Che-Yu Chen

Title：Regular black holes and traversable wormholes supported by 3-form

Abstract：
In this talk, we will discuss the possibility of constructing non-singular black holes and traversable wormholes in a minimally coupled 3-form model endowed with a proper potential. In the case of regular black holes, the singularity is replaced by a Nariai-type spacetime, in which the radius of the 2-sphere approaches constant. The interior geometry is compactified but continues to expand indefinitely. In the case of wormholes, the geometry has a single throat and it is everywhere regular and asymptotically flat. In particular, the 3-form wormholes could be potential black hole mimickers because they may cast shadow contour indistinguishable from that of a Schwarzschild black hole. In both the regular black hole and wormhole scenarios, the null energy condition has to be violated.

He-Feng Hsieh

Title：A Kilo-Hertz Gravitational Wave Feature in Rapidly Rotating Core-Collapse Supernovae

Abstract：

Shu-ichiro Inutsuka

Title：Star Formation in The Galactic Disk: A Bubble-Filament Paradigm

Abstract：
Recent observations have emphasized the importance of the formation and evolution of magnetized filamentary molecular clouds in the process of star formation. Theoretical and observational investigations have provided convincing evidence for the formation of molecular cloud cores by the gravitational fragmentation of filamentary molecular clouds. Thus, the mass function and rotations of molecular cloud cores should be directly related to the properties of the filamentary molecular cloud, which determines the initial size and mass distribution of a protoplanetary disk around a protostar created in a core. In this talk I explain our current understanding of the star formation processes in the Galactic disk, and summarize various processes that are required in describing the filamentary molecular clouds to understand the star formation rate/efficiency, and the stellar initial mass function. I will also address how massive stars form in dense molecular clouds identified as “hub-filament systems”, which can be understood in an extension of the filament paradigm.

Min-Kai Lin

Title：Hopes and challenges in modern planet formation

Abstract：
Planet formation appears ubiquitous in the universe. However, the road from micron-sized grains to fully grown planets is all but smooth. I will present recent studies on the formation

of planetesimals -- the building blocks of planets -- in models of protoplanetary disks that account for turbulence, stratification, and magnetic fields, which have not been considered in this context. I will describe new difficulties, but also possible new paths to planet formation under these conditions.

Yueh-Ning Lee

Title : From Prestellar Cores to Protoplanetary Disks

Abstract :
The formation of stars out of the diffuse interstellar medium happens through intermediate stages: the prestellar dense core and the protoplanetary disk, in particular. The general scenario that the prestellar core more or less serves as the mass reservoir of the star and that the accretion is mediated by the disk is commonly presumed. With improvements in observation techniques that now allow to resolve small scale structures and advances in the understanding of the detailed physics of star formation, the deterministic view of star formation has been constantly challenged. In this talk, I will touch on some aspects of links between stellar properties and that of its formation environment. First, is the stellar mass related to that of the cores? Second, do disk properties reflect that of the core or the star?

Kuo-Chuan Pan

Title : Hearing the sound of gravitational waves from Core-Collapse Supernovae

Abstract :
Core-Collapse supernovae are among the most energetic explosions in the universe and are birthplaces of neutron stars and stellar-mass black holes. Detection of gravitational waves from a nearby core-collapse supernova will be the next milestone of gravitational-wave astronomy and multimessenger astrophysics. In this presentation, I will discuss the numerical challenges in modeling these systems that involved detailed micro-and macro-physics and present a few recent full 3D simulations with realistic neutrino transport. In particular, I will focus on a few unique gravitational wave features from core-collapse supernovae that might be detected with the current gravitational wave detectors, e.g., Advanced LIGO, Virgo, and KAGRA.

Ue-Li Pen

Title : cosmic helicity and the origin of angular momentum

Abstract :
The majority of galaxies are rotating spirals, with an observable rotation axis. I will describe the origin of this conserved angular momentum, and how it probes the small scale initial conditions of the universe. This is confirmed in simulations and observations, and places constraints on early universe helicity. Future analyses of existing data may improve the measurements substantially through machine learning. I end with speculations on origins of helicity in inflation and other theories of initial conditions.

Hung-Yi Pu

Title : Modeling Black Hole Images at Horizon Scales

Abstract :
A new window to strong gravity has been opened after the first black hole images announced by the Event Horizon Telescope Collaboration. In this talk, I would like to introduce the modeling of horizon scale images for astrophysical black holes, including current success and challenges.

Hsi-Yu Schive

Title : Soliton Random Motion in Fuzzy Dark Matter

Abstract :
Fuzzy dark matter (FDM), composed of ultralight (~10^{-22} eV) bosons, is a promising dark matter candidate. It exhibits rich wave-like structures, including a soliton core surrounded by a granular halo. In this talk, I will address the soliton random motion, including its confined Brownian motion and density oscillations. The former leads to a new challenge against FDM since the resulting soliton tidal field may completely disrupt the ancient star clusters in the center of dwarf galaxies. In comparison, the gravitational heating from density oscillations is inefficient and adiabatic since the oscillation timescale is substantially longer than the characteristic timescale of a star cluster.

Jeremy Smallwood

Title : Protoplanetary Disc Dynamics around Higher-order Star Systems

Abstract :

Hsien Shang

Title : Visualizing Formation of Molecular Outflows

Abstract :

Hsiang-Yi Karen Yang

Title : The Microphysics of AGN Feedback in Galaxy Clusters

Abstract :
Feedback from active galactic nuclei (AGN) plays a critical role in determining the evolution of massive galaxies and clusters; however, the feeding and feedback processes of the central supermassive black holes remain elusive. In particular, our understanding of AGN feedback has been hindered by the "microphysics" -- physical processes that operate on microscopic

scales that are not captured by ideal hydrodynamic simulations. In this talk, I will summarize the recent progress in this field and highlight the ongoing research in the NCTS Astrophysics Division.