Nadine Soliman

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EDUCATION

CALIFORNIA INSTITUTE OF TECHNOLOGY | Doctor of Philosophy in Astrophysics   Expected June 2025
Advisor : Philip F. Hopkins

NEW YORK UNIVERSITY ABU DHABI (NYUAD) | Bachelor of Science in Physics   May 2019
Minors in Computer Science & Applied Mathematics
Thesis : Post-processing Predictions of Black Holes Accretion Models in Cosmological Simulations
Advisor : Andrea Macciò
Study Abroad : Courant Institute of Mathematical Sciences - New York University   2017-2018

RESEARCH INTERESTS

Astrophysical Dust • Fluid Instabilities • Turbulence • Radiation-magneto-hydrodynamics • ISM dynamics • Mathematical Modelling • Black hole formation and feedback • Star formation and feedback • Planet formation • High-energy Astrophysics

RESEARCH EXPERIENCE

HOPKINS CALTECH GROUP | PI: Philip F Hopkins   Oct 2020 - Present

- Conducting radiation-magneto-hydrodynamics simulations with a focus on dusty fluid dynamics, employing the GIZMO code with explicit evolution of dust grain dynamics.
- Investigating the influence of dust on the dynamics and thermodynamic evolution of various astrophysical settings, including dusty active galactic nuclei tori and star-forming giant molecular clouds.
- Running STARFORGE simulations of star formation processes to assess how different dust models influence star formation efficiency and the resulting properties of stars formed within the system.

NYUAD GALAXY FORMATION GROUP | PI: Andrea Macciò   Sep 2019 - Oct 2020

- Implemented sub-grid black hole accretion models like the viscous disk and gravitational torque based accretion in the GASOLINE2 N-body code.
- Ran the NIHAO galaxy formation simulations to compare different black hole accretion models and constrain the models' parameter space utilizing observational data sets.
- Created a post-processing python algorithm to determine black hole accretion for galaxy simulations and implemented semi-analytic models to test hypotheses more efficiently and with faster algorithms.

NEW YORK UNIVERSITY ABU DHABI | PI: Ian Dobbs-Dixon   May 2019 - May 2020

- Utilized the NINE orbital integration package to investigate the orbital stability of potential Earth-like planets within the habitable zone of 55 Cancri through running numerical simulations.
- Reduced the computational time of the simulations while minimizing errors to study the system's long-term evolution.
- Determined the detectability of earth-like planets within the habitable zones of stars with giant planets by utilizing analytical solutions to provide maximum and root mean square values of radial velocity and astrometric signals.

MAX PLANCK INSTITUTE FOR ASTRONOMY | PI: Andrea Macciò   Jun 2018 – Aug 2018

- Statistically modelled and analyzed the NIHAO galaxy population to probe the evolution of black hole - host galaxy scaling relations such as the Black Hole Mass - Sigma and Black Hole Mass - Bulge Mass relations.
- Presented weekly project results at group and faculty meetings in addition to reviewing recent research articles with professors and attending conference talks.

DEUTSCHES ELEKTRONEN-SYNCHROTRON (DESY) | PI: Timo Karg   Jun 2017 – Sep 2017

- Worked across the engineering and physics IceCube teams to provide technical improvements of instrumentation through hardware testing and calibration of silicon photo-multipliers, detector readout boards and scintillation panels to be deployed to the IceCube Neutrino Observatory in the South Pole.
- Implemented noise reduction, signal detection and performance stability algorithms to maximize performance.
- Instructed a group of 4 students at NYUAD on experimental design, hardware integration and testing detectors.

NYUAD SMART MATERIALS LAB | PI: Pančе Naumov   Jun 2016 – Sep 2016

- Employed analytical techniques and mathematical models to determine the structure of thermosalient benzoic crystals.
- Utilized methods of X-ray diffraction, Thermal Gravimetric analysis and Differential Scanning Calorimetry to characterize the nature of the crystal's thermal transition event.

PUBLICATIONS

Accepted or In Preparation Journal Articles

1. **Nadine H Soliman** and Philip F Hopkins. Dust Dynamics in AGN Winds: A New Mechanism For Multiwavelength AGN Variability. arXiv preprint arXiv:2210.13517, 2022

2. **Nadine H Soliman**, Andrea Macciò, and Marvin Blank. Co-Evolution vs. Co-existence: The Effect of Accretion Modeling on the Evolution of Black Holes and Host Galaxies. Submitted to MNRAS, 2022

3. Philip F Hopkins, Anna L Rosen, Jonathan Squire, Georgia V Panopoulou, **Soliman, Nadine H**, Darryl Seligman, and Ulrich P Steinwandel. Dust in the Wind with Resonant Drag Instabilities: I. The Dynamics of Dust-Driven Outflows in GMCs and HII Regions. Monthly Notices of the Royal Astronomical Society, 517(1):1491–1517, 2022

4. Marvin Blank, Andrea V Macciò, Xi Kang, Keri L Dixon, and **Nadine H Soliman**. NIHAO–XXVII: Crossing the Green Valley. Monthly Notices of the Royal Astronomical Society, 514(4):5296–5306, 2022

5. Marvin Blank, Liam E Meier, Andrea V Macciò, Aaron A Dutton, Keri L Dixon, **Nadine H Soliman**, and Xi Kang. NIHAO–XXVI: Nature versus Nurture, the Star Formation Main Sequence, and the Origin of its Scatter. Monthly Notices of the Royal Astronomical Society, 500(1):1414–1420, 2021

FELLOWSHIPS & AWARDS

KECK INSTITUTE FOR SPACE STUDIES AFFILIATE   Jan 2023

NYUAD POST-GRADUATE RESEARCH FELLOW   Sep 2019 - Oct 2020

UNIVERSITY HONORS SCHOLAR/ NYU FOUNDERS' DAY AWARD   May 2019

TEACHING & MENTORING

RADIATIVE PROCESSES - AY 121 | Teaching Assistant   Fall 2022

STRUCTURE AND EVOLUTION OF STARS - AY 123 | Teaching Assistant   Winter 2022

RADIATIVE PROCESSES - AY 121 | Teaching Assistant   Fall 2021

WOMEN EMPOWERMENT IN STEM AT NYUAD | Student Mentor   Sep 2018 – May 2019

RELEVANT PROJECTS

MONTE CARLO SIMULATION OF CRATERING ON JUPITER'S MOONS   March 2022

- Implemented a Monte Carlo simulation to investigate the origin of the differential cratering rate on the surface of Ganymede and Callisto.
- Compared simulation results to observations to constrain the synchornization time of the moons, and studied the effect of crater erasure due to new impacts.

SPH SIMULATION OF PROTO-PLANETARY ACCRETION DISKS   Dec 2018
- Implemented Smoothed-Particle Hydrodynamic Code in python to simulate viscous α-disk accretion.
- Investigated the effect of different α/viscosity parameters and thickness to radius ratios of the accretion disk on the accretion rates of the central object.

IBM - ETIHAD HACKATHON | PERSONALIZED TRAVEL APP   NOV 2016
- Utilized IBM's Artificial Intelligence platform, Watson, and Twitter scraping to generate personality profiles using the user's Twitter data to create a web app for personalized travel.
- Created a database of labelled personality traits/destinations which was used to sort the personality profiles.

SKILLS

PROGRAMMING LANGUAGES
Over 5000 lines: C • Python • Java
Over 1000 lines: Haskell • JavaScript • Matlab • Coq
Over 500 lines: HTML • CSS

SCIENTIFIC TOOLS
GIZMO simulation code • SLURM • UNIX • Linux • Miriad Data Reduction Software • Karma Visualization Suite • GASOLINE2 N-body Code • NINE Orbital Integration Package • Pynbody Analysis Package • Scikit-learn

SPOKEN & WRITTEN
English • Fluent
Arabic • Native