

# Taeho Ryu

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CONTACT INFORMATION	The Max-Planck Institute for Astrophysics, Karl-Schwarzschild-Str. 1 85748, Garching, Germany	<i>E-mail:</i> tryu@mpa-garching.mpg.de <i>Phone:</i> +1 5515740406, +49 1743130001 <i>Citizenship :</i> Korean citizen US permanent resident
PROFESSIONAL EXPERIENCE	<b>The Max-Planck Institute for Astrophysics - MPA</b> , Germany MPA fellow (100% independent)	2021 – present
	<b>Johns Hopkins University - JHU</b> , USA Postdoctoral research fellow	2018 – 2021
EDUCATION	<b>Stony Brook University - SBU</b> , USA Ph.D., Physics, 2018 (Advisor: Professor Rosalba Perna) M.A., Physics, 2014	2014 – 2018
	<b>Korea Institute for Advanced Study - KIAS</b> , South Korea Research Assistant to Professor Kimyeong Lee (Department of Physics)	2011 – 2012
	<b>Seoul National University - SNU</b> , South Korea B.S. in Chemistry & Physics (Double-major/Cum Laude) Teaching Practicum in chemistry	2005 – 2011
RESEARCH	<b>Primary interests:</b> Time domain Astronomy, Multi-messenger transients, Tidal disruption events, Gravitational waves, Formation of runaway/hypervelocity stars, Supermassive black hole binaries, Formation and interaction of Black Holes in the early universe - AGN & High-Mass X-ray Binaries, Dynamics of stellar clusters, Exoplanets.  <b>Methods:</b> Relativistic and Newtonian hydrodynamics simulation, $N$ -body simulations, time-dependent Fokker-Planck integrator, stellar evolution simulation	
HONORS, AWARDS AND AFFILIATION	<b>IAU junior member</b> , the International Astronomical Union <b>Member</b> of LISA consortium <b>Member</b> of KSEA <b>Dresden Prize</b> (for outstanding theoretical thesis prize), SBU <b>Peter B. Kahn Fellowship</b> , SBU <b>SNUANY Scholarship Award</b> , Seoul National University Alumni Association of Greater New York -SNUANY <b>SNUANY Scholarship Award</b> , SNUANY <b>The Benjamin Lee Award</b> , SBU <b>SNU Outstanding Student award</b> (Twice winner), SNU, <b>National Scholarship for Science &amp; Engineering</b> (Thrice winner), Korea Student Aid Foundation, <b>SNU Scholarship for Superior Academic Performance</b> (Five-time winner), SNU, 2005 - 2007	06/2022 - present 11/2022 - present 09/2014 - present 05/2018 05/2016 11/2014 12/2013 05/2013 2009 - 2010 2009 - 2010 2005 - 2007

SUPERCOMPUTING ALLOCATIONS	<b>Principal Investigator:</b> <i>HLRS</i> (Stuttgart tier 1), project name : <i>Global Relativistic Magneto-hydrodynamics Simulations of the Long-term Evolution of Tidal Debris in Tidal Disruption Events of Stars</i> , amount : <b>55M</b> cpu hours on Hawk	
	<b>Project Manager (Principal Investigator: Volker Springel):</b> <i>NHR@FAU</i> (tier 2), project name : <i>Transient formation in three-body encounters between stars and black holes</i> , amount : <b>3.6M</b> cpu hours on Fritz	
INVITED TALKS	<b>HUJI Astrophysics Seminar</b> , HUJI, Isreal	03/2023
	<b>2022 MIAPP Conference “The Fundamental Role of Stellar Multiplicity in Stellar Dynamics and Evolution”</b> , MIAPP, Germany	11/2022
	<b>Department colloquium</b> , the University of Tübingen, Germany	07/2022
	<b>Black hole workshop</b> , the Niels Bohr Institute, Denmark	06/2022
	<b>MPA seminar</b> , MPA, Germany	10/2021
	<b>Astro UdeC Seminar</b> , the Universidad de Concepción, Chile	04/2021
	<b>CTC seminar</b> , University of Maryland, USA	06/2019
	<b>Wine&amp;Cheese seminar</b> , Johns Hopkins University, USA	04/2019
	<b>Department seminar</b> , SBU, USA	04/2018
	<b>Numerical scattering workshop</b> , the Flatiron Institute, USA	12/2017
	<b>AST200 course</b> (by Prof. Jin Koda, talk for undergradate students), SBU	02/2017
	<b>Black Hole Network Workshop</b> , the Flatiron Institute, USA	12/2016
	<b>MODEST-16 NYC Gas and Gravitational Dynamics</b> , USA	09/2016
	<b>Saint-Petersburg WORKSHOP 2016</b> , Russia	09/2016
	<b>Frontier Research in Astrophysics – II</b> , Italy	05/2016
	<b>Astronomy Seminar</b> , Columbia University, USA	05/2016
CONTRIBUTION TALKS	<b>The Black Holes and Gravitational Waves Munich Day</b> , Germany	05/2023
	<b>Aspen workshop “Extreme Black Hole”</b> , USA	03/2023
	<b>WE Heraeus-EAS Early Career Researchers in Astronomy Workshop 2023</b> , Germany	03/2023
	<b>XMM-Newton Workshop 2022</b> , Spain	06/2022
	<b>Growing black holes: Accretion and mergers</b> , Nepal	05/2022
	<b>SESTAS meeting</b> , MPA	10/2021
	<b>HotSci@JHU/STScI</b> , STScI	08/2021
	<b>European Astronomical Society Annual Meeting</b> , Leiden	07/2021
	<b>Tidal Disruptions in Kyoto: Confronting Theory with Observations</b> , Yukawa Institute for Theoretical Physics, Kyoto university, Japan	01/2020
POSTER	<b>Distorted Astrophysical disks</b> , University of Cambridge	05/2021

	<b>The 7<sup>th</sup> Annual Johns Hopkins Postdoctoral Conference, JHU</b>	04/2021
TEACHING EXPERIENCE	<b>Teaching Assistant</b> , Department of Physics and Astronomy, SUNY, USA	2012-2014
	<b>Teaching practicum</b> , Seoul National University Girls' Middle School, South Korea	Spring 2011
	<b>Teaching Assistant</b> , Language Education Institute, SNU, South Korea	Spring 2011
	<b>Teaching Assistant</b> , Central Library, SNU, South Korea - Enhancing librarians' grasp of basic scientific concepts in chemistry and physics	Spring 2009
	<b>Teaching Assistant</b> , Hansung high school, South Korea - Volunteer work to teach mathematics for high-school students	Spring 2009
STUDENT SUPERVISION	Alonso Herrera (Master student, co-supervising with prof. Nathan Leigh), Universidad de Concepción (2021-present)	
	José Pinto (Master student, co-supervising with prof. Nathan Leigh), Universidad de Concepción (2021-present)	
	Kaitlyn Szekerczes (PhD student, Fulbright fellow, co-supervising with prof. Sherry Suyu), TUM (2022-present)	
	Pavan Vynatheya (PhD student, co-supervising with Dr. Rüdiger Pakmor, prof. Selma de Mink), MPA (2022-present)	
OUTREACH EXPERIENCE	<b>Girls' day, MPA, Germany</b>	04/2023
	preparation and execution of one of the five sessions where a group of high-school female students completes a given task.	
	<b>SEDS Celestia, BITS Pilani, India</b>	01/2023
	Invited public lecture about black hole and tidal disruption event	
	<b>Member of the MPA planetarium team</b>	04/2022 - present
	Present a planetarium show, lecture or talk to students visiting MPA	
	<b>Making a movie with NASA for the annual event "Black Hole Friday"</b>	
	0.3M views on YouTube in less than a week ( <a href="https://www.youtube.com/watch?v=ALnlZcRoQDY&amp;t=23s">https://www.youtube.com/watch?v=ALnlZcRoQDY&amp;t=23s</a> )	
	<b>The Johns Hopkins Korean Graduate Student Association, JHU</b>	09/2019
Invited public talk for Networking night (annual event)		
<b>SNU Obstacle Person Support Center, SNU, South Korea</b>	Spring 2009	
Assistant to a hearing-impaired student, and provider of study aid		
<b>Kyujanggak Institute for Korean Studies, SNU, South Korea</b>	Spring 2011	
Docent Program: Improving public understanding of Documentary Heritage of Chosun Dynasty		
<b>Museum of Art, SNU, South Korea</b>	Spring 2011	
Docent Program: Improving public understanding of interactive media art in The Garden of Forking Paths		

PROFESSIONAL SERVICE	Referee for <i>Monthly Notices of the Royal Astronomical Society</i> , <i>The Astrophysical Journal</i>	
LEADERSHIP EXPERIENCE	<p><b>Seminar organizer</b>, the Stellar Department at MPA <span style="float: right;">09/2021 - 09/2022</span>  Role: invite speakers (typically two speakers for each week), schedule seminars and chair the sessions for talks and discussions (along with two other organizers)</p> <p><b>Department of Chemistry</b>, SNU, South Korea <span style="float: right;">2005 - 2006</span>  Department Activities Representative and Organizer  (Student competitions, membership training, freshmen welcoming, etcetera)</p> <p><b>SNU Campus Life and Culture Center</b>, SNU, South Korea <span style="float: right;">2010 - 2011</span>  Mentor-team Manager in SNU Compliance/Mentoring Program  Elected Leader (30 members, My team chosen Best Team of the Year)</p>	
TECHNICAL EXPERIENCE	<p><b>Computing skills:</b> Fortran, C/C++, Python</p> <p><b>Code:</b> development of multi-domain infrastructure PATCHWORKMDH, usage of GRMHD code HARM3D, Moving-mesh magnetodynanics code AREPO (<a href="https://arepo-code.org/">https://arepo-code.org/</a>), Newtonian AMR hydrodynamics code CASTRO (<a href="https://amrex-astro.github.io/Castro/">https://amrex-astro.github.io/Castro/</a>)</p> <p><b>Analysis:</b> python, Matplotlib, Paraview, mathematica, GNUplot</p> <p><b>Presentation:</b> Latex, Overleaf, Wordpress, Microsoft Office, GitLab, GitHub</p> <p><b>High Performance computing:</b> the US (Frontera, Stampede, Rockfish, Seawulf), Germany (Hawk hrs, SuperMUC Leibniz, Cobra, Raven, Freya)</p> <p><b>Communication skills:</b> Spoken languages: Korean (native), English (Advanced proficiency in Reading, Writing, Listening, Speaking), Germany (beginner level)</p>	
CERTIFICATION	<p>Korean National Teacher Certification <span style="float: right;">2011</span></p> <p>Craftsman Information Processing Certification - HR Development Service of Korea <span style="float: right;">2009</span></p>	
EXTRA-CURRICULAR ACTIVITY	<p>Runner-up, national kendo competition sponsored by the city of Seoul, South Korea <span style="float: right;">1997</span></p>	
MILITARY SERVICE	<p><b>Military Required Service</b>, South Korea <span style="float: right;">2007 – 2009</span>  Rank of Sergeant  Served inter alia in Food/Water Inspectorate (Laboratory) plus assist. mgmt.</p>	
COLLABORATORS	<p>Selma de Mink (MPA), Rosalba Perna (SBU), Volker Springel (MPA), Julian Krolik (JHU), Zoltan Haiman (Columbia), Tsvi Piran (Hebrew University of Jerusalem), Ruediger Parkmor (MPA), Stephen Justham (MPA), Jing-Ze Ma (MPA), Pavan Vynatheya (MPA), Earl Bellinger (MPA), Robert Farmer (MPA), Jakub Klenchi (ESO), Tiara Battich (MPA), Deepika Bollimpalli (MPA), Chen Wang (MPA), Valeriya Korol (MPA), Nathan Leigh (University of Concepcion), Alessandro Trani (University of Tokyo), Yihan Wang (University of Nevada, Las Vegas), Sherry Suyu (MPA), Simon Huber (MPA), Kaitlyn Szekeczes (MPA), Pau Amaro Seoane (PUV), Barry McKernan (BMCC), Saavik Ford (BMCC), Matthew Graham (Caltec), Elisa Bortolas (UNIMIB), Alberto Sesana (UMB)</p>	

## References

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Prof. Julian Krolik, Professor  
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Prof. Tsvi Piran, Professor (Schwartzman Chair for Theoretical Physics)  
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Email: tsvi.piran@mail.huji.ac.il

# Publications

## Articles in refereed Journals

25. **Ryu, T.**, Krolik, J., Piran, T., Noble, S., Avara, M., *Shocks power Tidal Disruption Events*, submitted to ApJ (2023), arXiv:2305.05333
24. **Ryu, T.**, Valli, R., Pakmor, R., Perna, R., de Mink, Selma E., Springel, V., *Close encounters of black hole-star binaries with stellar-mass black holes*, submitted to MNRAS (2023), arXiv:2304.01792
23. Franchini, A., Bonetti, M., Lupi A., Miniutti, G., Bortolas, E., Giustini, M. , Dotti, M., Sesana, A., Arcodia, R., **Ryu, T.** *QPEs from impacts between the secondary and a rigidly precessing accretion disc in an EMRI system*, submitted to A&A, Arxiv: 2304.00775
22. Xin, C., H. Haiman, Z., Perna, R., Wang, Y., **Ryu, T.** *Tidal Peeling Events: low-eccentricity tidal disruption of a star by a stellar-mass black hole*, submitted to ApJ, Arxiv: 2303.12846
21. Bortolas, E. , **Ryu, T.**, Broggi, L., Sesana, A. *Partial stellar tidal disruption events and their rates*, submitted to MNRAS, Arxiv: 2211.02734
20. **Ryu, T.**, Perna, R., Parkmor, R., Ma, J., Farmer, R., de Mink, S. *Close Encounters of Tight Binary Stars with Stellar-mass Black Holes*, MNRAS, 519, 5787 (2023), arXiv: 2211.02734
19. **Ryu, T.**, Krolik, J., Piran, T. *Extremely Relativistic Tidal Disruption Events*, ApJL, 946, 33 (2023), arXiv: 2211.00059
18. **Ryu, T.**, Perna, R., Wang, Y. *Close Encounters of Stars with Stellar-mass Black Hole Binaries*, MNRAS, 516, 2204 (2022), arXiv: 2206.00603
17. **Ryu, T.**, Trani, A. A. , Leigh, N.W.C. *Tidal Disruption Events by Compact Supermassive Black Hole Binaries*, MNRAS, 515, 2430 (2022), arXiv: 2202.07668
16. McKernan, B., Ford, K.E.S., Cantiello, M., Graham, M.J., Jermyn, A.S., Leigh, N.W.C., **Ryu, T.**, Stern, D. *Starfall: A heavy rain of stars in 'turning on' AGN*, MNRAS, 514, 3 (2022), arXiv: 2110.03741
15. **Ryu, T.**, Krolik, J., Piran, T. *The Impact of Shocks on the Vertical Structure of Eccentric Disks*, ApJ, 920.2, 130, arXiv: 2105.09434 (2021)
14. **Ryu, T.**, Krolik, J., Piran, T. *Measuring stellar and black hole masses of tidal disruption events*, ApJ, 904.1, 73 (2020), arXiv: 2007.13765
13. Krolik, J., Piran, T., **Ryu, T.** *Tidal Disruptions of Main Sequence Stars – V. The Varieties of Disruptions*, ApJ, 904.1, 68 (2020), arXiv: 2001.03234
12. **Ryu, T.**, Krolik, J., Piran, T., Noble, N. *Tidal Disruptions of Main Sequence stars – IV. Relativistic effects and dependence on black hole mass*, ApJ, 904.2, 101 (2020), arXiv: 2001.03504
11. **Ryu, T.**, Krolik, J., Piran, T., Noble, N. *Tidal Disruptions of Main Sequence stars – III. Stellar mass dependence of the character of partial disruptions*, ApJ, 904.2, 100 (2020), arXiv: 2001.03503
10. **Ryu, T.**, Krolik, J., Piran, T., Noble, N. *Tidal Disruptions of Main Sequence stars – II. Simulation methodology and stellar mass dependence of the character of full tidal disruptions*, ApJ, 904.2, 99 (2020), arXiv: 2001.03502

9. **Ryu, T.**, Krolik, J., Piran, T., Noble, N. *Tidal Disruptions of Main Sequence Stars – I. Observable Quantities and their Dependence on Stellar and Black Hole Mass*, ApJ, 904.2, 98 (2020), arXiv: 2001.03501
8. **Ryu, T.**, Zingale, M., Perna, R. *Turbulence-driven thermal and kinetic energy in the atmospheres of hot Jupiters*, MNRAS, 481, 5517 (2018)
7. Ibragimov, T., Leigh, N., W. C., **Ryu, T.**, Panurach, T., Perna, R. *When do star clusters become multiple star systems? II. Toward a half-life formalism for arbitrary particle masses*, MNRAS, 477, 4213 (2018)
6. **Ryu, T.**, Perna, R., Haiman, Z., Ostriker, J. P., Stone, N. C. *Interactions between multiple supermassive black holes in galactic nuclei: a solution to the final parsec problem*, MNRAS, 473, 3410 (2018)
5. Belczynski, K., **Ryu, T.**, Perna, R., Berti, E., Tanaka, T. L., Bulik, T. *On the likelihood of detecting gravitational waves from Population III compact object binaries*, MNRAS, 471, 4702 (2017)
4. **Ryu, T.**, Leigh, N., W. C., Perna, R. *Formation of runaway stars in a star-cluster potential*, MNRAS, 470, 3049 (2017)
3. **Ryu, T.**, Leigh, N., W. C., Perna, R. *An analytic method for identifying dynamically-formed runaway stars*, MNRAS, 470, 2 (2017)
2. **Ryu, T.**, Leigh, N. W. C., Perna, R. *Numerical study of the  $N = 4$  binary-binary scatterings in a background potential*, MNRAS, 467, 4447 (2017)
1. **Ryu, T.**, Tanaka, T. L., Perna, R., Haiman, Z. *Intermediate-mass black holes from Population III remnants in the first galactic nuclei*, MNRAS, 460, 4122 (2016)
0. **Ryu, T.**, Tanaka, T. L., Perna, R. *Formation, disruption and energy output of Population III X-ray binaries*, MNRAS, 456, 223 (2016)

#### Articles in conference proceedings

1. **Ryu, T.**, Tanaka, T. L., Perna, R. *Population III X-Ray Binaries*, in “Frontier Research in Astrophysics – II”, Italy, (2016).