JETSET FP6, ”Jet Simulations, Experiments, Theory” 10 years later, what is next?

Rapport sur les contributions

ID de Contribution: **1** Type: **Non spécifié**

Modeling the accretion on Young Stars : recent results and perspectives

mercredi 23 mai 2018 14:30 (20 minutes)

Many questions still remain open on the stellar accretion process which occurs during the first phases of the life of young stars and consequently the details in the exchange of mass and momentum between the proto-star and its accretion disk still remain approximate: the topology of the accretion flow, its temperature, its observability in the UV and X-ray bands, the possibility of any periodicity, if and how accretion affects the coronal activity of the proto-star, etc.
In this talk, I will focus on 1D simulations of accretion columns falling onto a dynamically heated stellar chromosphere. I will present first the method used for the radiative hydrodynamics and the importance of the underlying opacities. Then, I will describe two phenomena that have been studied in this work: the mutual feedback between a dynamically heated chromosphere and the accretion process and the coupling between radiation and matter. Perspectives will finally be presented.

These studies have been funded by the French "Programme National de Physique Stellaire" of INSU, the French Italian cooperation program PICS 6838 "Physics of Mass Accretion Processes in Young Stellar Objects", the Observatoire de Paris and the LABEX PLAS@PAR (ANR-11-IDEX-0004-02)

Contribution

Talk

Author: DE SA, Lionel (LERMA, Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, Paris, France & CEA/DSM/IRFU/SAp-AIM, CEA Saclay, CNRS, Gif-sur-Yvette, France)

Co-auteurs: STEHLE, Chantal-Jeanne (LERMA, Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, Paris, France); HUBENY, Ivan (Steward Observatory, University of Arizona, Tucson, USA); IBGUI, Laurent (LERMA, Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, Paris, France); COLOMBO, Salvatore (LERMA, Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, Paris, France & INAF-Osservatorio Astronomico di Palermo, Palermo, Italy); ORLANDO, Salvatore (INAF-Osservatorio Astronomico di Palermo, Palermo, Italy); LANZ, Thierry (Observatoire de la Côte d'Azur, Nice, France)

Orateur: DE SA, Lionel (LERMA, Sorbonne Université, Observatoire de Paris, Université PSL, CNRS, Paris, France & CEA/DSM/IRFU/SAp-AIM, CEA Saclay, CNRS, Gif-sur-Yvette, France)

Classification de Session: S5 Simulations

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

On the impact of jets in disk evolution

In this talk, we'll address the impact of UV radiation from the jet on the evolution of protoplanetary and young planetary disks

Contribution

Talk

Author: Prof. GOMEZ DE CASTRO, Ana (Universidad Complutense)

Co-auteur: Dr VALLEJO, Juan Carlos (Universidad Complutense)

Orateur: Prof. GOMEZ DE CASTRO, Ana (Universidad Complutense)

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

Marie Sklodowska-Curie ITNs: What Has Changed and What's the Same?

mardi 22 mai 2018 16:30 (30 minutes)

The European Commission has made a large number of changes to the structure of innovative training networks (ITNs) in comparison to "The JETSET Era". Here I will look at these changes, explain the level of funding one might expect and what the budget will cover. I will also outline the differences, not always obvious, between the 3 main selection criteria of Excellence, Impact and Implementation. The intention of this talk is to stimulate discussion regarding the feasibility, and desirability, of applying for a future ITN.

Contribution

Talk

Author: Prof. RAY, Tom (Dublin Institute for Advanced Studies)

Orateur: Prof. RAY, Tom (Dublin Institute for Advanced Studies)

Classification de Session: Discussion

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

Magnetized laser-produced plasmas for astrophysics

tbd

Contribution

Talk

Author: CIARDI, Andrea

Orateur: CIARDI, Andrea

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

Protostellar jets and outflows: from Spitzer to Herschel, ALMA and beyond

jeudi 24 mai 2018 15:30 (20 minutes)

The conclusion of JETSET roughly coincided with the beginning of a new era when facilities such as Herschel and ALMA became operative, opening new observational possibilities in terms of sensitivity, angular and spectral resolutions. In this talk I will report on my continuing efforts to understand the role of jets and outflows in connection to their driving sources but also with respect to their influence on the surrounding environments. In addition, I will attempt to follow the evolution of investigations that were initiated during JETSET and still remain at the forefront of the field of protostellar jets.

Contribution

Talk

Author: Dr DIONATOS, Odysseas (University of Vienna)

Orateur: Dr DIONATOS, Odysseas (University of Vienna)

Classification de Session: S6 Future Projects

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

Connection between jets, winds and accretion in T Tauri stars

mardi 22 mai 2018 14:30 (20 minutes)

I will present a survey of forbidden line emission in a sample of 130 T Tauri stars in the Lupus, Chamaeleon and sigma Ori clouds conducted with the X-shooter instrument. The aim of the survey is to study the occurrence of high velocity jets and slow winds on a statistical bases, and investigate on the connection between the different mass loss phenomena and the source accretion properties.

Contribution

Talk

Author: NISINI, Brunella (INAF Osservatorio di Roma)

Orateur: NISINI, Brunella (INAF Osservatorio di Roma)

Classification de Session: S2 Observations and models

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

Jet launching simulations

mercredi 23 mai 2018 14:00 (20 minutes)

I will present results of recent jet launching MHD simulations. These include simulations considering a dynamo-generated disk magnetic flux, and simulations in 3D thus considering jet launching in binary systems. I will also discuss a general interrelation between the disk magnetization and the jet dynamical parameters.

Contribution

Talk

Author: FENDT, Christian (Max Planck Institute for Astronomy)

Orateur: FENDT, Christian (Max Planck Institute for Astronomy)

Classification de Session: S5 Simulations

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

Accretion bursts from young stars

mercredi 23 mai 2018 10:45 (20 minutes)

We will present new observations from accretion bursts from young stars.

Contribution

Talk

Author: EISLÖFFEL, Jochen (Thüringer Landessternwarte)

Orateur: EISLÖFFEL, Jochen (Thüringer Landessternwarte)

Classification de Session: S2 Observations and models

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

Jets and Outflows from the UWISH2 Survey

mardi 22 mai 2018 15:00 (20 minutes)

The talk will present the main results from the UK Wide-field Infrared survey for H2 (UWISH2).

Contribution

Talk

Author: Dr FROEBRICH, Dirk (University of Kent)

Orateur: Dr FROEBRICH, Dirk (University of Kent)

Classification de Session: S2 Observations and models

ID de Contribution: **11** Type: **Non spécifié**

Rotating molecular cavities scrutinized by ALMA: what can they tell us about magnetic fields in protoplanetary disks ?

mardi 22 mai 2018 14:00 (20 minutes)

Powerful atomic jets and molecular outflows are observed in young protostars at all stages of active accretion, from the young embedded Class 0 and Class 1 phases to the later optically revealed T Tauri or Class 2 phase. The origin of the ejection, its role in angular momentum extraction and impact on protoplanetary disk evolution remain as fundamental open questions in star formation. Studies at high angular and spectral resolution of molecular outflows are now providing important new clues to these questions. The recent detection of a small scale CO cavity/outflow in the prototypical edge-on HH 30 T Tauri star challenges the
traditional interpretation of molecular outflows as swept-up material. Instead these low velocity cavities could trace matter directly ejected from the inner regions of the disk. I will discuss recent band 6 ALMA observations in 12CO and 13CO of the prototypical HH 30 system and their implications for the origin of the CO cavity/outflow and its impact on the disk evolution. These observations also reveal direct strong evidence of strong vertical sedimentation and radial segregation of millimeter dust. Finally the binary scenario put forward for the origin of the HH 30 jet wiggling is strongly challenged by the ALMA observations
Preliminary results from ALMA Cycle 3 & 5 observations of a Class I disk/outflow source, DG Tau B, will be also discussed.

Contribution

Talk

Author: Mme DOUGADOS, catherine (ipag)

Co-auteur: CABRIT, Sylvie

Orateur: Mme DOUGADOS, catherine (ipag)

Classification de Session: S2 Observations and models

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

Radiation magnetohydrodynamic models and spectral signatures of plasma flows accreting onto Classical T Tauri Stars

mercredi 23 mai 2018 15:00 (20 minutes)

CTTSs are young stars accreting mass from their circumstellar disks. According to the largely accepted magnetospheric accretion scenario, the disk extends until the truncation radius, where the magnetic field is strong enough to disrupt the disk and to channel the material towards the star forming an accretion column. The material falls into the star at free fall velocity and hits the stellar surface producing shocks, that heat the plasma at few million degrees.
In the last twenty years the X-ray and UV observations of these systems have raised several questions. In particular, the observed X-ray luminosity is systematically below the value predicted by theoretical models, and the UV lines show complex profiles which cannot be easily interpreted with current accretion models based only on magnetohydrodynamical effects.

To tackle these problems we modeled the structure and the dynamics of the plasma in the impact regions using 3D magnetohydrodynamical simulations, but including the effects of radiative transport, for the first time in the Non Local Thermodynamical Equilibrium (NLTE) regime.

We found that the radiation arising from the shocked plasma is partially absorbed by the unshocked accretion column, and this might explain the excess of X-ray flux predicted by MHD models not including absorption effects. Moreover, due to the absorption of radiation, the pre-shock downfalling accreted material is gradually heated up to a few 10^5 K due to irradiation of X-rays arising from the shocked plasma at the impact region. We discuss the implication of this pre-shock heating for the UV and X-ray emission arising from the impact region.

This work has been done within the LABEX Plas@Par project, and received financial state aid managed by the Agence Nationale de la Recherche, as part of the Programme Investissements d' Avenir under the reference ANR-11-IDEX-0004-02

Contribution

Talk

Author: M. COLOMBO, Salvatore (Università di Palermo, Pierre et Marie Curie University, INAF - Istituto Nazionale di Astrofisica)

Co-auteurs: Dr STEHLE, Chantal (Pierre et Marie Curie University); Dr IBGUI, Laurent (Pierre et Marie Curie University); Dr DE SA, Lionel (Pierre et Marie Curie University); Prof. RODRIGUEZ PÉREZ, Rafael (Universidad de Las Palmas de Gran Canaria); Dr ORLANDO, Salvatore (Osservatorio di Palermo - INAF Istituto Nazionale di Astrofisica)

Orateur: M. COLOMBO, Salvatore (Università di Palermo, Pierre et Marie Curie University, INAF - Istituto Nazionale di Astrofisica)

Classification de Session: S5 Simulations

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

ANALYSIS OF THE PHYSICAL PROPERTIES OF JETS/OUTFLOWS IN T TAURI STARS

mardi 22 mai 2018 15:30 (20 minutes)

Winds and jets are key factors in the evolution of accretion disks in pre-main sequence stars, and deriving their physical properties is one of the most important steps for a full understanding of the connection among outflow, jet and accretion processes. In this work we determine the physical properties of the high velocity component (HVC) and the low velocity component (LVC) emitting region of the optical forbidden [N II], [O I] and [S II] lines for the jets of DG Tau, SZ 102, CW Tau and RW Aur. We found two well defined ranges of temperatures and densities for the gas emission lines: one with 4.125 ≤ log T e (K) ≤ 4.55 and 2.25 ≤ log n e (cm^3) ≤ 5.25, and another one with 5.25 ≤ log T e (K) ≤ 5.6 and 5.25 ≤ log n e (cm 3) ≤ 6.75. The LVC has high temperatures and high densities for DG Tau and CW Tau, whereas for SZ 102 it has much lower densities and temperatures. The peak velocities and full width at half maximum of the LVC pointed out that its origin is from a MHD disk wind at 0.05-1.69 AU and that Keplerian rotation is the main responsible of the broadening of the lines. The relation found between the accretion luminosity with the LVC's temperature and density, suggests that the accretion plays an important role in the physical properties of the emitting region, likely a steady accretion is performing in the outflow driving region. We did not find evidence of Keplerian broadening for the HVC, whereas we found a correlation between the mass loss rate and accretion luminosity, probably because episodic accretion is occurring in the region where the jet is driven.

Contribution

Talk

Author: Mme LOPEZ-MARTINEZ, Fatima (Instituto de Astrofísica e Ciências do Espaço)

Co-auteur: Dr GAMEIRO, J.F. (Instituto de Astrofísica e Ciências do Espaço)

Orateur: Mme LOPEZ-MARTINEZ, Fatima (Instituto de Astrofísica e Ciências do Espaço)

Classification de Session: S2 Observations and models

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

Constraining the structure of X-ray emitting jets close to the launching site

jeudi 24 mai 2018 10:30 (20 minutes)

Observations of stellar jets show evidence of X-ray emitting shocks close to the launching site. In some cases, including YSOs at different stages of evolution, the shocked features appear to be stationary (e.g. HH 154 and DG Tau). We study the case of HH 154, the jet originating from the embedded binary Class 0/I protostar IRS 5, and the case of the jet associated with DG Tau, a more evolved Class II disk-bearing source (CTTS), both located in the Taurus star-forming region. We aim at investigating the effect of perturbations in X-ray emitting stationary shocks in stellar jets, and explore the differences from Class 0 to Class II sources. We performed a set of 2.5-dimensional MHD numerical simulations modelling supersonic pulsed jets ramming into a magnetized medium, exploring different parameters for the model. We consider two cases: a jet less dense than the ambient medium (HH 154), and a jet denser than the ambient (DG Tau). In both cases, we found that the jet is collimated by the magnetic field forming a quasi-stationary shock at the base which emits in X-rays even when perturbations are present. From the comparison of the count rate synthesized from the simulations with Chandra X-ray observations, we also derived the physical parameters that can give rise to X-ray emission consistent with observations of HH 154 and DG Tau and provided an estimation of the maximum perturbations that can be present.

Contribution

Talk

Author: Mlle USTAMUJIC, Sabina (Universidad Complutense de Madrid)

Orateur: Mlle USTAMUJIC, Sabina (Universidad Complutense de Madrid)

Classification de Session: S5 Simulations

ID de Contribution: **16** Type: **Non spécifié**

Mass accretion impacts in classical T Tauri stars: a multi-disciplinary approach

jeudi 24 mai 2018 14:30 (20 minutes)

Accretion of matter is a process that plays a central role in the physics of young stellar objects. The analysis of the structure by which matter settles on the star can unveil key information about the process of star formation by providing details on mass accretion rates, stellar magnetic field configurations, possible effects of accretion on the stellar coronal activity, etc.
Here we review some of the achievements obtained by our group by exploiting a multi-disciplinary approach based on the analysis of multi-dimensional magnetohydrodynamic simulations, multi-wavelength observations, and laboratory experiments of accretion impacts occurring onto the surface of CTTSs. We discuss the future perspectives especially in view of new generation world-class instruments as JWST (in the optical) and Athena (in the X-rays).

Contribution

Talk

Author: Dr ORLANDO, Salvatore (INAF-Osservatorio Astronomico di Palermo)

Co-auteurs: STEHLE, Chantal-Jeanne; Dr ARGIROFFI, Costanza (Universita' di Palermo); Dr IBGUI, Laurent (LERMA - Sorbonne University - Paris Observatory); Dr MICELI, Marco (Universita' di Palermo); Dr BONITO, Rosaria (INAF-Osservatorio Astronomico di Palermo); COLOMBO, Salvatore; Dr MATSAKOS, Titos (University of Chicago)

Orateur: Dr ORLANDO, Salvatore (INAF-Osservatorio Astronomico di Palermo)

Classification de Session: S6 Future Projects

ID de Contribution: **17** Type: **Non spécifié**

GIARPS/GRAVITY survey: broad-band 0.44-2.4 micron high-resolution spectra of T-Tauri and Herbig AeBe stars. Combining high spatial and high spectral resolution data to unveil the inner disc physics

jeudi 24 mai 2018 15:00 (20 minutes)

In this talk I will present the first results of our GIARPS survey of a sample of T-Tauri and Herbig AeBe stars ($\sim$ 100 objects), belonging to the GRAVITY/VLTI GTO sample of Young Stellar Objects (YSOs).
GIARPS is a broad-band spectrometer combining HARPS-N and GIANO which allows obtaining high-resolution spectra from 0.44 micron (R $\sim$ 115000) to 2.44 micron (R $\sim$ 50000) in one shot.
By combining high spatial (milliarcsecond) and spectral (R $\sim$ 50000) observations, we will obtain an unprecedented view of the innermost regions of circumstellar discs in YSOs with a wide range of masses ($0.1 - 5 M_{\odot}$) and ages ($10^5 - 10^7$ yr).
The final goal is to model the accretion and ejection mechanisms and study how they evolve as a function of YSO mass and age, using the spatially- and spectrally-resolved observations of atomic and molecular lines from the inner gaseous regions.
The GIARPS survey has already been granted 4 nights at the TNG in December 2017, when a first sample of 17 T-Tauri and Herbig AeBe stars were successfully observed with GIARPS

Contribution

Talk

Author: Dr MASSI, Fabrizio (INAF-Osservatorio Astrofisico di Arcetri)

Orateur: Dr MASSI, Fabrizio (INAF-Osservatorio Astrofisico di Arcetri)

Classification de Session: S6 Future Projects

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

Seeking for magnetic fields through ALMA polarimetric studies of rotating jet/disk systems

jeudi 24 mai 2018 10:00 (20 minutes)

We have recently obtained ALMA Band 7 polarimetric data for the young systems DG Tau and CW Tau,
for which the rotation properties of jet and disk have been investigated in previous high angular resolution studies.
The motivation was to test the models of magneto-centrifugal launch of jets via the determination of the magnetic configuration at the disk surface. Non-spherical dust grains tend to align with their short axes parallel to the magnetic field, and in this case the dust radiation is polarized, with polarization vectors perpendicular to the direction of the magnetic field lines. We thus planned to compare the rotation properties in these systems with the observed magnetic field geometry. We present here the first results of the project, illustrating the different interpretations.
The analysis of these data reveals that dust self-scattering concurs strongly to shape the polarization patterns.
It is shown that even if no information on the magnetic field can be derived in this case, the polarization data are a powerful tool for the diagnostics of the dust properties in disks.

Contribution

Talk

Author: Dr BACCIOTTI, Francesca (INAF - Osservatorio Astrofisico di Arcetri)

Orateur: Dr BACCIOTTI, Francesca (INAF - Osservatorio Astrofisico di Arcetri)

Classification de Session: S5 Simulations

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

Precessing Jets in Supernovae Shells

jeudi 24 mai 2018 11:30 (20 minutes)

Supernovae (SN) and astrophysical jets are two of the most energetic and intriguing objects in the universe. We examine an interesting scenario that involves the interaction of these two extreme phenomena, uniquely ''combined" in the W50-SS433 system: a jet launched from the microquasar SS433 (an X-ray binary, XRB) located inside a supernova remnant (SNR), W50. Observations have revealed a unique morphology of the remnant, attributed to the presence of the jet. The jet penetrates the shell and alters its quasi-spherical shape, leading to an elongated shape parallel to the mean jet axis - which is frequently mentioned as a "manatee"shape.

We perform full 3D relativistic hydrodynamic simulations to better resolve the interaction between the supernova remnant and the jet. These simulations capture both the initial supernova blast (non-relativistic regime) and the subsequent evolution of the jet (relativistic regime). The first part of our project is to analyze the propagation of the jet inside the shell, the resulting shape of the nebula and the effect of the density profile of the ambient medium. The precession of the jet in SS433 is also taken into account, testing different scenarios.

The second, complementary part of this project, is the creation of emission maps by post-processing the simulation data with a radiation transfer code. Synchrotron emission is a common choice, assuming equipartition to compensate for the hydro nature of the simulations, but other emission regimes can also be considered.

Contribution

Talk

Author: M. MILLAS, Dimitrios (KU LEUVEN)

Co-auteurs: Dr PORTH, Oliver (Goethe University Frankfurt); Prof. KEPPENS, Rony (KU Leuven)

Orateur: M. MILLAS, Dimitrios (KU LEUVEN)

Classification de Session: S5 Simulations

ID de Contribution: **21** Type: **Non spécifié**

Laboratory Astrophysics at ELI-NP

mercredi 23 mai 2018 09:45 (20 minutes)

Extreme Light Infrastructure –Nuclear Physics (ELI-NP) is the Romanian pillar of the pan-European distributed research facility based on ultra-short-pulse lasers. Due to the unprecedented intensity regimes the 10PW lasers at ELI-NP can reach, and also to the combination of beams that can be synchronized and made available at the same time, new experiments relevant for the extreme conditions of astrophysics can be imagined.

Moreover, ELI-NP features a high-intensity, tunable, narrow bandwidth gamma beam system, that can be used for studies of nuclear astrophysics and can also be used at the same time in experiments with the high power laser beams.

Some of the proposed experiment categories relevant for astrophysics will be presented, as well as an overview of the beam capabilities and interaction chambers available for external users access. A long-term Astrophysics programme at ELI-NP is under development by the forming international user community.

Contribution

Talk

Author: Dr TESILEANU, Ovidiu (ELI-NP, IFIN-HH, Romania)

Orateur: Dr TESILEANU, Ovidiu (ELI-NP, IFIN-HH, Romania)

Classification de Session: S3 Experiments

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

Tribute to Kanaris

mercredi 23 mai 2018 16:00 (15 minutes)

TBA

Contribution

Talk

Author: SAUTY, Christophe

Orateur: SAUTY, Christophe

Classification de Session: S4 Special

ID de Contribution: **24** Type: **Non spécifié**

Jet Stability

mardi 22 mai 2018 10:25 (20 minutes)

The linear stability of magnetized jets against nonaxisymmetric modes will be discussed.

Contribution

Talk

Author: Prof. VLAHAKIS, Nektarios (Department of Physics, University of Athens, Greece)

Orateur: Prof. VLAHAKIS, Nektarios (Department of Physics, University of Athens, Greece)

Classification de Session: S1 Theory and models

ID de Contribution: **25** Type: **Non spécifié**

Magnetorotational turbulence, dynamo action and transport in convective disks

mardi 22 mai 2018 09:55 (20 minutes)

We present a numerical study of turbulence and dynamo action in stratified shearing boxes with zero mean magnetic flux. We assume that the fluid obeys the perfect gas law and has finite (constant) thermal diffusivity. We identify two regimes. The first is a conductive regime in which the heat is transported mostly by conduction and the density decreases with height. In the limit of large thermal diffusivity this regime resembles the more familiar isothermal case. The second is the convective regime, observed at smaller values of the thermal diffusivity, in which the layer becomes unstable to overturning motions, the heat is carried mostly by advection, and the density becomes nearly constant throughout the layer. In this latter constant-density regime we observe evidence for large-scale dynamo action leading to a substantial increase in transport efficiency relative to the conductive case.
We then present an approach to deriving global properties of accretion disks from the knowledge of local solutions derived from numerical simulations based on the shearing box approximation. In this way we can discuss the consistency of the convective solutions.

Contribution

Talk

Author: Dr BODO, Gianluigi (INAF OATO)

Orateur: Dr BODO, Gianluigi (INAF OATO)

Classification de Session: S1 Theory and models

ID de Contribution: **26** Type: **Non spécifié**

High energy emission from shocks due to jets and accretion in young stars with disks: combining observations, numerical models, and laboratory experiments

jeudi 24 mai 2018 14:00 (20 minutes)

High energy emission from young stars with disks, with all their components due to accretion and outflow activity, can have a deep impact on the evolution of their disks and on the formation of exo-planetary systems.
An inter-disciplinary approach, which combines multi-wavelength observations, magnetohydrodynamical models, and laboratory experiments, allows us to get a more complete description of the accretion/ejection phenomena characterizing young stars.
We will discuss the case of the HH 154 jet, its X-ray emission localized at the base ot the jet and its complex morphology, comparing observations, models, and laser experiments.
We will present the comparison between magnetohydrodynamical models prediction and high energy observations (UV and X-ray bands) of TW Hya, a promising object to perform also Doppler shift measurements, pushing to the limit the capabilities of currently available instruments (e.g. Chandra Telescope).
We will discuss how multi-band investigation and the use of future instruments (Athena and LSST) will improve our understanding of the accretion process in young stars.

Contribution

Talk

Author: BONITO, Rosaria (INAF - Osservatorio Astronomico di Palermo)

Co-auteurs: CIARDI, Andrea (Sorbonne Universités, UPMC); ARGIROFFI, Costanza (UNIPA; INAF - OAPa); FUCHS, Julien (LULI (Laboratoire pour l'Utilisation des Lasers Intenses)–CNRS, École Polytechnique); MICELI, Marco (UNIPA; INAF - OAPa); ORLANDO, Salvatore (INAF - OAPa)

Orateur: BONITO, Rosaria (INAF - Osservatorio Astronomico di Palermo)

Classification de Session: S6 Future Projects

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

An energy integral for non polytropic astrophysical winds and jets.

mardi 22 mai 2018 11:15 (20 minutes)

A criterion is derived for distinguishing if a rotating hydrodynamic outflow emerging from the atmosphere and the gravitational well of a central object obtains a radial (wind) or cylindrical (jet) asymptotical shape. Quasi-analytical solutions are obtained via a nonlinear separation of the variables, which are the spherical distance and the mass flux function, in the relevant physical quantities. Attention is focused on the streamline shape which is calculated exactly and self consistently throughout the outflow to formulate the criterion. It is concluded that in such hydrodynamic outflows their asymptotical shape is conical in the form of a non collimated wind, unless a suitable external pressure distribution is applied laterally to push the outflow towards the symmetry axis and thus obtain a collimated jet. This last situation is rather unlikely to happen in most environments, and thus the natural outcome is a wind rather than a jet. This study is complementary to the MHD energetic criterion developed by Sauty & Tsinganos (1994), wherein a similar magnetized outflow from efficient magnetic rotators obtains either cylindrical asymptotics via the magnetic hoop stresses, and/or a suitable external pressure gradient, or, radial asymptotics from inefficient magnetic rotators. Our results point towards the general conclusion that collimated astrophysical outflows from young stellar objects, or, AGNs are inevitably magnetically collimated. Without such magnetic confinement in efficient magnetic rotators, those outflows would have been radial, as is the case of the solar wind. Therefore, the magnetic field is the key factor for collimation of astrophysical outflows in the widespread phenomenon of astrophysical jets and winds, which without sufficiently strong azimuthal magnetic fields and fast rotaion would have been uncollimated as winds

Contribution

Talk

Author: Prof. TSINGANOS, KANARIS (UNIVERSITY OF ATHENS)

Co-auteurs: SAUTY, Christophe (Observatoire de Paris); M. CHANTRY, Loic (Observatoire de Paris); M. DAMOULAKIS, Michael (University of Athens); Prof. VLAHAKIS, Nektarios (University of Athens); Dr CAYATTE, Veronique (Observatoire de Paris)

Orateur: Prof. TSINGANOS, KANARIS (UNIVERSITY OF ATHENS)

Classification de Session: S1 Theory and models

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

Simulating accretion and outflow regions in YSOs

jeudi 24 mai 2018 09:30 (20 minutes)

One of the puzzling questions surrounding Young Stellar Objects (YSOs) concerns the unexpected evolution of their angular momentum. Theoretically, we should expect Classical T Tauri stars (CTTs) to rotate faster due to ongoing accretion and contraction processes towards the main-sequence. Apparently, that it is not observed. Many authors suggest that the interaction star-disk has an important role towards the deceleration of these objects. Additionally, this interaction includes not only accretion, but also outflow mechanisms.

In this presentation the dynamics of accretion and outflow regions will be characterized through observations of CTTs and numerical simulations performed with PLUTO code. This study results from a collaboration between Instituto de Astrofísica e Ciências do Espaço and Observatoire de Paris.

Contribution

Talk

Author: ALBUQUERQUE, Raquel

Co-auteurs: SAUTY, Christophe; GAMEIRO, Jorge Filipe (Instituto de Astrofísica e Ciências do Espaço); LIMA, João (Instituto de Astrofísica e Ciências do Espaço); CAYATTE, Veronique

Orateur: ALBUQUERQUE, Raquel

Classification de Session: S5 Simulations

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

Jet precession and synchronous outbursts in the binary (triple?) protostar SVS13A

mercredi 23 mai 2018 11:15 (20 minutes)

The role of multiplicity and close stellar encounters in accretion and ejection bursts in young stars is a debated issue (Reipurth et al. 2014; Audard et al. 2014, and references therein). An interesting target of study in this context is SVS 13A, a 0.3" (70 au) binary solar-type protostar (VLA4A,VLA4B; Anglada et al. 2000) with multiple signs of ejection bursts. SVS 13A is the candidate source of the HH7–11 chain of optical /H2 knots (Davis et al. 2000), drives high-velocity CO bullets (Bachiller et al. 2000), and hosts a small scale atomic jet with H2 arcs (Hodapp & Chini 2014 and refs therein). Here we present the highest angular resolution study in the millimeter domain (0.3"-0.8") of the SVS13 A system in dust continuum, CO, SiO and SO, obtained in the frame of the CALYPSO (Continuum And Lines in Young ProtoStellar Objects) Large Program at the IRAM Plateau de Bure interferometer. The source of the molecular jet and its precessing structure are revealed in unprecedented detail. In particular, we show that the CO bullets and the HH7-11 atomic knots actually trace two different outflows that undergo synchronous major outbursts every 300yrs, probably triggered by orbital interactions. We also find that the unusually large rotation reported across the CO bullets by Chen et al. (2016) is most likely an artefact of the strong jet precession and time variability, and that a third outflow source maybe present in the system (see Lefèvre et al. 2017 for full details).

Contribution

Talk

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Orateur: CABRIT, Sylvie

Classification de Session: S2 Observations and models

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

Magnetic field diffusion in multi-fluid MHD turbulence

mardi 22 mai 2018 12:15 (20 minutes)

Diffusion of, and turbulence in, magnetic fields are believed to be critical to various processes in astrophysics such as particle acceleration, magnetic reconnection and star formation. It has been suggested that MHD turbulence itself can play a critical role in magnetic field diffusion. If this is true then it implies that some of our notions about global structures in turbulent astrophysical media, such as the canonical hour-glass shape of magnetic fields in the cartoon version of low mass star formation, are internally inconsistent. In this talk we will discuss some results on the diffusion of magnetic fields in MHD turbulence following the general paradigm used by Lazarian & Vishniac (1999). We will begin by first giving a short introduction to MHD turbulence, some of the ideas of turbulent magnetic diffusion and multi-fluid MHD. We then review the results of numerical simulations on turbulent diffusion and present new results on turbulent diffusion in a weakly ionised medium, such as may be found in star forming regions and proto-planetary disks.

Contribution

Talk

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Classification de Session: S1 Theory and models

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

Internal chocs in stratified relativistic jets

jeudi 24 mai 2018 12:00 (20 minutes)

We investigate the plasmoid knot formation in stratified relativistic jet by means of relativistic magneto-hydrodynamics simulations. Indeed, astrophysical jets in active galactic nuclei seem to be transversely stratified, with a fast inner jet and a slower outer jet. As it is likely that the launching mechanism for each component is different. In the other hand, the steady and moving knots properties are observed along these jets. With the proposed model, we were able to link the different types of observed knot in various radio loud AGN with specific stratified jet characteristics. We showed that the increase energy flux at the outer edge of the jet induces a steady knot near the core and a moving knots at larger distance.

Contribution

Talk

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Classification de Session: S5 Simulations

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

Meridional self-similarity MHD flow: From Classical to flow around Kerr Hole

mardi 22 mai 2018 11:45 (20 minutes)

The meridional self-similarity method was a very effective method in classical MHD to produce models describing the MHD flows of young stellar jets.

But the jets produced by AGN are extremely energetic natural phenomena and thus constitute a real laboratory of higly reltivistic MHD flow and high energy physics. Indeed, it is well admitted that the fluid velocity of thes jets atteins higly relativistic regim and some recent observation seems show that the base of the jets start in some region we cannot neglect the general relativity effect.

Thus to describe the inner-spine jet of AGN in the context of ideal, stationary and axial-symetric MHD, we build a meridional self-similar model in Kerr metric. The choice of this metric is justified in order to describe the flow near the super-massive central black hole, and in particular to study the effects of its rotation. The model, characterized by 8 parameters, is based on a first order expansion of the governing general relativistic equations in the magnetic flux function around the symmetry axis of the system. A complete treatment for an outflow in a Kerr metric allowed us to present four enthalpy driven solutions with different field geometries and Lorentz factors, wherein the contribution of the Poynting flux is rather small. The jet power of the ultra-relativistic outflow solutions are of the same order as that determined from numerical simulations conducted by several groups.

Furthermore, our model is able to describe both an incoming and outgoing flow at the level of the stagnation radius; at this radius, pairs are created from neutrinos or highly energetic photons coming from the disk. Coupling inflow and outflow models allows us to describe the MHD flow from the horizon of the black hole up to infinity. We can estimate the different contributions of each of those processes: at the black hole level the energetic component coming from the Blandford-Znajek effect or the generalized Penrose mechanism, and the energetic input due to the creation of pairs.

Contribution

Talk

Author: M. CHANTRY, Loic (LUTH)

Co-auteurs: M. SAUTY, Christophe (LUTH); M. TSINGANOS, Kanaris (Université Kapodistrian Athènes); M. VLAHAKIS, Nektarios (Univeristé Kapodistrian Athènes); Mme CAYATTE, Véronique (LUTH)

Orateur: M. CHANTRY, Loic (LUTH)

Classification de Session: S1 Theory and models

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

Modeling the spin evolution of classical TTauri stars

jeudi 24 mai 2018 12:30 (20 minutes)

The spin evolution of classical TTauri stars (CTTS) represents a puzzling problem. Since they are still contracting and accreting, these protostars would be expected to spin-up at breakup speed in a few million years. On the other hand, as soon as they emerge from the Class 0-I embedded phases, they are observed to rotate with periods between 1-10 days, well below their breakup limit. In addition, the evolution of the rotational distribution displayed by open clusters of different ages suggests that the rotation of TTauri stars still surrounded by their accretion disks could stay approximately constant for a few million years. Clearly, an efficient spin-down mechanism is required to explain the spin evolution of CTTS. I will briefly review different models of the magnetic interaction of a slowly rotating protostar with a surrounding accretion disk that have been proposed in the literature to explain the angular momentum evolution of accreting pre-main-sequence stars. I will then use a suitable torque parametrization derived from numerical models of stellar winds and magnetic star-disk interaction to compute the long-term evolution of the stellar angular momentum. These results can be directly compared to the observed evolution of the stellar rotational distribution, providing different constraints to the models and shedding light on our current understanding of the star-disk interaction process.

Contribution

Talk

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Orateur: ZANNI, Claudio (INAF - Osservatorio Astrofisico di Torino)

Classification de Session: S5 Simulations

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

The Musca molecular cloud: An interstellar symphony

mercredi 23 mai 2018 11:45 (20 minutes)

Molecular clouds are the birthplaces of stars. Their structure and evolution hold the key to understanding the initial conditions of star and planet formation, and the physics that sets the distribution of masses and multiplicities of newborn stars. However, their complexity, their typically turbulent, filamentary, disordered appearance, and ubiquitous projection effects hinder all efforts to model them in detail. An exception to this messy picture is found in a recently discovered class of structures, molecular cloud striations: ordered, low-column-density, quasi-periodic, elongated structures parallel to the magnetic field. The physics that drives the formation of such striations has remained a mystery since their discovery. We have performed a comprehensive numerical experiment testing all possible driving mechanisms, and we have found that the only viable explanation for the appearance of striations is their formation by magnetohydrodynamic waves generating trapped modes, just like vibrations in a resonating chamber: they are, in every sense, a magnetohydrodynamic "song", with dense filaments being the instrument. We have additionally demonstrated that, by examining the spatial power spectrum of striations, we can find the normal modes of the "resonating chamber", and thus derive the true dimensions of dense filaments, including their previously inaccessible by any means line-of-sight dimension. We have applied such a normal mode analysis towards the Musca molecular cloud - one of the best-studied "dense filaments" in the interstellar medium and, contrary to all expectation, we have unequivocally demonstrated that the Musca filament is not, in fact, a filament: it is a sheet-like structure with comparable line-of-sight and plane-of-sky dimensions, seen edge-on. We discuss the implications of this discovery for the physics of dense molecular cloud formation.

Contribution

Talk

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Classification de Session: S2 Observations and models

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

Tribute to Kanaris

mercredi 23 mai 2018 16:15 (15 minutes)

TBA

Contribution

Talk

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Classification de Session: S4 Special

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

Tribute to Kanaris

mercredi 23 mai 2018 16:30 (15 minutes)

TBA

Contribution

Talk

Author: Dr NEKTARIOS, Vlahakis (University of Athens)

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Classification de Session: S4 Special

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

Tribute to Kanaris

mercredi 23 mai 2018 16:45 (5 minutes)

Contribution

Talk

Author: Dr LIMA, Joao (University of Porto)

Orateur: Dr LIMA, Joao (University of Porto)

Classification de Session: S4 Special