

Astrophysics Seminar Speakers

2022-23

Philip Wiseman (University of Southampton)

Explosive Environmentalists: the critical connections between type Ia supernovae and their host galaxies

26 October 2022

Some of the most fundamental questions in astronomy relate to how stars live and die. Significant efforts in observing, classifying and understanding the evolution and ultimate destruction of white dwarf stars — type Ia supernovae (SNe Ia)— have been made over the past century, culminating in modern surveys that are capable of detecting tens to hundreds of SNe every night, and using them to measure distances in the Universe to unprecedented precision. Despite these advances and the uniformity of the SNe, the exact nature of the progenitor system and explosion mechanism remains a mystery.

In this talk, I will outline the toolkit made available by studying the host galaxies of SNe Ia, and how the galaxies relate to different characteristics of SNe themselves. I will then show how this toolkit is being deployed on the rich dataset provided by the Dark Energy Survey, including an insight into the mysterious progenitor scenario as well as uncovering unexplained links between the brightness and colour of type Ia SNe and their host galaxy environments, which will aid the process of standardising their brightnesses even further.

Michelle Collins (University of Surrey)

Tiny galaxies, massive questions: Understanding the Universe with dwarf galaxies

9 November 2022

Thanks to revolutions over the past few decades in how we image the sky, astronomers have been able to detect ever fainter galaxies in our cosmic backyard. Some of these are fainter than a single giant star and - whilst visually unimpressive - they are extremely important tools in our quest to understand (1) how galaxies form and (2) what our Universe is made up of. In this talk, I will review how we use observations of the faintest galaxies to probe the very nature of the Universe. I will show the work my group are doing to detect the faintest galaxies, measure and constrain the properties of dark matter, and to understand how star formation progressed in the very early Universe.

Hannah Übler (University of Cambridge)

Galaxy kinematics at cosmic noon and beyond

1 December 2022

Galaxy kinematics not only tell us about the dynamical state of a system, but they are used to constrain the redshift evolution of galactic mass budgets, a fundamental aspect of galaxy evolution. In this seminar, I will review our knowledge of galaxy kinematics at $z \sim 1-3$, with a focus on spatially-resolved integral-field spectroscopic data. The cosmic noon period is of particular interest due to the intensity of ongoing baryonic processes such as star formation, but it also represents the limit of current ground-based work exploiting well-studied rest-frame optical lines. With new data from JWST we are now able to push kinematic studies based on e.g. H-alpha out to $z \sim 7$, to witness the build-up of the first massive galaxies. I will highlight early results and prospects for kinematic studies of galaxy evolution within the first year of JWST observations.

Ting-Yun Cheng (Durham University)

Beyond the Hubble sequence - exploring galaxy morphology with machine learning

1 March 2023

Astronomy today is in an exciting and challenging era with the fast-increasing amount of data from large-scale sky surveys and future facilities. This necessitates the development of machine learning techniques in astronomical studies to help improve conventional analyses in various aspects, as well as inspire new perspectives to look into data. In this talk, I will share my experience of machine learning techniques on galaxy morphology. We construct one of the largest galaxy morphological classification catalogues including over 20 million galaxies for the Dark Energy Survey using a convolutional neural network. Galaxy morphology is further explored by unsupervised machine learning to avoid human's opinion in categorisation. With our novel approach, galaxies in the local universe are categorised into 27 classes with distinctive physical properties. In addition to the improvement in efficiency and accuracy of astronomical analysis, I will also discuss some problems we faced in these works with machine learning approaches.

Patricia Schmidt (Birmingham University)

Prospects for Gravitational-Wave Asteroseismology with Binary Neutron Stars

29 March 2023

Gravitational waves (GWs) from colliding neutron star binaries provide a unique means to probe matter and fundamental physics at supranuclear densities. Whilst adiabatic tidal effects related to the tidal deformability of the star leave the strongest imprint in the gravitational-wave signal, additional dynamical tidal effects due to the stars' fundamental oscillation modes (f-modes) arise at late times in the binary inspiral, modifying the GW phase at high frequencies. In this seminar, I will illustrate how this small change of the GW signal makes f-mode asteroseismology an accessible observable with GW detections of the inspiral phase due to its explicit dependence on the f-mode frequency. I will then show that without invoking universal relations we can place a lower limit on the f-mode frequency for current GW observations. Finally, I will present

prospects for measuring the f-mode frequency from inspiraling neutron star binaries with future GW observatories such as the Einstein Telescope or Cosmic Explorer and demonstrate that the neglect of dynamical tides can lead to a biased inference of the nuclear equation of state.

Chris Harrison (Newcastle University)

How supermassive black holes do (or don't) impact upon their host galaxies and turning astronomical data into sound

26 April 2023

This talk will take two parts. In part 1 I will focus on the question of how growing supermassive black holes, known as active galactic nuclei, influence the gas in their host galaxies. Using a galaxy sample in the nearby Universe, I will use our multi-wavelength observations to show the surprisingly important role of low power jets of charged particles, launched from the central super massive black holes. These jets are shown to drive flows of gas in multiple phases, from small to large scales. I will also show that this ‘‘feedback’’ effect does not instantaneously influence the whole galaxy, which agrees with current simulations – even though these simulation predictions are often misinterpreted in the literature. In part (2) I will discuss our ongoing work to turn these types of data, and others, into sound (through ‘sonification’). Our motivation for this is for enhancing scientific discovery, making more engaging educational content, and making astronomy more accessible to those who are blind or have low vision.