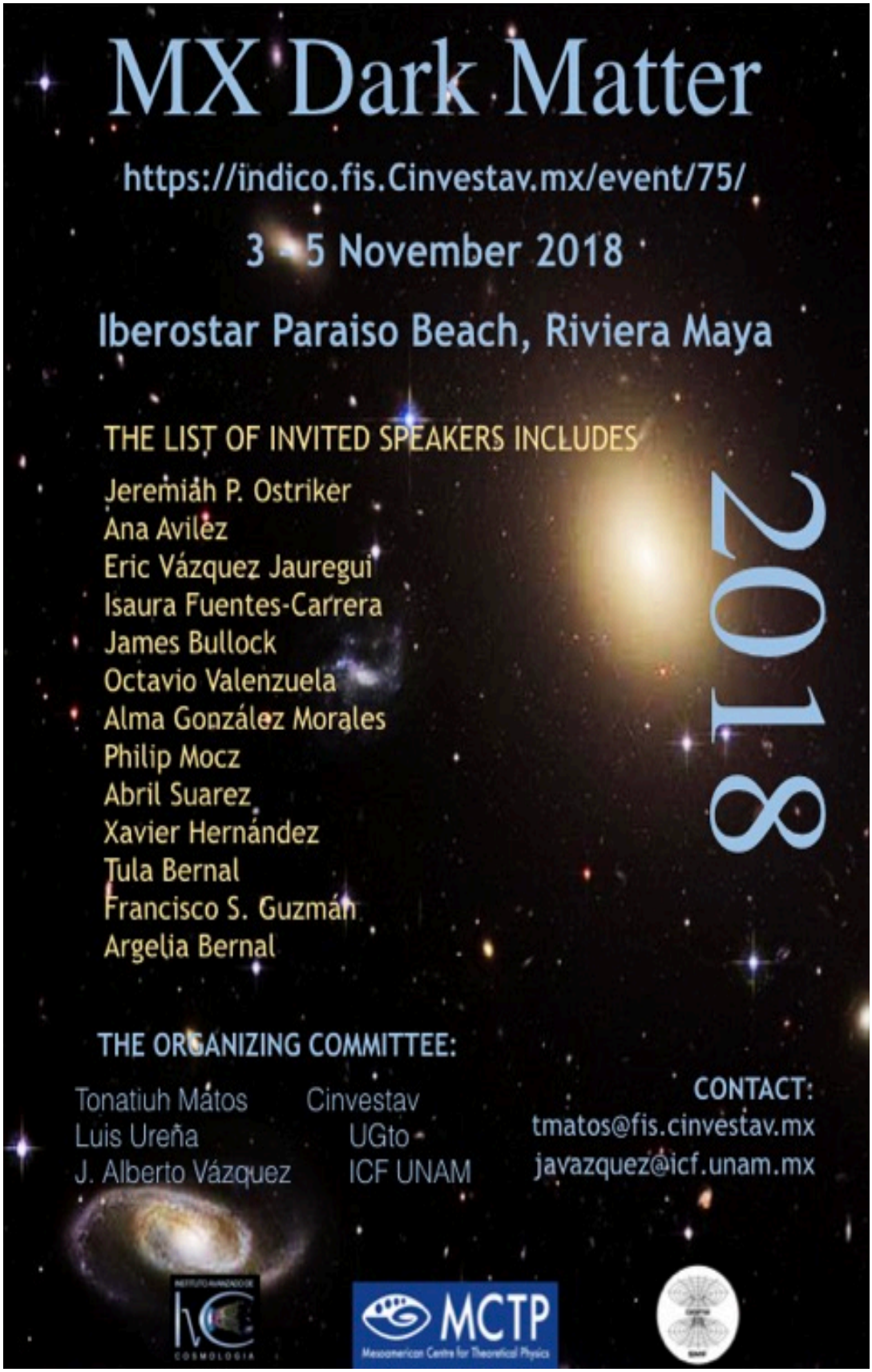
TITLES AND ABSTRACTS



Saturday

Octavio Valenzuela
Instituto de Astronomía, UNAM

Dynamical Friction Constrains on Dark Matter in Galaxies

Two of the most discussed issues regarding dark matter in galaxies are the core-cusp and also the abundance of low mass galaxies, triggering the exploration of different DM nature models.

In this talk I will review the status of dark matter halo structure constrains using dynamical friction and I will present new calculations on the subject. I will briefly show preliminary results of ongoing calculations of low mass halos on DM models with Power Spectrum suppression at small scales.

Sergio Mendoza
Instituto de Astronomía, UNAM

Astrophysical extensions of gravity motivated by Tully-Fisher scalings

Newtonian gravity and its relativistic extension, the general theory of relativity, are extremely well tested in our solar system. Both proposals were built with solar system dynamics provided in Kepler's laws for the motion of planets. When the scales of mass and length associated to a particular astrophysical system greatly exceed the solar system values in such a way that the gravitational acceleration on a given test particle is less or about 10^{-10} m /s^2, either non-baryonic dark matter is required or Kepler's third law of motion requires a modification (the Tully-Fisher law). In this talk I will discuss non-relativistic and relativistic developments for extending gravity based on the Tully-Fisher law, which in its simplest form yields the basic MOdified Newtonian Dynamics (MOND) formula. I will also show that this prescription has so far been adequate to explain dynamics of systems from scales to solar system up to galaxy clusters and the accelerated expansion of the universe. Also, I will explain how these ideas are in very good agreement with the deflection of light and gravitational lensing in individual, groups and clusters of galaxies.

Isaura Luisa Fuentes Carrera
Escuela Superior de Física y Matemáticas,
Instituto Politécnico Nacional

Dark matter haloes in interacting galaxies.

We present Halpha scanning Fabry-Perot observations of the several interacting galaxy pairs. The velocity field and rotation curve of the galaxies in each pair were derived. Together with HI observations, several mass models were adjusted in order to study the nature of the dark halo as well as the mass-to-light ratio of the galaxy. We find that in order to constrain these models, it is important to have a high resolution Halpha rotation curve for the inner parts of the galaxy, as well as information on the external parts.

James Bullock
University of California, Irvine

Simulating the Small-Scale implications of Alternative Dark Matter Models

Tula Bernal
Universidad Autónoma Chapingo

Dark matter and modified gravity in clusters of galaxies

Philip Mocz
Princeton University

Quantum Wave Dark Matter and the Classical Limit

In this talk we investigate the correspondence of between the quantum mechanical Schrodinger-Poisson equations for fuzzy dark matter which evolves a 3D complex wave function and the collisionless Vlasov-Poisson equations for classical cold dark matter, which evolves a 6D phase space distribution, in a cosmological context. The wavefunction captures rich phenomena such as multiple phase-sheets, shell-crossings, and velocity dispersions seen in classical simulations. Furthermore, the quantum potential acts as a regularizer of caustics and singularities in classical solutions (e.g. singular halo profiles, splashback radius discontinuities). Unlike the classical solution, the quantum wave solution is riddled with fluctuating interference patterns which have important astrophysical dynamical heating effects. In the limit hbar/m->0, we show classical solutions are recovered in the sense that the gravitational potential field converges as (hbar/m)^2, fast enough so that the dynamical effect of the interference patterns also vanishes in this limit, and the dynamics of baryons coupled to the dark matter approach that of cold dark matter.

Axel de la Macorra
Instituto de Física, UNAM

Cosmological properties of Bound Dark Matter (BDM)

We present a Dark Matter model, motivated by particle physics and gauge theories, where the DM is not a fundamental but a composite particle, similar as protons and neutrons. Its mass is due to the binding energy of the fundamental states. We study the cosmological properties of BDM and show that it naturally has a non trivial free streaming scale and a suppression of small scales compatible with current cosmological observations.

Eric Vazquez-Jauregui
Instituto de Física, UNAM

Current status of direct dark matter detection: experiments and future perspectives

Juan Barranco
División de Ciencias e Ingenierías,
Universidad de Guanajuato

Constraining light dark matter candidates with a astrophysical data

Astroparticle physics begins to expose the failure of the WIMP paradigm. New dark matter candidates with masses ranging from 10^-22 eV up to few MeV emerge as possible serious contenders to WIMP dark matter candidates. In this talk we use different astrophysical observations, i.e. rotation curves of galaxies, dispersion velocities of dwarf spheroidal galaxies, the UNION Supernova data, neutrino from supernovas, data from neutron Stars etc, that migh constraint properties and interactions of those light dark matter particle candidates.

Ashlea Kemp
Royal Holloway University of London

The potential to search for axion-like particles with the DEAP-3600 detector.

The DEAP-3600 detector is a single-phase liquid argon detector, hoping to observe WIMPs using the direct detection method. DEAP-3600 has extremely good sensitivity to WIMP interactions, as a result of the low radioactivity of the materials used to build the detector, the large target mass achieved by using liquid argon, and the very low background levels due to its location in the SNOLAB facility, 2km underground, shielding cosmic-ray muons that would interfere with the detection of WIMPs. However, is it possible to use this state of the art detector to search for other potential candidates for dark matter, such as axion-like particles or hidden photons? In this talk, the signature of these dark matter candidates will be discussed, as well as the potential sensitivity of DEAP-3600 to these particles and also the main challenges of conducting this search using DEAP-3600.

Sunday

Vladimir Avila-Reese
Instituto de Astronomía, UNAM

Constraints on the dark matter nature from cosmic structure formation

The concept of dark matter has emerged as the past century from astronomical studies, and today is a main component in the most accepted cosmological model, the so-called Lambda Cold Dark Matter (LCDM). From the point of view of cosmic structure formation, the ΛCDM model is the simplest one. In this model, there is not a relevant cutoff in the mass power spectrum of the perturbations, the DM particles have zero thermal velocities and are collisionless, without any self-interaction. Several astronomical studies at small scales suggest the necessity to explore the relaxation of these assumptions. I will briefly review some of the paths followed in this exploration and the emergence of alternative models to the CDM one, as Warm DM and Self-Interacting DM. I will discuss also on new ways to constrain galaxy evolution and the nature of the underlying cosmological model through the so-called semi-empirical approaches.

Xavier Hernández
Instituto de Astronomía, UNAM

On the presence of an acceleration scale in Astrophysics and Cosmology; A geometrical interpretation of a0 and Lambda

Alma Xochitl Gonzalez Morales
División de Ciencias e Ingenierías,
Universidad de Guanajuato

Unbiased constraints on ultralight axion mass from dwarf spheroidal galaxies

Analysis of the mock data reveals that the least-biased constraints on the axion mass result from fitting the luminosity-averaged velocity dispersion of the individual chemodynamical components directly. Applying our analysis to two dSph's with reported stellar subcomponents, Fornax and Sculptor, and assuming that the halo profile has not been acted on by baryons, yields core radii rc>1.5 kpc and rc>1.2 kpc respectively, and m_a < 0.4\times 10^{-22}\text{eV} at 97.5\% confidence.

Jeremiah P. Ostriker
Princeton University

Ultra-light scalars as cosmological dark matter

The nature of the primary constituent of cosmological dark matter remains unknown. The Cold Dark Matter ("CDM") paradigm fits all high redshift and all large- scale observations with accuracy, but on scales of several kpc or less the CDM model runs into difficulties, and direct detection of CDM particles has been without success. However, if the dark matter is comprised of ultra-light bosons with mass of roughly 10^{-22} eV and de-Broglie wavelength typically of order 1kpc, all large-scale phenomena are the same as with CDM, but small-scale problems are alleviated in this model, which is sometimes called Fuzzy Dark Matter ("FDM"). Low mass halos and galaxies are less abundant, alleviating the "two big to fail" galaxy problem and the absence of dark matter cusps is understood as well as other dynamical issues in low mass systems. Tests based on the Lyman-α forest and delayed high redshift galaxy formation will provide critical means to evaluate and test the FDM paradigm.

Ana Avilez
Facultad de Ciencias Físico Matemáticas
BUAP

Head-on Collisions of imperfect Ultralight Scalar Field configurations

In this talk I will present some results arising from numerical simulations of head-on collisions of ultralight scalar field binary configurations with axial symmetry arisen as dynamical solutions of the Schroedinger-Poisson system. The dynamics of initial configurations involving excited states and with different masses is studied. Considering these more general initial conditions gives rise to new features of the relaxation process via gravitational cooling and the attractor density profiles either in the regimes of solitonic and merger behavior.

Abril Suarez
Cinvestav

Cosmological and Astrophysical Constrains for the Ultra-light Complex Self-interacting SFDM

In this talk we discuss a number of important achievements and characteristics used in modeling in an alternative way the dark matter in the Universe: the scalar field/Bose-Einstein condensate dark matter model (or wave DM), which represents the wave function of a relativistic self-gravitating Bose-Einstein condensate. Since the scalar field has a nonzero Jeans length due to its quantum nature (Heisenberg uncertainty principle or quantum pressure due to the self-interaction of the bosons), it appears that its wave properties can stabilize gravitational collapse at small scales, providing halo cores and suppressing small-scale linear power. Constraints on the free parameters of the scalar field, obtained from astrophysical and cosmological observations are given. Numerical applications are made for ultralight bosons without self-interaction (fuzzy dark matter), for bosons with repulsive self-interaction and for bosons with attractive self-interaction (QCD axions). In light of the difficulties that the ΛCDM model is currently facing the SFDM model can be a worthy and exciting alternative to keep exploring further in the present dark matter quest.

Víctor Robles
University of California, Irvine

Scalar field dark matter Simulations

Luis Urena-Lopez
División de Ciencias e Ingenierías,
Universidad de Guanajuato

Scalar field dark matter: general considerations.

Francisco S. Guzmán
Instituto de Física y Matemáticas,
Universidad Michoacana de San Nicolás de Hidalgo

Local dynamics of ultralight Bose Einstein Condensate dark matter

The ultralight BEC dark matter model assumes the dark matter particle is a spinless boson with mass of order between 10^{-22}-10^{-23}eV/c^2. We assume the system that rules the evolution of this dark matter is the Gross-Pitaevskii-Poisson (GPP) set of equations. Based on the numerical solution of the GPP system at local scales, in this talk I present the dynamics of local configurations in different scenarios, the nature of equilibrium configurations of the GPP system, the stability against spherical and axial perturbations, their gravitational cooling as the only relaxation mechanism, their attractor properties, final states of initially rather arbitrary density profiles, rotating configurations and the impact on galactic rotation curves, the collision between two structures, the impact of the interference on the behavior of luminous matter in head-on encounters. Descriptions, tests and difficulties of the various numerical methods involved in these analyses are included.

Argelia Bernal
División de Ciencias e Ingenierías,
Universidad de Guanajuato

Some implications at central regions in galaxies of the scalar field dark matter model

Francisco Linares
División de Ciencias e Ingenierías,
Universidad de Guanajuato

Scalar Field Dark Matter with an Axion-like Potential: Cosmological Implications

In this talk we will see the cosmological evolution of a scalar field as dark matter. This scalar field is endowed with a trigonometric potential. Once the numerical solutions for both, the background and linear perturbation equations are obtained, we proceed to build up observables such as the anisotropies of the CMB and the Matter Power Spectrum, to compare our model with the LCDM case and scalar field with quadratic potential. Likelihoods from Planck collaboration are used to constraint the parameters of this model.