Agenda for the Postdoc & Engineer Day

Time	Speaker	
10:00-10:05	Opening	
10:05-10:20	Grégoire Aufort	Simulation Based Inference of Star Formation History in the Euclid Deep Fields
10:20-10:35	Barnabàs Deme	The Boltzmann equation in generalized Hamiltonian mechanics
10:35-10:50	Federica Guidi	Towards precision cosmology with the extended fields of the South Pole Telescope
10:50-11:05	Kunyang Li	Using Dual AGNs to Predict the Rate of Black Hole Mergers
11:05-11:20	Sophie Huot	Euclid, one month before the launch
11:20-11:40	Coffee break	
11:40-11:55	Neda Heidari	Detection and characterization of long-period planet
11:55-12:10	Ali Rida Khalife	H_0 Olympics 2023-24 with SPT3G
12:10-12:25	Jean-Grégoire Ducoin	Follow up of gravitational waves events: focus on development for SVOM
12:25-12:40	Filip Alamaa	Radiation-mediated shocks in photospheric GRB observations
12:25-12:35	Conclusion	

Gregoire Aufort:

Title: Simulation Based Inference of Star Formation History in the Euclid Deep Fields

Abstract:

In this talk, we present a simulation-based inference approach for reconstructing the star formation history of galaxies using photometric data from the Euclid Deep Fields. Our method leverages Bayesian inference and the Horizon-AGN simulation cosmological hydrodynamical simulation to infer the star formation rates of galaxies, based on their observed photometry. We demonstrate the efficacy of our approach on a simulated sample of galaxies and discuss its potential applications of our approach in future galaxy evolution studies.

Barnabas Deme:

Title: The Boltzmann equation in generalized Hamiltonian mechanics

Abstract:

The relaxation of galaxies and dark matter halos can be described by the collisionless Boltzmann equation. Strictly speaking, such systems never reach an equilibrium state due to the lack of interactions between particles. However, after some time we find them in a so-called quasi-stationary state, to which they evolve via two processes: phase mixing and Landau damping.
The standard mathematical framework for the collisionless Boltzmann equation is (the symplectic) Hamiltonian mechanics. In this presentation I will review a generalized version of it, called the contact Hamiltonian mechanics. I will re-derive the Boltzmann equation in this new formalism and investigate its use in collisionless relaxation.

Federica Guidi:

Title: Towards precision cosmology with the extended fields of the South Pole Telescope

Abstract:

The South Pole Telescope (SPT) is a 10-meters diameter telescope observing the Cosmic Microwave Background (CMB) from the South Pole, with arcminute angular resolution. The third generation camera (SPT-3G) that was mounted on SPT in 2018 showed the remarkable performances of this experiment, which is currently one of the most competitive for CMB science. During the first observing season, SPT-3G observed its baseline sky patch (~1500 deg2) and obtained cosmological constraints consistent with those from the Planck mission. Deeper observations of the baseline field and observations in extended fields (additional ~3000 deg2) are currently ongoing, with the goal of achieving cosmological constraints at a level of precision comparable with Planck's, or even better. Notably, the SPT-3G and Planck constraints will be largely independent, and will make possible to shade light on the very much debated cosmological tensions. In this talk I will present the work I am doing at the IAP to achieve this exciting goal.

Kunyang Li:

Title: Using Dual AGNs to Predict the Rate of Black Hole Mergers

Abstract:

Dual active galaxy nuclei (dAGNs) trace the population of post-merger galaxies and are the precursors to massive black hole (MBH) mergers, an important source of gravitational waves that may be observed by LISA. We used the population of nearly 2000 galaxy mergers predicted by the TNG50-3 simulation to seed semi-analytic models of the orbital evolution and coalescence of MBH pairs with initial separations of about 1 kpc. We also calculate the dAGN luminosities and separation of these pairs as they evolve in post-merger galaxies, and show how the coalescence fraction of dAGNs changes with redshift. We present a method to estimate the MBH coalescence rate as well as the potential LISA detection rate given a survey of dAGNs. Comparing these rates to the eventual LISA measurements will help determine the efficiency of dynamical friction in post-merger galaxies.

Sophie Huot:

Title: Euclid, one month before the launch

Abstract:

IAP is very active in the the Euclid project, the spacial ESA mission destined to characterized dark energies. The laboratory is in charge of the simulation and the processing of VIS canal images. Simulation of images are at the very beginning of all images process before the launch of the satellite, that why this is so important for the mission. To be ready for the real data processing, simulated image need to be very accurate and realistic. At one month of the telescope launch, we now need to add the real model that directly come from the test of the instrument.

Neda Heidari:

Title: Detection and characterization of long-period planet

Abstract:

Transiting planets with orbital periods longer than 40 days with mass and radius determined are extremely rare, accounting for only 1% of the 5000+ discovered planets. The two methods of radial velocity and photometry, each have their own unique challenges when it comes to detecting these long-period planets. As a result, the study of planet demographics, formation, evolution, and star-planet relations is hampered by the absence of these populations. In this talk, I will discuss my work at IAP to discover and characterize this "missing population".

Ali Rida Khalife:

Title: H_0 Olympics 2023-24 with SPT3G

Abstract:

Since it’s a appearance almost a decade ago, the Hubble Tension has witnessed an avalanche of theoretical models that attempt to alleviate it, with no “winning” model yet. However, with recent and upcoming data from the South Pole Telescope’s 3^d generation camera(SPT-3G), combined with others, will bring better constraints on these models. In this talk, I will briefly describe the Hubble tension, attempts to solve it and how well do those models fit this data.

Jean-Gregoire Ducoin:

Title: Follow up of gravitational waves events: focus on development for SVOM

Abstract:

I will discuss the challenge of the search for electromagnetic counterparts of gravitational waves events. I present the recent development dedicated to the SVOM satellite observations made at IAP for O4 (starting at the end of may).

Filip Alamaa Samuelsson:

Title: Radiation-mediated shocks in photospheric GRB observations

Abstract:

Radiation-mediated shocks (RMSs) below the photosphere may play an important role in the prompt emission of gamma-ray bursts (GRBs). However, fitting an RMS model to data has been infeasible due to the computational cost of simulating such shocks. We bridge the gap between theory and observation by creating an approximate but accurate model called the Kompaneets RMS approximation (KRA). In this talk, I present the first-ever fit of a prompt GRB spectrum with an RMS model. Furthermore, using the KRA we can quantitatively study the observational properties of shock-heated photospheric emission in GRBs. We find that the modeled photospheric emission is spectrally consistent with the majority of observed GRBs. Additionally, the spectra often exhibit an additional break in X-rays, similar to observations. In conclusion, dissipative photospheric models are an interesting, viable candidate for the prompt emission in GRBs.