

Lars Lund Thomsen

Researcher in Hong Kong

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EDUCATION

The University of Hong Kong

Hong Kong

Ph.D., Astrophysics

August 2023

Dissertation: *Understanding Extreme Accretion and Outflows Around Black Holes through Radiative Transfer Studies*

Advisor: Jane Lixin Dai & Stephen Ng

Honours:

Outstanding (top 5%)

The University of Copenhagen

Copenhagen, Denmark

M.S., Niels Bohr Institute, Astrophysics

August 2019

Thesis: *Theoretical Modelling of X-Ray Reverberation from Super-Eddington Accretion Disks*

Advisor: Jane Lixin Dai & Enrico Ramirez-Ruiz

GPA:

94/100

The University of Copenhagen

Copenhagen, Denmark

B.S., Physics

August 2016

Minor: Astronomy,

Research Project: *Estimation of Masses of Supermassive Black Holes*

Advisor: Marianne Vestergaard & Sandra Raimundo

GPA:

88/100

RESEARCH EXPERIENCE

The University of Hong Kong

Hong Kong

Modelling Tidal Disruption Events

August 2021 – Now

- Conducted research on modelling the light emitted during the process of stars being devoured by black holes (Tidal Disruption Events).
- Integrated high-resolution accretion disk simulations with radiative transfer code to develop the most sophisticated theoretical model to this date, which can explain many of the puzzling observed features.
- Demonstrated expertise in interpreting simulation results, and comparing it to observations.
- Currently engaged in ongoing work involving the development of a Gaussian Process machine-learning emulator for parameter estimation when fitting to observation.

The University of Hong Kong & The University of Copenhagen

Hong Kong/Denmark

X-Ray Reverberation Studies

January 2018 – December 2022

- Conducted extensive research on the utilisation of light echoes, specifically X-ray reverberation, to probe the geometry of accretion disks surrounding black holes in Active Galactic Nuclei (AGNs). This was achieved through the analysis of spectral features and Fourier analysis of time series.
- Developed a generalised approach for X-ray reverberation that can be applied to any geometry, significantly expanding the applicability of the technique. Due to the lack of available analytical descriptions for fast growing black holes, accretion disk simulations were adopted in this regime.
- Validated the research findings and model through the use of Markov-Chain Monte Carlo simulations to find the best fit parameter, such as the black hole mass. These simulations involved fitting observational data to a fast-growing black hole scenario, resulting in statistically significant evidence favouring the presence of a geometrically thick disk over the commonly assumed thin disk.

The University of Copenhagen

Denmark

Black Hole Mass Estimates

December 2015 – July 2016

- Doppler effects cause emission lines to undergo redshift or blueshift, depending on their motion relative to us. The gas velocity surrounding black holes is influenced by the gravitational potential, resulting in rotation.
- By analysing the line width and distance to the emitting region, it is possible to estimate the mass of a black hole. However, which emission lines provide a more precise estimation with less variation?
- I conducted modelling on the three primary optical emission lines, namely MgII, H β , and CIV. By fitting the spectral line profile and incorporating uncertainty propagation, I determined that H β lines offer smaller errors, resulting in a more consistent estimation of the black hole mass.

TEACHING EXPERIENCE

The University of Hong Kong

Hong Kong

Teaching Assistant for Astrophysics & Principles of Astrophysics

September 2020 - June 2023

- Assisted in the instruction of two introductory courses in astrophysics, delivering weekly lectures and leading problem-solving sessions for a group of 20-40 students each semester.
- Provided constructive feedback for assignments, exams, and homework to promote student learning and growth.

The University of Hong Kong

Virtual Lab Instructor

Hong Kong

September 2019 - June 2020

- Transitioned second semester lab exercises to virtual format due to Covid-19. As principal demonstrator, live-streamed all lab exercises and adjusted teaching methods for online setting.
- Ensured inclusive learning experience despite challenges of having virtual labs. Actively engaged students by asking questions, making common mistakes, and prompting discussion on identifying and rectifying errors.

The University of Hong Kong

Teaching Certificate

Hong Kong

December 2019

- Through an 18 hours course, I obtain a teaching certificate where I learned about:
- Outcome Based Approaches to Student Learning (OBASL), Assessment and Feedback, Designing Learning Activities and Continuing Professional Development

PUBLICATIONS

[1] **Thomsen L. L.**, Lixin Dai J., Ramirez-Ruiz E., Kara E., Reynolds C.,
“X-Ray Fluorescence from Super-Eddington Accreting Black Holes,”
Astrophysical Journal Letter, 884, L21. doi:10.3847/2041-8213/ab4518, October 2019.

[2] **Thomsen L. L.**, Dai L., Kara E., Reynolds C.
“Relativistic X-Ray Reverberation from Super-Eddington Accretion Flow ,”
Astrophysical Journal, 925, 151. doi:10.3847/1538-4357/ac3df3, February 2022.

[3] **Thomsen L. L.**, Kwan T. M., Dai L., Wu S. C., Roth N., Ramirez-Ruiz E.,
“Dynamical Unification of Tidal Disruption Events ,”
Astrophysical Journal Letter, 937, L28. doi:10.3847/2041-8213/ac911f, October 2022.

[4] Leloudas G., Bulla M., Cikota A., Dai L., **Thomsen L. L.**, et al.,
“An asymmetric electron-scattering photosphere around optical tidal disruption events,”
Nature Astronomy, 6, 1193. doi:10.1038/s41550-022-01767-z, September 2022

CONTRIBUTED CONFERENCE TALKS

Astrophysical Black Holes: A Rapidly Moving Field

Talk: Dynamical Unification of Tidal Disruption Events -

Linking theoretical accretion disk simulations to observations of TDEs

Hong Kong

23rd-26th June, 2023

237th American Astronomical Society Meeting:
Talk: Explaining the X-Ray Reverberation of the TDE
Swift J1644+57 with Super-Eddington Accretion Flow

Online
January 11th-15th, 2021

CUHK Student Conference
Talk: X-ray Reverberation on Super-Eddington Accretion Disks

Hong Kong/Online
September 9th 2020

30th Texas Symposium on Relativistic Astrophysics
Talk X-ray Fluorescence from Super-Eddington Accreting Black Holes
INVITED CONFERENCE TALKS

Portsmouth, UK
15-20 December 2019

Tidal Disruption Events and Nuclear Transients:
Entering the Data-Rich Era
Title to be determined!

Heraklion, Greece
2-6 September 2024

AWARDS, GRANTS & FELLOWSHIPS

Dissertation Year Fellowship (DYF) , 331,200 HKD	2023-2024
Outstanding PhD Thesis work (Top 5% of Submitted Thesis)	2023
Hong Kong PhD Fellowship Scheme (HKPFS) , 1,324,800 HKD	2019-2023
The Best Presentation at Conference, CUHK Student Conference	2020

COLLABORATIVE VISITS

University of California Santa Cruz (2 weeks)	2023
NBIA Workshop on Radiation Transfer in Astrophysics, Denmark (1 week)	2022
Cambridge University, UK (1 week)	2019

ACADEMIC SERVICE

Reviewer for scientific journals	2022-Now
Co-supervising one Postgraduate Student	2021-Now
Co-supervised two undergraduates for their Final Year Project	2019-2023

LEADERSHIP & OUTREACH

Heising-Simons Faculty Mentoring Network Retreat

2022

Participated in a diversity workshop in the US to gain a deeper understanding of the obstacles that females and people of racial and ethnic minorities face in academia and how we can help create a more inclusive environment.

Lead Journal Club

2019-2022

Restarted and led the weekly journal club meetings at The University of Hong Kong, where we discuss two new papers each week.

Science Expo 2021 in Hong Kong

2021

Created a video explaining my research work to the public in an easy-to-understand manner for the Science Expo.