed Geodetic Light-Cone (GLC) gaugeallow to derive an explicit and exact expression for the Jacobi map connecting a geodetic remarkable properties of the recently proposed Geodetic Light-Cone (GLC) gaugeallow to derive an explicit and exact expression for the Jacobi map connecting a geodetic source to a geodetic observer in a generic space time. In the GLC gauge the exact Jacobi map factorizes as the product of a local quantity at the source times one at the observer.

Futamase

Weak lensing detection of DM subhalos in Coma cluster

We have detected 32 DM subhalos down to the order of 10^{-3} of the virial mass by weak lensing observation using Subaru and constrructed DM mass funnction in the two order of magnitude in mass. The result is consisitent with CDM prediction.

Tytgat

Significant Bremsstrahlung from the Vector-Like Portal

There has been recently much interest on dark matter candidates that may give rise to observable gamma-ray spectral features, like a gamma-ray line. In this talk we discuss a very simple model, based on a real scalar dark matter candidate that interacts with Standard Model fermions through heavy vector-like fermions (a scenario which has been dubbed the Vector-Like Portal). We show that the annihilation of dark matter into light fermions is d-wave suppressed while radiative corrections, in particular internal Bremsstrahlhung, are enhanced. For the sake of comparison, we confront this scenario to the familiar case of a Majorana singlet annihilating into light lepton-antilepton pairs, and show that the virtual internal bremsstrahlung signal may be enhanced by a factor of (up to) two orders of magnitude, thus potentially leading to significant gamma-ray features. We discuss the phenomenological implications of this scenario and its possible extensions.

Hambye

Effective Theory of DM decay into gamma-ray lines.

We construct this effective theory, show it contains only a few operators, show that gauge invariance implies interesting constraints from associated cosmic ray emission (upper bounds on these lines).

Kusmartsev

Origin of Cosmological Constant

Within conventional big bang cosmology, we model dark-energy via an axion scalar-field, embedded within a low-dimensional universe. An average vacuum energy associated with the quantum fluctuations of all other existing quantum fields, which are associated with all energy scales, is considered. Exact analytical and numerical solutions of the corresponding Einstein equations have been found. We also show that there may arise an effect of screening, presenting an effective cosmological constant, more comparable to that small value observed in recent experiments. The compensation arises due to a special character of the axion scalar field fluctuations which is driven by some arbitrary potential. This is found to counteract to the other fields contributions analogous to an elasticity of the spatial domain, thus providing a compensation of the total overall accelleration of the global expansion.

Kersten

Dark Radiation from Particle Decay

We study particle decay as the origin of dark radiation. After elaborating general properties of the scenario we provide model-independent constraints from structure formation, primordial nucleosynthesis and the cosmic microwave background. If there are two dark decay modes, dark radiation and the observed dark matter with adjustable free-streaming can originate from the same decay, solving the missing satellite problem. Our results can be used as a guideline for model building.

Kumar

Unimodular Constraint on global scale Invariance

We study global scale invariance along with the unimodular gravity in the vacuum. The global scale invariant gravitational action which follows the unimodular general coordinate transformations is considered without invoking any scalar field. The possible solutions for the gravitational potential under static linear field approximation are discussed.
The new modified solution has additional corrections to the Schwarzschild solution which describe the galactic rotational curve. A comparative study

of unimodular theory with conformal theory is also presented. Furthermore, the cosmological solution is studied and it is shown that the unimodular constraint preserve the de Sitter solution explaining the dark energy of the universe.

Saridakis

f(T) Gravity and Cosmology

Torsion has been proved to be crucial in gauging gravity, which is in turn a necessary step towards its quantization. On the other hand, almost all the efforts in modifying gravity has been performed in the usual curvature-based framework. We investigate the case where one modifies gravity based on its simplest torsional-teleparallel formulation, namely the f(T) gravity paradigm, and its cosmological applications. In particular, we analyze the perturbations of the theory examining the growth history, we construct a cosmological bounce, and we use solar system observations in order to impose constraints on the f(T) forms. Additionally, we study the case where T is nonminimally coupled to a scalar field, that is the scenario of “teleparallel dark energy”. Finally we analyze the charged black hole solutions of the theory, performing a comparison between f(R) and f(T) modifications.

Golovnev

On gravitational collapse in MOND

I will discuss the perspectives of embedding the MOND paradigm into a full cosmological theory. The gravitational collapse in MOND has some peculiar features. And there might be severe problems with describing a hierarchy of collapsing structures. I will explain some problems which should be addressed.

Urbanowski

False vacuum as a quantum unstable state: possible implications for cosmology

Calculations performed within the Standard Model suggest that the electroweak vacuum is unstable if $M_{H} < 126 $ GeV, (M_{H} is the mass of the Higgs particle). LHC discovery of the Higgs boson indicates that $M_{H} \simeq 125$ GeV. So the vacuum in our Universe may be unstable. the vacuum in our Universe may be unstable. We analyze properties of unstable vacuum states from the point of view of the quantum theory. We try also to explain why the universe with the unstable vacuum needs not to decay: It appears that some of false (unstable) vacuum states may survive up to times when their survival probability has a non-exponential form. At asymptotically late times the survival probability as a function of time t has aninverse power--like form. We show that at this time region the energy of the false vacuum states tends to the energy of the true vacuum state as $1/t^{2}$ for $t \to \infty$. This means that the energy density in the unstable vacuum state should have analogous properties and hence the cosmological constant $\Lambda =\Lambda (t)$ too. So Λ in the Universe with the unstable vacuum should have a form of the sum of the "bare" cosmological constant and of the term of a type $1/t^{2}$:$\Lambda(t) \equiv \Lambda^{bare} + \frac{d}{t^{2}}$, (where Λ^{bare} is the cosmological constant for the Universe with the true vacuum).We analyze properties of unstable vacuum states from the point of view of the quantum theory. We try also to explain why the universe with the unstable vacuum needs not to decay: It appears that some of false (unstable) vacuum states may survive up to times when their survival probability has a non-exponential form. At asymptotically late times the survival probability as a function of time t has aninverse power--like form. We show that at this time region the energy of the false vacuum states tends to the energy of the true vacuum state as $1/t^{2}$ for $t \to \infty$. This means thatthe energy density in the unstable vacuum state should have analogous properties and hence the cosmological constant $\Lambda =\Lambda (t)$ too. So Λ in the Universe with the unstable vacuum should have a form of the sum of the "bare" cosmological constant and of the term of a type $1/t^{2}$:$\Lambda(t) \equiv \Lambda^{bare} + \frac{d}{t^{2}}$, (where Λ^{bare} is the cosmological constant for the Universe with the true vacuum).

CHOUDHURY

AN ACCURATE BOUND OF TENSOR-TO-SCALAR RATIO FROM SUB-PLANCKIAN MODELS OF INFLATION AFTER PLANCK

In this paper we will analyze generic predictions of an inflection-point model of inflation with Hubble-induced corrections and study them in light of the Planck data. Typically inflection-point models of inflation can occur below the Planck scale. The flexibility of the potential allows us to match the observed amplitude of the TT-power spectrum of the cosmic microwave background radiation with low and high multipoles, spectral tilt, and virtually mild running of the spectral tilt, which can put a bound on an upper limit on the tensor-to-scalar ratio, r ≤ 0.12. Since the inflaton within MSSM carries the Standard Model charges, therefore it is the minimal model of inflation beyond the Standard Model which can reheat the universe with the right thermal degrees of freedom without any dark-radiation. we ALSO provide an accurate bound on tensor-to-scalar ratio (r) for class of models where inflation always occurs below the Planck scale, and the field displacement during inflation remains sub-Planckian.

Gomez Vargas

Constraints on WIMP Annihilation for Contracted Dark Matter in the Inner Galaxy with the Fermi-LAT

We derive constraints on parameters of generic dark matter candidates by comparing theoretical predictions with the gamma-ray emission observed by the Fermi-LAT from the region around the Galactic Center. Our analysis is conservative since it simply requires that the expected dark matter signal does not exceed the observed emission. The constraints obtained in the likely case that the collapse of baryons to the Galactic Center is accompanied by the contraction of the dark matter are strong.

Bonometto

Strongly coupled Dark Energy cosmologies

Quite a number of authors showed that cosmologies allowing a flux of energy from CDM to DE ease the coincidence problem. They require a CDM-DE coupling, which causes slight spectral distortions, possibly compensating those due to neutrino mass. Fits to data set limits on the allowed coupling. A much higher CDM-DE coupling seems however possible, if 2 kinds of DM exists, so also easing the so--called CDM crisis. Above a suitable threshold, a tracker solution exists, allowing primeval CDM and DE to dilute as a^4, in parallel to radiation, so constituting a fixed portion of cosmic materials, possibly since inflation. The supposed derelativization of a further WDM component breaks this pseudo scale-invariance, and then the background component naturally evolve towards present day proportions. These results, illustrated by Bonometto et al (JCAP08,2012,015), are implemented by the analysis of fluctuation modes.

Borgani

Aiding cluster cosmology with simulations

In my talk I will first briefly overview the recent advances in the application of galaxy clusters as cosmological tools, as driven by the increasing quality of observational data, and by the much improved description of clusters through detailed numerical simulations. I will present recent results on the analysis of such simulations aimed at calibrating clusters as precision tools for cosmology. In this context, I will discuss possible biases that affect mass estimates based on X-ray, weak lensing and dynamical analyses.

Gaggero

Dimensional models of CR propagation

We present a major update of DRAGON, a numerical package that computes CR transport in the Galactic interstellar medium taking into account most relevant processes including diffusion, spallation, reacceleration, convection, energy losses. The code is now three dimensional; moreover, fully anisotropic diffusion is implemented so the user is free to implement an arbitraty positrion and rigidity dependent parallel and perpendicular diffusion coefficient with respect to a 3D regular magnetic field model. We also discuss some remarkable new results obtained with the code. We implemented the spiral arm structure and found that it is possible to reproduce the recently released AMS data on hadrons and leptons with a reasonable electron injection index for the primary component, compatible with shock acceleration theory; the enhanced energy losses due to the fact that the Sun is located in an interarm region produces a noticeable steepening in the electron spectrum that leaves room for the extra component needeed to fit the rising positron fraction. We also present preliminary results obtained with anisotropic diffusion and in particular a 3D update of our phenomenological model that solves both the anisotropy and gradient problem of CRs at the same time taking into account position-dependent diffusion coefficient.

Geoffrey Beck

Axionic Dark Matter as an Astrophysical Probe

Axion-like particles (ALPs) remain a strong candidate for a component of dark matter. Chiefly due to their ubiquity in both high-energy theories and in extensions of the standard model. Additionally, ALPs exhibit the ability to mix with photons in the presence of an electromagnetic field. This process could manifest as an imprint on the spectra of cosmic high-energy sources or in the depolarisation of polarised beams propagating through cosmic magnetic fields. Thus, this mixing provides a strong avenue of potential observation of axionic dark matter and may also contribute to phenomena such as the unexplained transparency of the universe to high-energy photons. Moreover, there are interesting analogies between the mixing process and Compton scattering phenomena, as will be demonstrated. Furthermore, the mixing gives rise to ``non-conversion" energies, where photons entering the magnetic field with these energies leave as photons only. This raise the possibility of using ALP-photon mixing as a method of probing for astrophysical information about the structure of the magnetic field, when used in conjunction with high-energy ALP constraints. Or, when used in conjunction with radio observation data about the field in question, such energies may supply additional information about the ALP mass and coupling.

Maio

The birth of the first tiny objects

Results from high-resolution numerical, hydrodynamical, chemistry simulations of the formation of the first generation of proto-galaxies will be presented. The transition from the primordial metal-free popIII regime to the following enriched popII one and its consequences on the re-ionization process will be discussed. Implications for cosmic metal pollution, molecular-driven star formation, high-z luminosity functions, extremely metal-poor gas in the 1st Gyr, and for expected properties of GRB host galaxies will be addressed.

Mychelkin

Dark Energy as Antiscalar Field

The antiscalar approach to gravity (where complete energy-momentum tensor of the fundamental scalar field (FSF) enters the Einstein equations with the sign opposite to that of the ordinary matter) arises from the requirements of thermodynamic stability, as well as of conformity to experiments. This approach follows from the analysis of space-time deformation tensor and the known Papapetrou ansatz according to which the realistic metric tensor field is induced by the FSF. Such FSF might be identified in stationary regime as a neutral superposition of quasi-static electric (electro-vacuum) fields which, following Schwinger, are supposed to have their own carriers with the negative square of mass within the Hubble mass-scale. Such really existing, rather than hypothetical, field is identified with dark energy (DE). All other fields and particles (except gravity itself) might, in principle, be represented as special states of the FSF. The systems of the Einstein equations with only antiscalar FSF might represent DE-filled proto-universes (the Szekeres-type solutions) capable of producing the primordial scalar-type dark matter.

Supratik Pal

The next generation CMB features

In this talk I will discuss certain important features of Cosmic Microwave Background (CMB) Radiation and their possible reflection on forthcoming CMB observations. To this end, I will focus on some aspects of weak lensing in CMB and provide a method to extract the unlensed temperature and polarization power spectra from the observed (lensed) ones which will also give a sketch of how to obtain the intrinsic B-mode power spectra. I also plan to discuss primordial non Gaussian features in CMB and primordial magnetic field to some extent.

Pyungwon Ko *

Generic aspects of Higgs portal DM and Higgs phenomenology

I discuss Higgs portal DMs (scalar, fermion and vector DM) within renormalizable models and respecting the full SM gauge symmetry, not just the unbroken part of it, and compare with the models based on the effective Lagrangian approaches respecting the unbroken subgroup of the SM gauge group. And then I describe the Higgs phenomenology within the Higgs portal DMs and demonstrate that the future LHC data can test this scenario.

Minamitsuji

Degravitation features in the cascading gravity model

We obtain the e#ective gravitational equations on the codimension-2 and codimension-1 branes in the cascading gravity model. We then apply our formulation to the cosmological case and obtain the effective Friedmann equations on the codimension-2 brane, which are generically given in terms of integro-differential equations. Adopting an approximation for which the thickness of the codimension-2 brane is much smaller than the Hubble horizon, we study the de Sitter codimension-2 brane solutions. Studying the cosmological solutions shows that the cascading model exhibits the features necessary for degravitation of the cosmological constant.

Makukov

Tachyon Neutrinos Conglomerate as Dark Matter

Both tachyonic (primordial) and bradyonic (secondary) neutrinos exist, then the question arises concerning the underlying symmetries. It might be shown that certain velocity inversions produce three separate Lorentz-type groups: bradyonic, tachyonic and Euclidian. Particles and fields in separate sectors of this ▪grouppoid ▪ appear as mutually sterile. The helicity conservation of massive neutrinos naturally puts them into tachyon sector with Dirac-conjugated wave functions replaced with Hermitian-conjugated ones. Then mass-term is defined separately for neutrinos and antineutrinos. As a result, superposition of the squares of free tachyon spinor neutrino and antineutrino fields might be represented as scalar-type conglomerate with negative square of mass in the Einstein and Klein-Gordon equations, which might naturally explain the dark matter (DM) phenomenon. In stationary approximation the primary sterile tachyon neutrino DM background is described with nonlocal gravitational interaction. Then DM accumulated at scales of galaxies and clusters might behave as a stable isothermal medium. If one also considers the primordial ▪hot ▪ universe, then inevitably arising radial beams of tachyon neutrinos and antineutrinos collide in the central domain of super-strong gravitational field and are reprocessed into vector bosons and leptons, with the subsequent evolution of the Universe close to the standard scenario.

Rovira

Accurate Theoretical Density Profile and Mass Function of CDM Haloes

Using consistency arguments only, we determine the one-to-one correspondence between virialized halos with mass M at a time t and their seeds, namely peaks with a given density contrast at a filtering scale. This allows us to fix a new formalism for the exact derivation of the mass function and typical spherically averaged density profiles (among other properties) of haloes formed from triaxal peaks in the primordial linear densitiy field, taking into account, in an exact fashion, their ellipsoidal collapse and virialisation. The predictions of this rigurous formalism, including no single free parameter, are in full agreement with the results of numerical simulations.

Chechin

Some New Astronomical Consequences of the Dark Matter Conception

For discovering the global properties of scalar fields that can describe the observable characteristics of dark matter on the cosmological space and time scales, we propose the simplest form of central symmetric potential celestial â mechanical type. It was shown that this potential allows get rather satisfactorily dark matter profiles and rotational curves lines for dwarf galaxies. The good agreement with some previous results based on the N-body simulation method, was pointed out also. The light rays propagation is searched in the gravitational lens described both by dark matter as well as baryonic matter. We focused on the case when contributions on the gravitational lensing of these components are comparable each other. It was shown that positions of images of lensing object depend on profiles of dark matter and baryonic matter. The Cherenkov radiation in a galaxys halo of dark matter, described by profiles of Navarro-Frenk-White and Burkert was searched also. It was shown that correspondent radiation temperature in the X-rays diapason have the the preferable dark matter density distribution in a galaxy.

Qaisar Shafi *

Will Planck Observe Gravity Waves?

Mesinger

Probing dark mater with the cosmological 21cm signal

We have entered an exciting new era of radio observations of the early Universe. The redshifted 21cm line of neutral hydrogen will unveil a wealth of information about the Dark Ages and the Cosmic Dawn. First generation interferometers and all-sky instruments are already taking data, while the upcoming Square Kilometre Array promises orders of magnitude improvement on the sensitivity. I will discuss how these powerful observations can robustly probe the nature of dark matter, using (i) the astrophysically "clean" epochs, where the signal probes the mater fluctuations directly; (ii) the abundance of early galaxies, which is very sensitive to warm dark matter models; and (iii) the heating of the IGM through DM annihilations and WDM decay. I will show how astrophysical degeneracies can be overcome by studying the gradient of the global signal, and the power spectrum of fluctuations in the pre-reionization epoch.

Shaaban Khalil *

Warm Dark Matter in B-L extension of the standard model with inverse seesaw.

We show that a standard model gauge singlet fermion field, with mass of order keV or larger, and involved in the inverse seesaw mechanism of light neutrino mass generation, can be a good warm dark matter candidate. Our framework is based on B-L extension of the Standard Model and the construction ensures the absence of any mixing between active neutrinos and the aforementioned dark matter field. This circumvents the usual constraints on the mass of warm dark matter imposed from X-rays. We show that over-abundance of thermally produced warm dark matter can be reduced to an acceptable range in the presence of a moduli field decaying into radiation --- though only when the reheating temperature is low enough. Our warm dark matter candidate can also be produced non-thermally, directly from the decay of the moduli field during reheating. In this case, obtaining the right amount of relic abundance of our dark matter candidate, while keeping the reheating temperature high enough as to be consistent with Big Bang nuceosynthesis bounds, places constraints on the branching ratio for the decay of the moduli field into dark matter.

Lineros

Probing interactions within the dark matter sector via extra radiation contributions

Despite the observational evidences of Dark Matter its nature is still dark. Theoretical realizations assume that dark matter is stable and is the lightest state within the dark sector (e.g. WIMPs). The dark sector can also contain light states like dark bosons and fermions. However, those can be completely disconnected from the visible sector except by interaction with the dark matter. We focus our attention on these very-light dark particles and their contribution to the radiation budget of the Universe as dark radiation. We provide constraints on how large the dark matter sector can be depending on the dark matter freeze-out temperature and on the number of dark particles.

Fuertes

Canonical Halo Mass Definition and Universal Mass Function

We derive the mass function (MF) of haloes in cold dark matter cosmologies from the number density of non-nested peaks in the primordial Gaussian random density field, taking into account their exact ellipsoidal collapse and virialisation. The derivation is so accurate that the resulting MF depends on the specific halo massdefinition adopted. For FOF masses with linking length b equal to 0.2 and SO masses with overdensity equal to the virial value $\Delta\vir$, the multiplicity functions obtained are very similar and approximately universal, accurately matching those found insimulations for identical halo masses. We show that the ultimatereason for these results is the inside-out growth of accretinghaloes. A practical, physically motivated, analytic expression forthis universal MF is provided which is valid inside as well as outside the halo mass range analysed in simulations.

Narimani

Minimal Parameterizations of modified gravity

Parameterizing modified gravity models facilitates the systematic testing of the predictions of GR, and gives a framework for detecting possible deviations from it. Several different parameterizations have already been suggested, some linked to classifications of theories, and others more empirically motivated. Here I describe a particular new approach which casts modifications to gravity through two free functions of time and scale,

which are directly linked to the field equations, but also easy to confront with observational data. I compare our approach with other existing methods of parameterizing modied gravity, specifically the parameterized post-Friedmann approach and the older method using the parameter set $\{\mu,\gamma\}$. I explain the connection between our parameters and the physics that is most important for generating cosmic microwave background anisotropies. Some qualitative features of this new parameterization, and therefore modifications to the gravitational equations of motion, are illustrated in a toy model.

Wild

Prospects of antideuteron detection from Dark Matter annihilations or decays at AMS-02 and GAPS

The search for cosmic antideuterons has been proposed as a promising method to indirectly detect Dark Matter, due to the very small background flux from spallations expected at the energies relevant to experiments. In this talk we first of all discuss the validity of the commonly used coalescence model for antideuteron production with the result of some previously unknown challenges. Furthermore we consider the fact that the antideuteron flux from Dark Matter annihilations or decays is severely constrained by the non-observation of an excess in the antiproton-to-proton fraction measured by PAMELA. We discuss, for various Dark Matter annihilation and decay channels, the prospects to observe a signal at AMS-02 and GAPS from requiring that the associated antiproton flux is in agreement with the PAMELA data.

Yaguna

Models of dark matter and neutrino masses

A list of particle physics models at the TeV-scale that are compatible with neutrino masses and dark matter are provided. In these models, the Standard Model particle content is extended with a small number (\leq 4) of scalar and fermion fields transforming as singlets, doublets or triplets under SU(2), and neutrino masses are generated radiatively via 1-loop diagrams. The dark matter candidates are stabilized by a Z_2 symmetry and are in general mixtures of the neutral components of such new multiplets. We describe the particle content of each of these models and determine the conditions under which they are consistent with current data. We find a total of 35 viable models, most of which have not been previously studied in the literature. There is a great potential to test these models at the LHC not only due to the TeV-scale masses of the new fields but also because about half of the viable models contain particles with exotic electric charges, which give rise to background-free signals. These results should serve as a first step for detailed analysis of models that can simultaneously account for dark matter and neutrino masses.

Dunsby *

Shining light on the nature of f(R) dark energy

In this talk I will present a comprehensive survey of recent work done on f(R) theories of gravity and their astrophysical and cosmological consequences. Particular focus will be given to the perturbative and dynamical systems techniques used to unravel the fourth order nature of these theories and to shed light on the expansion history and evolution of large scale structure in the Universe, their imprint on the cosmic microwave background and the development of a scheme to investigate the production and features of gravitational waves generated by astrophysical sources. The comparison of these results with data coming from a range of cosmological surveys, together with future CMB and gravitational wave experiments will provide us with a much more detailed understanding of the nature of the gravitational interaction, as well as a possible explanation of the late time acceleration of the universe.

Cerezo

The importance of being warm (during inflation)

The amplitude of primordial curvature perturbations is enhanced when a radiation bath at a temperature T>H is sustained during inflation by dissipative particle production, which is particularly significant when a non-trivial statistical ensemble of inflaton fluctuations is also maintained. Since gravitational modes are oblivious to dissipative dynamics, this generically lowers the tensor-to-scalar ratio and yields a modified consistency relation for warm inflation, as well as changing the tilt of the scalar spectrum. We show that this alters the landscape of observationally allowed inflationary models, with for example the quartic chaotic potential being in very good agreement with the Planck results for nearly-thermal inflaton fluctuations, whilst essentially ruled out for an underlying vacuum state.

Kulkarni

Introducing SModelS with an application to light neutralino DM

I present a new automated tool, SModelS, to decompose generic Beyond the Standard Model particle spectra presenting a Z_2 symmetry into Simplified Model Spectrum (SMS) topologies and test them against the existing limits from LHC SUSY searches. As a show-case example, I then present an application of SModelS in a study of light neutralino dark matter in the MSSM (arXiv:1308.3735). I discuss the viability of light neutralino DM with mass below 35 GeV consistent with LHC bounds, Higgs search results as well as direct and indirect DM detection constraints will be discussed in detail. I further discuss the implications of these scenarios for future Higgs measurements at the LHC.

Hague

A Bayesian Method for Constraining Dark Matter Halo Profiles

The density profiles of dark matter haloes give and insight into the formation and evolutionary history of galaxies. We have developed a Markov Chain Monte Carlo (MCMC) method of constraining these profiles in a large parameter space that is more informative than fitting individual density profiles. We present the results of applying this method to kinematic data from the THINGS survey. We derive physical constraints on the evolution of a subset of the galaxies studied, that constraint their evolution from a presumed cosmological starting point.

Comelli

DM & EW corrections

We show the importance of the electroweak corrections for a correct evaluation of the final state spectra in DM annihilation/Decay, as soon as the mass M of DM particles is larger than the electroweak scale.

Garcia Cely

Novel Gamma-ray Spectral Features in the Inert Doublet Model

We show evidence for the existence of internal bremsstrahlung signatures in the Inert Doublet Model (IDM). In particular, we show they naturally arise in the high dark matter mass regime due to the near-degeneracy of the extra scalar masses. We calculate the corresponding annihilation cross-sections and compare them against constraints coming from direct and indirect dark matter searches. Finally we comment on the possibility of observing this feature with the H.E.S.S experiment."

De Zotti *

Self-regulated evolution of spheroidal galaxies and active nuclei

I will present recent results on the early evolution of galaxies and of their active nuclei in the framework of the self-regulated evolutionary scenario

Lopez Gehler

Constraining dark matter scenarios with gamma-ray boxes

The observation of a sharp spectral feature in the gamma-ray sky would be one of the cleanest ways to identify dark matter and pinpoint its properties. Besides gamma-ray lines and internal bremsstrahlung, gamma-ray boxes, which naturally arise in dark matter cascade processes, show competent constraining power. We make use of the Fermi-LAT and H.E.S.S. data to derive robust, model independent upper limits on the dark matter annihilation cross section scanning an extensive band of dark-matter masses from a few tenths of GeV up to multi-TeV masses. The gamma-ray output of axion-mediated dark matter develops naturally such a phenomenological behaviour, and produces a sizeable gamma-ray flux for thermal relics without fine-tuning the model parameters nor invoking boost factors of particle or astrophysical nature. This large output is in line with recent Fermi-LAT observations towards the galactic centre region and is on the verge of being excluded.Villaescusa-Navarro

Villaescusa-Navarro

Clustering properties in cosmologies with massive neutrinos

We have run a large set of N-body simulations with cold dark matter and massive/massless neutrinos to study the clustering properties of both dark matter haloes and galaxies. We investigate the impact of neutrino masses into the dark matter haloes bias. We populate the haloes with a simple HOD model to investigate whether galaxy clustering alone can be used to put constrains on the masses of the neutrinos. We show how halos should be populated with galaxies to reproduce the observations and how well those observations can be matched with the different cosmological models.

Farzan

Natural explanation for 130 GeV photon line within vector boson dark matter model

I present a dark matter model for explaining the observed 130 GeV photon line from the galaxy center. The dark matter candidate is a vector boson of mass m_V with a dimensionless coupling to the photon and Z boson. The model predicts a double line photon spectrum at energies equal to m_V and $m_V(1-m_Z^2/4m_V^2)$ originating from the dark matter annihilation. The same coupling leads to a mono-photon plus missing energy signal at the LHC. The entire perturbative parameter space can be probed by the 14 TeV LHC run. The model has also a good prospect of being probed by direct dark matter searches as well as the measurement of the rates of $h \to \gamma \gamma$ and $h \to Z \gamma$ at the LHC.

Zhou *

Implications of the recent AMS-02 results on dark matter annihilation and decay.

In light of the first release of high precision measurement on the cosmic-ray electrons and positrons by the AMS-02 experiment, we perform a detailed global analysis on the interpretation of the latest data of PAMELA, Fermi-LAT,and AMS-02 in terms of dark matter (DM) annihilation and decay, using the GALPROP code. The allowed regions for the DM particle mass and its annihilation cross section or decay life-time are obtained for channels with leptonic final states. We show that for DM annihilation into 2\mu (4\mu) final states, the AMS-02 data alone favour a DM particle mass ~460(900) GeV, which is significantly different from that favoured by the Fermi-LAT data on the total flux of electrons and positrons. The allowed regions by the two experiments are inconsistent with each other at high confidence levels, which is insensitive to the changes of the normalization and slope of the conventional astrophysical background. Consistent fits are obtained only for annihilation channels with 2\tau (4\tau) final states, which is constrained by the Fermi-LAT gamma-ray data. Possible solution such as charge asymmetric DM decay is discussed.

Ester Piedipalumbo

High Redshift Investigation On The Dark Energy Equation of State

The understanding of the accelerated expansion of the Universe poses oneof the most fundamental questions in physics and cosmology today. Whether or not the acceleration is driven by some form of dark energy, and in the absence of a well-based theory to interpret the observations, many models have been proposed to solve this problem, both in the context of General Relativity and alternative theories of gravity. Actually, a further possibility to investigate the nature of dark energy lies in measuring the dark energy equation of state   and its redshift dependence at high accuracy. However, since w(z) is not directly accessible to measurement, reconstruction methods are needed to extract it reliably fromobservations. Here we investigate different models of dark energy, described through several parametrizations of the EOS. Our high-redshift analysis is based on the Union2 Type Ia Supernovae data set, the Hubblediagram constructed from some Gamma Ray Bursts luminosity distance indicators, and Gaussian priors on the distance from the Baryon Acoustic Oscillations , and the Hubble constant h. To perform our statistical analysis and to explore the probability distributions of the EOS parameters we use the Markov Chain Monte Carlo Method. It turns out that the dark energy equation of state is evolving for all the parametrizations that we considered.

FRIGERIO MARTINS *

TBA