Journées Théorie PNHE

Rapport sur les contributions

https://indico.in2p3.fr/e/17144

ID de Contribution: **2** Type: **Non spécifié**

Probing dark matter around black holes at the centers of galaxies

mardi 2 octobre 2018 12:10 (20 minutes)

The dark matter (DM) distribution in the central regions of galaxies remains poorly constrained at present. In particular, DM density profiles may be significantly affected by the presence of central black holes, leading to the possible formation of density spikes. I will discuss different avenues that can shed light on the characteristics of the DM distribution in the cores of galaxies. On the one hand, I will focus on the vicinity of supermassive black holes in the central regions of the Milky-Way or giant galaxies such as M87 and Centaurus A, in light of experiments such as Fermi-LAT, H.E.S.S., and the Event Horizon Telescope. On the other hand, there is also growing evidence for intermediate-mass black holes in smaller objects like dwarf galaxies and globular clusters. I will present gamma-ray observations that provide us with information on the inner regions of these objects.

Auteur principal: Dr LACROIX, Thomas (Laboratoire Univers & Particules de Montpellier)

Orateur: Dr LACROIX, Thomas (Laboratoire Univers & Particules de Montpellier)

ID de Contribution: **3** Type: **Non spécifié**

Small-scale structuring of Galactic dark matter and impact on indirect searches

lundi 1 octobre 2018 14:45 (20 minutes)

Cold dark matter is known to structure on scales much smaller than typical galaxies. This structuring translates into a large population of subhalos in galactic halos that impact indirect dark matter searches by boosting the annihilation signal (gamma rays, antimatter cosmic rays). I will present the first model of the Galactic subhalo population fully consistent with dynamical constraints. The mass, concentration and spatial distributions of these objects are predicted from first principles and inherit from cosmological properties. I will detail the impact of this subhalo population on indirect searches with gamma rays and cosmic-ray antiprotons.

Auteurs principaux: STREF, Martin (LUPM); LAVALLE, Julien (Lab. Univers et Particules de Montpellier (LUPM))

Orateur: STREF, Martin (LUPM)

ID de Contribution: **4** Type: **Non spécifié**

Recent results with the USINE and CLUMPY codes

lundi 1 octobre 2018 17:25 (20 minutes)

USINE is a public code for Galactic Cosmic Ray propagation (first public release is V3.4, arXiv:1807.02968). This code can be used to interpret AMS-02 data, and I will show one example of its use (arXiv:1803.04686). CLUMPY is a public code for dark matter searches in the gamma-ray and neutrino channels (third release V3, arXiv:1806.08639). I will show one recent application of the code for the calculation of the extragalactic (dark matter-induced) gamma-ray signal (JCAP 02, 005, 2018).

Auteur principal: MAURIN, David (LPSC)

Orateur: MAURIN, David (LPSC)

ID de Contribution: **5** Type: **Non spécifié**

Transport de moment cinétique dans les novae naines

lundi 1 octobre 2018 12:20 (20 minutes)

Les novae naines sont des binaires compactes composées d'une étoile de type solaire et d'une naine blanche entourée d'un disque d'accrétion oscillant entre un état quiescent et un état éruptif. Les temps caractéristiques sur lesquels la luminosité du disque évolue permettent d'obtenir des contraintes sur la valeur de α, rapport du stress turbulent responsable du transport de moment cinétique sur la pression thermique. Dans l'état éruptif, on trouve une valeur de α de 0,1 comparé à 0,01 dans l'état quiescent. L'instabilité magnéto-rotationnelle (MRI) est le meilleur candidat à ce jour pour expliquer le transport de moment cinétique turbulent dans ces objets. Nous présenterons une étude numérique du transport dû à la MRI dans le régime des novae naines afin d'expliquer ces valeurs de α. Dans un premier temps, nous nous intéresserons uniquement au transport turbulent et montrerons que l'état quiescent, peu ionisé, pose problème pour l'application de la MRI. Dans un deuxième temps, nous présenterons les résultats de simulations MRI développant des vents magnéto-hydrodynamiques. Nous montrerons que le transport par le vent peut aisément dominer le transport turbulent dans des conditions réalistes de novae naines. L'impact de ce nouvel élément sur le modèle d'instabilité de disque et les courbes de lumière sera discuté.

Auteurs principaux: SCEPI, Nicolas (IPAG CNRS); DUBUS, Guillaume (IPAG); LESUR, Geoffroy (IPAG CNRS)

Orateur: SCEPI, Nicolas (IPAG CNRS)

ID de Contribution: **6** Type: **Non spécifié**

A unified accretion ejection paradigm for X-ray binaries

lundi 1 octobre 2018 12:00 (20 minutes)

The hysteresis behavior of X-ray binaries during their outbursts remains a mystery. In this work, we developed the paradigm proposed in Ferreira et al (2006) where the disk material accretes in two possible, mutually exclusive, ways. In the Standard Accretion Disk (hereafter SAD) mode, the dominant local torque is due to MHD turbulence that transports radially the disk angular momentum. In the Jet Emitting Disk (hereafter JED) mode, magnetically-driven jets carry away mass, energy and all the angular momentum from the disk. Within our framework, the transition from one mode to another is related to the magnetic field distribution, an unknown yet. As a first step, we used the transition radius as a free parameter and focused on accurately computing the spectral energy distributions from various disk configurations.

Using a two-temperature plasma code, we computed the thermal balance at each radius for a large ensemble of disk parameters, as well as the global emitted spectrum. The radiative cooling term and related spectrum (Comptonized Bremsstrahlung and Synchrotron emission) obtained using the BELM code (Belmont et al. 2008, 2009). Heating processes are analytical and due only to accretion (Petrucci et al. 2010). Advection is properly taken into account, carrying outside-in the memory of the outer thermal states.

It will be shown that Hard States can be quite nicely reproduced by dynamical configurations harboring an inner JED (Marcel et al. 2018a, A&A 615, A57). They radiate a power-law spectrum from 0.001 to >0.1 Eddington luminosities. On the contrary, Soft States require an inner SAD configuration, emitting a multicolour disk blackbody spectrum (Marcel et al. 2018b, A&A in press). We produced also a full theoretical Disk Fraction Luminosity Diagram that could be successfully compared to the 2010-2011 outburst of GX339-4, using both X-ray spectral shapes and radio observations (Marcel et al. 2018c,d to be submitted). This is, to our knowledge, the first time that such an accretion-ejection cycle is reproduced, using both accretion (X-rays) and ejection (radio) constraints. We will finally discuss the implications of our results on the physical evolution of XrBs.

Auteur principal: MARCEL, Grégoire (Institut de Planétologie et d'Astrophysique de Grenoble)

Co-auteurs: Prof. FERREIRA, Jonathan (IPAG/CNRS); PETRUCCI, pierre-olivier (IPAG); Dr CLAVEL, Maïca (IPAG/CNRS); RODRIGUEZ, Jerome (CEA - Paris Saclay / SAp); CORBEL, Stephane (University Paris Diderot & CEA Saclay); Dr CORIAT, Michael (IRAP/CNRS); Dr BELMONT, Renaud (IRAP/CNRS); MALZAC, Julien (IRAP); HENRI, Gilles (IPAG-Observatoire de Grenoble)

Orateur: MARCEL, Grégoire (Institut de Planétologie et d'Astrophysique de Grenoble)

ID de Contribution: **7** Type: **Non spécifié**

Ultra-high energy neutrinos from neutron-star mergers / Neutrinos de ultra-haute energie des fusions d'étoiles à neutrons

mardi 2 octobre 2018 17:05 (20 minutes)

English version :

In the context of the recent multi-messenger observation of neutron-star merger GW170817, we examine whether such objects could be sources of ultra-high energy astroparticles. At first order, the energetics and the population number is promising to envisage the production of a copious amount of high-energy particles, during the first minutes to weeks from the merger. In addition, the strong radiative and baryonic environment in the kilonova ejecta can be an important background causing energy losses for cosmic-ray nuclei and producing associated high-energy neutrino emissions. We model the evolution of the photon density and the baryonic density in the kilonova ejecta and calculate numerically the signatures in terms of ultra-high energy neutrinos.

Version française :

Dans le contexte recent de l'observation multi-messager de la fusion d'étoile à neutrons GW170817, nous étudions si de tels objets pourraient êtres à l'origine d'astroparticules de ultra-haute énergie. En premier lieu, le bilan énergétique et la population de ces événements sont prometteurs pour envisager la production d'un grand nombre de particules de haute énergie, durant les premières minutes, jusqu'au premières semaines après la fusion. De plus l'environnement radiatif et baryonique très intense au sein de l'ejecta de la kilonova peuvent causer d'importantes pertes énergétiques pour les rayons cosmiques lourds et ainsi produire des émissions neutrinos associées. Nous modélisons l'évolution de la densité de photons et de la densité baryonique dans l'éjecta de la kilonova et calculons numériquement les signatures en neutrinos de ultra-haute énergie.

Auteur principal: DECOENE, Valentin (Institut d'Astrophysique de Paris)

Co-auteurs: GUÉPIN, Claire (IAP); Dr FANG, Ke (University of Maryland); KOTERA, Kumiko (Institut d'Astrophysique de Paris); Dr METZGER, Brian D (Columbia University)

Orateur: DECOENE, Valentin (Institut d'Astrophysique de Paris)

ID de Contribution: **8** Type: **Non spécifié**

Neutron stars: macroscopic objects with quantum properties

mardi 2 octobre 2018 11:10 (20 minutes)

Within the last few years, the physics of compact objects has greatly benefited from terrestrial based and space telescopes. Among them, neutron stars predicted to be end products of stellar evolution remain badly understood. Moreover, pulsars form a peculiar class of neutron stars which emission remains enigmatic although discovered 50 years ago.

Magnetized neutron stars harbour gravitational fields that deviate strongly from the Newtonian weak field limit. Moreover they are believed to host strong electromagnetic fields anchored into the star and give rise to non-linear corrections to Maxwell equations described by quantum electrodynamics (QED). Magnetic field strengths close to or even above the critical value of B=4,4*10^9 T are suspected to sustain the electromagnetic activity of pulsars and magnetars. To account properly for emission emanating from the neutron star surface like for instance thermal radiation and its polarization properties, it is important to include general relativistic (GR) effects simultaneously with non-linear QED. This can be achieved through a 3+1 formalism known in general relativity and generalized to QED perturbations to Maxwell equations. Starting from the lowest order corrections to the Lagrangian for the electromagnetic field, as given for instance by Born-Infeld or Euler-Heisenberg theory, we derive the non-linear Maxwell equations in general relativity including quantum vacuum effects. We also derive a prescription for the force-free limit and show that these equations can be solved with classical finite volume methods for hyperbolic conservation laws. It is therefore straightforward to include general relativity and quantum electrodynamics in the description of neutron star magnetospheres by using standard classical numerical techniques borrowed from Maxwell and Newton theory. As an application, we show that spin-down luminosity corrections associated to QED compared to GR corrections.

Auteur principal: PÉTRI, Jérôme (Observatoire astronomique de Strasbourg)

Orateur: PÉTRI, Jérôme (Observatoire astronomique de Strasbourg)

ID de Contribution: **9** Type: **Non spécifié**

Dark Matter Accretion in Neutron Stars

mardi 2 octobre 2018 11:50 (20 minutes)

If DM interacts with nucleons and/or electrons it can be trapped by astrophysical objects such as the Sun or neutron stars. Elastic scattering of a DM particle with ordinary matter can in particular reduce the kinetic energy of the DM particle when it passes through these stars, such that its speed passes below the corresponding escape velocity. Once gravitationally trapped, DM undergoes further scatterings until it gets gravitationally confined inside the star and move towards the center. This possibility is interesting in many ways. For the Sun it is mostly interesting because it can leads to DM indirect detection signals in the form of a neutrino flux from DM annihilation. For a neutron star, DM accumulating in the center could form a dense core which could gravitationally collapse into a black hole. In this talk I will present how we have reconsidered in details neutron star DM accretion, incorporating a series of effects which had not been considered (or only partially incorporated) before. Among those, we have performed a proper calculation of the DM accretion rate, taking into account the highly degenerate nature of the neutron plasma in the neutron star combined with realistic neutron star profiles. Secondly, a new treatment of DM thermalization has let us investigate the time evolution of the DM cloud. Using these improvements, I will present our updated constraints on DM, from neutron stars collapsing into black holes.

Auteurs principaux: GÉNOLINI, Yoann (LAPTh); Dr GARANI, Raghuveer (ULB); HAMBYE, Thomas Hambye (Service de Physique Theorique, Universite Libre de Bruxelles)

Orateur: GÉNOLINI, Yoann (LAPTh)

ID de Contribution: **10** Type: **Non spécifié**

The influence of pair production upstream of relativistic collisionless shocks

mardi 2 octobre 2018 14:45 (20 minutes)

Among other powerful relativistic astrophysical objects, gamma-ray bursts, blazars and pulsar winds provide an ideal environment to understand the acceleration mechanisms of high-energy charged particles. The radiative spectra observed in such objects are generally attributed to particles energized in relativistic collisionless shock waves. In this presentation, we investigate the backreaction on the shock dynamics of pair production due to photon-photon collisions in the upstream region. Initially, the shock generates a distribution of Fermi-accelerated suprathermal particles, which progressively cool down through synchrotron emission in the downstream electromagnetic turbulence. The resulting high-energy photons propagate upstream of the shock at the speed of light, where they decay into electron-positron pairs via the Breit-Wheeler process. Through plasma micro-instabilities, those pairs cause the plasma to heat up and slow down. This modifies the shock jump conditions, up to a critical pair injection level where the shock eventually disappears. When this happens, the Fermi acceleration stops, and only a weakening radiation background fed by the leftover suprathermal particles remains in the upstream plasma. The pair injection rate then drops, thus allowing the shock to reform. The problem is investigated by use of analytical models describing the respective phases and by comparison with ab initio, large-cale kinetic simulations.

Auteurs principaux: VANTHIEGHEM, Arno (IAP); LEMOINE, Martin (IAP); GREMILLET, Laurent (CEA DAM)

Orateur: VANTHIEGHEM, Arno (IAP)

ID de Contribution: **12** Type: **Non spécifié**

Introduction

lundi 1 octobre 2018 10:30 (10 minutes)

Orateurs: DUBUS, Guillaume (IPAG); VERGANI, Susanna (CNRS-Observatoire de Paris)

ID de Contribution: **13** Type: **Non spécifié**

Le trou noir central de la Galaxie

lundi 1 octobre 2018 10:40 (30 minutes)

Orateur: VINCENT, Frédéric

ID de Contribution: **14** Type: **Non spécifié**

Exploring black hole spacetimes with SageManifolds

lundi 1 octobre 2018 11:10 (20 minutes)

Orateur: GOURGOULHON, Eric (LUTH, Observatoire de Paris)

ID de Contribution: **15** Type: **Non spécifié**

Quels mécanismes transportent la matière dans les disques d'accrétion ?

lundi 1 octobre 2018 11:30 (30 minutes)

Orateur: LASOTA, Jean-Pierre

ID de Contribution: **18** Type: **Non spécifié**

Turbulence et dynamo dans les noyaux actifs de galaxies

lundi 1 octobre 2018 12:40 (20 minutes)

Orateur: RIOLS-FONCLARE, Antoine (IPAG)

ID de Contribution: **20** Type: **Non spécifié**

Dark matter searches with gamma rays

lundi 1 octobre 2018 14:15 (30 minutes)

Orateur: CALORE, Francesca (LAPTh, CNRS)

ID de Contribution: **22** Type: **Non spécifié**

Voyager probing dark matter

lundi 1 octobre 2018 15:05 (20 minutes)

Orateur: BOUDAUD, Mathieu (LPTHE)

ID de Contribution: **23** Type: **Non spécifié**

Quo Vadis, Materia Nigra?

lundi 1 octobre 2018 15:25 (30 minutes)

Orateur: SERPICO, Pasquale Dario (LAPTh, Annecy-le-vieux)

ID de Contribution: **27** Type: **Non spécifié**

On the origin and composition of Galactic cosmic rays

lundi 1 octobre 2018 18:05 (20 minutes)

Orateur: PRANTZOS, Nikos (IAP Paris)

ID de Contribution: **28** Type: **Non spécifié**

Transport des rayons cosmiques dans la Galaxie

lundi 1 octobre 2018 16:55 (30 minutes)

Orateur: GABICI, Stefano (DIAS, Dublin)

ID de Contribution: **29** Type: **Non spécifié**

Numerical Observatory of Violent Accreting systems (NOVAs): a general relativistic tool to put GR(M)HD simulations to the test of high-energy observations

mardi 2 octobre 2018 09:00 (30 minutes)

Orateur: CASSE, Fabien (AstroParticule & cosmologie)

ID de Contribution: **30** Type: **Non spécifié**

Rotation and magnetic field effects on the stability of two-component jets

mardi 2 octobre 2018 09:30 (20 minutes)

Orateur: MELIANI, Zakaria

ID de Contribution: **31** Type: **Non spécifié**

Comptonisation et création de paires près de l'horizon d'un trou noir

mardi 2 octobre 2018 09:50 (20 minutes)

Orateur: LAURENT, Philippe (CEA/SAp & APC)

ID de Contribution: **32** Type: **Non spécifié**

L’équation d’état de la matière nucléaire

mardi 2 octobre 2018 10:10 (30 minutes)

Orateur: OERTEL, Micaela (LUTH, Observatoire de Paris)

ID de Contribution: **33** Type: **Non spécifié**

Modélisation numérique des étoiles à neutrons: vers une meilleure description physique

mardi 2 octobre 2018 11:30 (20 minutes)

Orateur: NOVAK, Jérôme

ID de Contribution: **34** Type: **Non spécifié**

Explosions extrêmes : hypernovae, sursauts gamma, supernovae superlumineuses

lundi 1 octobre 2018 16:25 (30 minutes)

Orateur: GUILET, Jérôme (Max-Planck Institut fuer Astrophysik (Garching))

ID de Contribution: **35** Type: **Non spécifié**

Modélisation physique des sursauts gamma

mardi 2 octobre 2018 12:30 (20 minutes)

Orateur: DAIGNE, Frédéric (Institut d'Astrophysique de Paris - Université Pierre et Marie Curie)

ID de Contribution: **36** Type: **Non spécifié**

Accélération de particules au voisinage des magnétosphères relativistes

mardi 2 octobre 2018 14:15 (30 minutes)

Orateur: CERUTTI, Benoît (Institut de Planétologie et d'Astrophysique de Grenoble / Université Grenoble Alpes)

ID de Contribution: **37** Type: **Non spécifié**

G4BetheHeitler5DModel: un générateur d'événements gamma -> e+e-

mardi 2 octobre 2018 15:05 (20 minutes)

Orateur: BERNARD, Denis (LLR, Ecole Polytechnique, CNRS/IN2P3)

ID de Contribution: **38** Type: **Non spécifié**

Precision big bang nucleosynthesis with improved Helium-4 predictions

mardi 2 octobre 2018 15:25 (20 minutes)

Orateur: PITROU, Cyril

ID de Contribution: **39** Type: **Non spécifié**

Perspectives théoriques pour l'astrophysique des ondes gravitationnelles

mardi 2 octobre 2018 16:15 (30 minutes)

Orateur: LE TIEC, Alexandre (Observatoire de Paris)

ID de Contribution: **40** Type: **Non spécifié**

A high-energy electromagnetic precursor to binary neutron star mergers?

mardi 2 octobre 2018 16:45 (20 minutes)

Orateur: CRINQUAND, Benjamin