IPM School of Astronomy

Iranian National Observatory Organization

Baryons in Galaxies and Beyond

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ROLE OF ENVIRONMEON NUCLEAR ACTIVIT

Amirnezam Amiri

Motivated by the apparently conflicting results reported in the literature on the effect of environment on nuclear activity, we have carried out a new analysis by comparing the fraction of galaxies hosting active galactic nuclei (AGNs) in the most overdense regions (rich galaxy clusters) and the most underdense ones (voids) in the local universe. Exploiting the classical BPT diagnostics, we have extracted volume limited samples of star forming and AGN galaxies. We find that, at variance with star-forming galaxies, AGN galaxies have similar distributions of specific star formation rates and of galactic ages (as indicated by the Dn4000 parameter) both in clusters and in voids. In both environments galaxies hosting AGNs are generally old, with low star formation activity. The AGN fraction increases faster with stellar mass in clusters than in voids, especially above 1010.2 M⊙. Our results indicate that, in the local universe, the nuclear activity correlates with stellar mass and galaxy morphology and is weakly, if at all, affected by the local galaxy density.

Keywords: Void galaxy, Cluster galaxy, AGN activity, Stellar parameters

The interplay between galaxies and their host haloes

Ghazaleh Erfanianfar

In order to build a global picture of galaxy evolution, it is mandatory to understand how the evolution of galaxies and their environment is intertwined. We build the largest galaxy group and clusters catalog to study the relation of galaxies and their host halos. We find that galaxies at the end of star forming main sequence are mainly bulge dominated. We also find a strong correlation between the stellar mass of BCGs and the mass of their host halos. This relation shows no evolution since $z \sim 0.65$. We measure a mean scatter of 0.21 and 0.25 for the stellar mass of BCGs in a given halo mass at low ($z < 0.3$) and high ($0.3<z<0.65$) redshifts, respectively. We further demonstrate that the BCG mass is covariant with the richness of the host halos.We also find evidence that part of the scatter between X-ray luminosity and richness can be reduced by considering stellar mass as an additional variable.

Investigating the Relation Between Mass Distribution

and Star FormationRate of Galaxies at Redshift Range of 0.5 - 1.2

Shiva Hosseinnejad

We study the relation between the stellar mass distribution and star formation rate of high-redshift galaxies ($0.5 < z < 1.2$), by means of the structural parameters derived from the spatially resolved stellar mass maps. We used 3D-HST catalog and imaging data to select 346 galaxies located in the GOODS-South field within the stellar masses of $M_* > 10^{10} M$. The 2-dimensional stellar mass maps of galaxies were constructed through the pixel-by-pixel SED-fitting method on the galaxy images from the broad-band observations by Hubble Space Telescope. We then performed parametric and non-parametric morphological analysis on the resolved stellar mass maps. We find that the main-sequence galaxies are in general, less concentrated and have smaller Sersic indices compared to the quiescent galaxies, consistent with the results based on the light distribution analysis. Using these mass maps, we also find that the star-forming galaxies are more clumpy and asymmetric compared to the quiescent galaxies. In addition, low-mass star-forming galaxies $M_* < 10^{10.5} M$ tend to be clumpier and more asymmetric compared to the massive ones on the main-sequence.

IPM School of Astronomy
Iranian National Observatory Organization
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Disk-Outflow Interaction: Exchange of Mass and Angular Momentum

Somayeh Sheikhnezami

Jets and outflows from YSO and AGNs affect their environment, and, thus, the formation process of the objects that are launching them. Numerous studies investigate effects of such feedback mechanisms in star and planet formation and galaxy formation. However, a quantitative investigation of how much mass, momentum, or energy from the infall is actually recycled into a high-speed outflow needs to resolve the innermost jet-launching region and to model the physical process of launching directly. According to the current understanding, accretion and ejection are related to each other. One efficient way to remove angular momentum from a disk is to connect it to a magnetized outflow. In this talk, I will present the recent studies of the detailed physics of accretion-ejection structure in the inner part of the disk focusing on launching process of an outflow from a magnetically diffusive accretion disk at different scales from YSO to AGNs

Galactic evolution in non-local gravity

Mahmood Roushan

In this talk I report the results of a series of galactic N-body simulations in the context of a nonlocal theory of gravity (NLG). In this theory the appearance of the dark matter problem in cosmology and astrophysics is a manifestation of the nonlocality of the gravitational interaction. Using high-resolution N-body simulations, we investigate the dynamical evolution of disk galaxies and compare the result with the standard dark matter viewpoint. Although the initial conditions are the same in both models, their long-term dynamics reveals some notable differences. For example, it turns out that the bar instability happens with higher rate in NLG model compared with the standard case. On the other hand, at the end of the simulation, we find that bars are weaker and faster in NLG compared with the standard case.

As a separate note: I have already planned for attending another conference to be held in the same period of time. However, my travel has not been finalized yet. Therefore, please note that there is a possibility that, I might not be able to attend the "Baryons in Galaxies and beyond" conference. Of course, I will inform you of the final status of my travel as soon as possible.

Gas mass fraction of galaxies and star formation regulation

Jérémy Fensch

Star forming galaxies at the peak of the cosmic star formation history (CSFH), around z=2, have peculiar gaseous and stellar morphologies, typically dominated by a few massive clumps. They also have gas mass fractions of around 60% of their baryonic mass (e.g. Combes et al., 2013). To understand the rise and winding down of the CSFH, one needs to understand how star formation proceeds and is regulated in these gas-dominated and clumpy systems .

Using parsec-scale hydrodynamical simulations with the RAMSES code, we show that only galactic disks with a gas mass fraction above ~50% form massive (10^8-9 Msun) and long-lived (>100 Myr) gas clumps. The survival time of these massive clumps depends only weakly on the stellar feedback prescriptions (Bournaud & Fensch, in prep.). This elevated gas mass fraction is responsible for the onset of violent disc instabilities which drive strong nuclear inflows and elevated turbulence in the interstellar medium (ISM).

One may wonder how this gas-driven internal disc instabilities may regulate extreme star formation events in clumpy galaxies. It has indeed been observed that mergers at higher-redshift are less efficient at triggering strong starbursts (Rodighiero et al. 2011, Schreiber et al. 2015). With numerical simulations we systematically compare the physical processes at play in typical z~0 and z~2 galaxy mergers and see that, for the same orbits, z~2 mergers trigger much weaker and shorter starburst phases than at z~0 (Fensch et al., 2017). By studying the behaviour of the ISM, we show that this lower efficiency can be explained by a saturation of the physical processes responsible for starbursts: compressive turbulence in the ISM and nuclear gas inflows (Renaud et al. 2014). Contrarily to z~0 disks, these processes are already fuelled by gas-driven disc instabilities in gas-rich disks in isolation. Thus, tidal interactions can only weakly enhance these processes further, resulting in shorter and weaker starburst phases in tidally interacting galaxies with a higher gas mass fraction (Fensch et al., in prep.). In particular, we show that this saturation of star formation in gas-dominated galaxies arises solely from hydro-dynamical effects and is independent on the strength of the stellar feedback. Our results thus highlight the important role of the gas mass fraction of galaxies in the regulation of star formation at the peak of the cosmic star formation history.

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Distributions of the Stellar Mass within Galaxies and their Environmental Dependence

Moein Mosleh

We study the evolution of the stellar mass profiles of galaxies with M* > 10^ {10} M_sun, using multi-wavelength imaging data from the Hubble Space Telescope (HST) and the Sloan Digital Sky Survey (SDSS). We show that at fixed stellar mass, the half-mass sizes of quiescent galaxies increase from z ~ 2 to z ~ 0 by a factor of ~3-5, whereas the half-mass sizes of star-forming galaxies increase only slightly, by a factor of ∼2. The central densities of quiescent galaxies decline slightly (by a factor of ~ 1.7) from z ~ 2 to z ~ 0, while for star-forming galaxies the central densities increase with time, at fixed mass. We show that the central density of galaxies has a tighter correlation with specific star-formation rate (sSFR) than the surface density at effective radii. We also show that for all masses and redshifts, galaxies with higher central density are more prone to be quenched. In addition, the role of environment in shaping the stellar mass profiles of the quiescent galaxies in the local Universe is studied. We find that quiescent galaxies in the isolated regions have similar central properties (such as the central density and central velocity dispersion) to their counterparts in groups and clusters. However, the isolated quiescent galaxies have at most 25% smaller sizes than the quiescent ones in clusters .

Building a disc galaxy by gas accretion after a major merger

Nicolas Peschken

The wet major merger of two galaxies has long been thought to create elliptical galaxies due to the destruction of the progenitors in the violent relaxation phase of the merger. However in case of wet mergers it has been shown that accretion of gas after the merger can create a new disc component in the remnant, both from observations (e.g. Hammer et al. 2005) and from simulations of isolated galaxies (Athanassoula et al. 2016). In our work we investigate this phenomenon in the larger frame of a cosmological context using the simulation Illustris .
Illustris is a large hydrodynamical cosmological simulation based on the moving mesh code AREPO, reproducing many observational results in the area of galaxy formation and evolution. We select a sample of 38 cases where a major merger creates a disc galaxy in Illustris, and study their formation and evolution after the merger, and in particular the formation of the disc component in the remnant galaxy. We then look into details at one fiducial case, by tracking the accreted gas particles and the subsequent star formation to characterize the gas accretion as the main mechanism for the building of a disc after the major merger.

Differences in stellar properties between central dominant and offset brightest group galaxies

Ghassem Gozaliasl

I will present the results of a search for X-ray galaxy clusters and groups in the ∼2 deg^2 of the COSMOS field using all available X-ray observations from the XMM–Newton and Chandra observatories. The X-ray centers of groups are determined using high-resolution Chandra imaging. We investigate the relations between the offset of the brightest group galaxies (BGGs) from the X-ray centers and group properties and compare with predictions from semi-analytic models and hydrodynamical simulations. I will also present our results on of the contribution of the BGG stars to the total baryonic content of X-ray groups over the last 9 billion years of the age of the Universe.

The balance of cooling and heating in galaxy cluster core

Mohammad Hossein Zhoolideh Haghighi

The discrepancy between expected and observed cooling rates of X-ray emitting gas has led to the cooling flow problem at the cores of clusters of galaxies. A variety of models have been proposed to model the observed X-ray spectra and resolve the cooling flow problem, which involves heating the cold gas through different mechanisms. Realistic models of X-ray spectra of galaxy clusters need to involve both heating and cooling mechanisms.We argue that the heating time-scale is set by the magneto-hydrodynamic (MHD) turbulent viscous heating for the intracluster plasma. We will illustrate our model (Cooling+Heating flow model) and talk about the fitting results of this model with X-ray observations. Using a cooling+heating flow model, we show that a value of $\alpha \simeq 0.08$ (Shakura-Sunyaev viscosity parameter) provides improved fits to the X-ray spectra of cooling flow, while at the same time, predicting reasonable cold mass budgets accumulated in the cores of clusters over half the Hubble time.

IPM School of Astronomy
Iranian National Observatory Organization
Baryons in Galaxies and Beyond
17-19 February, 2019

Monitoring survey of the most evolved AGB stars in the Local Group dwarf galaxies

Survey overview and first results for Andromeda I

Elham Saremi

The Local Group (LG) dwarfs offer the chance for a complete inventory within a galactic environment. We set out to reconstruct their formation histories, and to probe their structure and evolution. In this regard, we have conducted an optical long-term monitoring survey of the majority of dwarf galaxies in the LG, with the Isaac Newton Telescope (INT), to identify the most evolved AGB stars that are long period variable (LPV). The LPV stars reach the largest amplitudes of their brightness variations at optical wavelengths, due to the changing temperature. They trace stellar populations as young as 30 Myr to as old as 10 Gyr and identifying them is one of the ∼ 30 Myr to as old as ∼ 10 Gyr and identifying them is one of the best ways to reconstruct ∼ 30 Myr to as old as ∼ 10 Gyr and identifying them is one of the best ways to reconstruct best ways to reconstruct the star formation history.The observations are made over ten epochs, spaced approximately three months apart, as the luminosity of LPV stars varies on timescales of months to years. The system of galactic satellites of the large Andromeda spiral galaxy (M31) forms one of the key targets of our monitoring survey. We present the first results in the And I dwarf galaxy, where we discovered 89 LPVs among over 10,000 stars.

Deep learning era

Alireza Vafaei Sadr

New generations of observations/experiments produce a huge amount of high-quality data. This provides opportunities for researchers around the world not only to contribute to different projects but also to inspire other groups for being incredibly sophisticated in their data accusation and modeling. This talk gives a brief introduction to data science and machine learning and how they help cosmology. In the following and as an application, I will then talk about one of my researches on using deep learning methods for point source detection.

The dissolution rate of star clusters with a top-heavy IMF in a dense metal poor Galactic environment

Ghasem Safaei

In the case of a top-heavy initial mass function (IMF) which is supported by several observational and theoretical studies, the inferred stellar IMF slope for stars with mass $M > 1M_\odot$ is flatter in more massive, denser and metal-poorer environments. We present a comprehensive series of direct N-body simulations to study the evolution of star clusters starting with a top-heavy IMF and undergo early gas expulsion. By changing the degree of top-heaviness we calculate the minimum cluster mass needed for the cluster to survive after 12 Gyr of evolution. The early gas expulsion leads to a rapid expansion of the star clusters. Decreasing the slope of IMF at the high-mass end leads to a faster dissolution of the star clusters. We show that the cluster final sizes, bound mass fraction and their survival rate are strongly influenced by the details of the degree of top-heaviness.

Galactic outflow properties using background quasars: the MEGAFLOW survey

ILANE SCHROETTER

Lots of efforts has been made to study the outflowing gas of galaxies. In observation, most of them usually use the absorption lines seen in the host galaxy spectrum. This limits the study of only near face-on galaxies as well as the unknown location of this absorbing gas being ejected. Lacking the location of this outflowing gas leads to order of magnitudes uncertainties on major properties like the loading factor (the ejected mass rate divided by the host galaxy star formation rate). However, another technique is to use background sources like quasars to study this outflowing gas of a foreground galaxy. This technique has the advantages of knowing the location of the absorbing gas, allowing for more accurate results. The bottleneck of this technique is the rarity of such systems (galaxy-quasar pairs) and therefore one needs to develop specific observational techniques to optimize the number of such pairs. In this talk, I will present the last results on galactic outflow properties obtained by a combination of UVES and MUSE observations of galaxy-quasar pairs: the MusE GAs FLOw and Wind (MEGAFLOW) survey.

The properties of wind generated from accretion flows

Amin Mosallanezhad

Observations indicate that wind can be generated in both hot and cold accretion flows. In terms of hot accretion flow, the properties of wind generated from strongly magnetized accretion flow have not been studied. We study the properties of wind generated from both weakly and strongly magnetized accretion flow. We mostly focus on how the magnetic field strength affects the wind properties. We solve steady-state two-dimensional magnetohydrodynamic equations of black hole accretion in the presence of a large-scale magnetic field. We find that wind exists in both weakly and strongly magnetized accretion flows. When the magnetic field is weak, wind is driven by gas pressure gradient and centrifugal forces. When the magnetic field is strong, wind is driven by gas pressure gradient and magnetic pressure gradient forces. We also perform two-dimensional hydrodynamical simulations of slowly rotating accretion flows in the region $0.01-7$ pc around a supermassive black hole to study the properties of wind in cold accretion model. The accretion flow is assumed to be irradiated by the photons from the central active galactic nucleus (AGN). The outflow properties found in this study are consistent with those of the recent observations of ultrafast outflows (UFOs). Based on these results, we expect line-driven outflow may be the origin of UFOs.

Constructive approaches to describe the surface density and its peculiarities at the edge of dwarf spheroidal galxies

Vahid Amiri

Parameterization and classification of galaxies are one of the most important issues in astrophysics. In this study, we not only derived the Sersic parameters of dwarf spheroidal galaxies but also introduced modified KKBH and AH profiles which are Sersic based by which can explain the surface density profile of these galaxies even in the large radii where the debris seemed problematic. Also, this study proposes a mass distribution profile which is completely helpful to describe the velocity dispersions of dwarf spheroidal galaxies with lower values of mass-to-light ratio

The Milky-Way stellar mass and star formation rate in the IGIMF context

Hamidreza Mahani

As the integrated galactic initial mass function (IGIMF) depends on metallicity and star formation rate (SFR), this theory allows the shape of the measured present day mass function to be used to constrain the stellar mass and the current SFR of the disk of the Galaxy. We have investigated the in uence of the IGIMF on the present-day global properties of the thin disk of the Milky Way (MW). In particular, we compared the eects of the canonical IMF and the IGIMF on the present day mass function(PDMF) of the MW.

Key words: methods: numerical - stars: luminosity function, mass function - Galaxy.

Rotation curves of galaxies and the stellar mass-to-light ratio

Aziz Khodadadi

Mass models of a sample of 171 low- and high-surface brightness galaxies are presented in the context of the cold dark matter (CDM) theory using the NFW dark matter halo density distribution to extract a new concentration-viralmass relation (c−Mvir). The rotation curves (RCs) are calculated from the total baryonic matter based on the 3.6 μm-band surface photometry, the observed distribution of neutral hydrogen, and the dark halo, in which the three adjustable parameters are the stellar mass-to-light ratio, halo concentration and virial mass. Although accounting for a NFW dark halo profile can explain rotation curve observations, the implied c − Mvir relation from RC analysis strongly disagrees with that resulting from different cosmological simulations. Also, the M/L−color correlation of the studied galaxies is inconsistent with that expected from stellar population synthesismodels with different stellar initial mass functions. Moreover, we show that the best-fitting stellar M/L− ratios of 51 galaxies (30% of our sample) have unphysically negative values in the framework of the CDM theory. This can be interpreted as a serious crisis for this theory. This suggests either that the commonly used NFW halo profile, which is a natural result of CDM cosmological structure formation, is not an appropriate profile for the dark halos of galaxies, or, new dark matter physics or alternative gravity models are needed to explain the rotational velocities of disk galaxies.

Dark matter-baryon scaling relations from Einasto halo fits to SPARC galaxy rotation curves

Amir Ghari

Dark matter-baryon scaling relations in galaxies are important in order to constrain galaxy formation models. Here, we provide a modern quantitative assessment of those relations, by modelling the rotation curves of galaxies from the Spitzer Photometry and Accurate Rotation Curves (SPARC) database with the Einasto dark halo model. Our analysis is complementary to the analysis of Chemin et al. (2011) and the recent one of Li et al. (2018). In particular, we focus here on the comparison between the original SPARC parameters, with constant mass-to-light ratios for bulges and disks, and the parameters for which galaxies follow the tightest radial acceleration relation (RAR). We show that fits are improved in the second case, and that the pure halo scaling relations also become tighter. We report that the density at the radius where the slope is -2 is strongly anticorrelated to this radius, and to the Einasto index. The latter is close to unity for a large number of galaxies, indicative of large cores. In terms of dark matter-baryon scalings, we focus on relations between the core properties and the extent of the baryonic component, which are relevant to the cusp-core transformation process. We report a positive correlation between the core size of halos with small Einasto index and the stellar disk scale-length, as well as between the averaged dark matter density within 2 kpc and the baryon-induced rotational velocity at that radius. This finding is related to the consequence of the RAR on the diversity of rotation curve shapes, quantified by the rotational velocity at 2 kpc. While a tight RAR slightly decreases the observed diversity compared to the original SPARC parameters, the diversity of baryon-induced accelerations at 2 kpc is sufficient to induce a large diversity, incompatible with current hydrodynamical simulations of galaxy formation, while maintaining a tight RAR

School of Astronomy
Iranian National Observatory Organization
Baryons in Galaxies and Beyond
17-19 February, 2019

The global mass function of 32 Galactic globular star clusters

Hamid Ebrahimi

We present the result of analysis of photometric data for 32 Galactic globular clusters. We have collected more than 120 parallel field images of various Galactic globular clusters which were observed with the Wide Field Channel of the Advanced Camera for Surveys of the Hubble Space Telescope. We have derived two catalogues for real and artificial stars for each globular cluster by photometry of these images and combined them with the similar catalogues for center of each globular cluster prepared by the globular clusters treasury project (Sarajedini et al. 2017).We have calculated the global present-day mass functions of these globular clusters by comparing the result of photometric data with multimass dynamical models. In addition, we were able to obtain the dynamical parameters like half-mass radii, mass-to-light ratios and the mass fraction of dark remnants using available radial velocity information. We conclude that the globular clusters follow the single power law functions with slopes >-1.5. Also a tight anticorrelation between the mass function slopes and the half-mass relaxation times has been found. It indicates that the two-body relaxation is the main mechanism to form the present-day mass function.

The Evolution of the Star-Formation Rate Profiles of Galaxies at 0.5 < z < 1.2

Zahra Hosseini-Shahisavandi

We explore the star formation activity of galaxies in different radius at high redshifts ($0.5 < z < 1.2$). We have selected 326 galaxies from the 3D-HST catalog, located in the GOODS-South field within the stellar mass range of ($10.0 < Log(M/M\_sun) < 11.2$) . We first constructed the 2D surface star-formation rate (SFR) maps of galaxies by means of the pixel-by-pixel SED-fitting method using the broad-band images observed by the Hubble Space Telescope. Then, galaxies were categorized as star-forming and quiescent relative to the main sequence relation at their given redshift. We compared the star-formation rate profiles of galaxies in different masses and redshift intervals and find that quiescent galaxies have positive SFR gradient in their inner regions. However, the star-forming galaxies, in general, have negative SFR gradients.

Understanding photometry data of microlensing event with data reduction method

Elahe Khalouei

Nowadays, the microlensing surveys such as OGLE, MOA and KMTNet and the follow-up tele- scopes as MiNDSTEp, ROBONet-II, etc are doing the photometry to measure the ux of star's light during the microlensing events. The Iranian subgroup of the MiNDSTEp collaboration started the data reduction process since one year. In this work, We review the seven steps of data reduction process for producing the microlensing light curve from the photometric images, observed by the Danish 1.54m follow-up Telescope.

Gas Accretion by Globular Clusters and the Formation of MSP

Asiyeh Yaghoobi

The recent photometric and spectroscopic observations have shown that Globular Clusters (GCs) host multiple stellar populations(MSPs) with variations in light elements. So a number of scenarios have been proposed to explain the formation of MSPs in GCs, but none of them have been succeeded to explain all of the observations until now. All scenarios require the processed ejecta of the first generations stars to be mixed with pristine gas and Some require more gas in GCs. So it is very important to know how much gas does a globular cluster could accumulate from its surrounding medium? and in how long does it take? To answer these questions a series of hydrodynamic simulations are performed to measure the accretion rate of a cluster. As a result, we find that a cluster could collect gas as much as 0.05 times of mass of cluster in 50 Myr. This amount of gas might supply a part of the mass required for the formation of MSPs in star clusters

Flare activity and Magnetic feature analysis of flare stars (Kepler Mission)

Hadis Goodarzi

We analyze 2375 flare stars and study the relationship between the magnetic feature characteristics and flare activity. Coverage and stability of magnetic features are inspired from rotational modulation of light curve variation and flare activity of stars are obtained using our automated flare detection algorithm. The results show that (i) flare time occupation ratio (or flare frequency) increases by increasing relative magnetic feature coverage in F-M type stars (ii) magnetic feature stability is highly correlated with the coverage of magnetic structures as this is the case for the Sun (iii) Total relative power of flares increases for G-M type stars by decreasing rotation period due to excess of produced magnetic field from dynamo procedure and increases by increasing relative magnetic feature coverage

IPM School of Astronomy

Iranian National Observatory Organization

Baryons in Galaxies and Beyond

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Conceptual design, computation and manufacturing method for non-spherical surfaces using the best spherical fit method

Sara Momeni mokoei

It appears that making use of a spherical surface is the best method for manufacturing non-spherical lenses and mirrors. This is performed via unloading of a spherical surface with known radius in order to minimize the waste in glass material in use. In order to do that using the least square algorithm, a number of minimum points between spherical and non-spherical surfaces are obtained which make it possible to find the best fit. The aim of the current study is to use this method to estimate all parameters of a non-spherical surface without designing the values, so that the measurement no longer depends on design. This leads to easier manufacturing processes and cost savings. In this paper, non-spherical surface parameters are extracted via numerical computations and computer programs, and are simulated by the optical design software.

Turbulence driven by stellar jets, the possibility and the efficiency

Mohsen Abgharian

We investigate the interaction of jets and the ambient gas in hydrodynamic and magneto hydrodynamic regime. Using the PLUTO 4.2 code, we solve the time-dependent hydrodynamic and magnetohydrodynamic equations for evolution simultaneously. The main question we address is whether the stellar jet can drive turbulence significantly into the outer medium? In addition, we investigate which system can drive and maintain the turbulence more efficiently and for a longer time evolution. We perform a case study of different parameters runs including the jet power, initial velocity geometry, jet magnetic fields and jet-clump interaction. In general, we confirm the previous studies on turbulence driven by protostellar jets that they induce the Turbulence on neighboring region and are unlikely drivers of large-scale supersonic turbulence in molecular clouds. Although, they are considerable candidate in driving the sub-sonic or transonic turbulence in some specific model setups. In particular, we find that the higher jet power can drive and maintain the subsonic and transonic turbulence in the surrounding area more efficiently. Moreover, from magnetized jet setups we find that the toroidal magnetic field has a considerable contribution in driving the turbulence into the ambient medium in particular the sub-sonic and transonic turbulence. Also, we investigate the environmental effect on driving the turbulence by protostellar jets. We find that including a quiescent clump (long lasting perturbation) in the surrounding ambient gas can produce a considerable fraction of turbulent motion and is a good candidate to deliver the Turbulence into the surrounding gas.

Gravitational Instability of filamentary clouds: Non-Ideal MHD regime

Shahram Abbassi

The gravitational instability of a filamentary molecular cloud in non-ideal MHD is investigated. the effect of ambipolar diffusion have been added to the filament which is threaded by an initial uniform axial magnetic field along its axis. The recent observations of the filamentary molecular clouds which clearly show that their properties deviate from the isothermal equation of state. Theoretical investigations proposed that the logatropic and the polytropic equations of state with negative indexes can provide a better description for these filamentary structures. We tried to develop out solution to compare the effects of these softer non-isothermal equation of states with their isothermal counterpart on the global gravitational instability of a filamentary molecular cloud. By incorporating the ambipolar diffusion, we use the non-ideal magnetohydrodynamics framework for a filament that is threaded by a uniform axial magnetic field. We perturb the fluid and obtain the dispersion relation both for the logatropic and polytropic equations of state by taking the effects of magnetic field and ambipolar diffusion into account. Our results suggest that, in absence of the magnetic field, a softer equation of state makes the system more prone to gravitational instability. We also observed that a moderate magnetic field is able to enhance the stability of the filament in a way that is sensitive to the equation of state in general. However, when the magnetic field is strong, this effect is suppressed and all th equations of state have almost the same stability properties Moreover, we find that for all the considered equations of state, the ambipolar diffusion has destabilizing effects on the filament..