Ryosuke Hirai

Curriculum Vitae

Personal Information

Name	Ryosuke Hirai (平井 遼介)
Nationality	Japanese
Gender	Male
Date of Birth	12th August, 1989
Email	ryosuke.hirai@monash.edu

Research Interests

2012–	Binary stars and supernovae
2015–	Efficient numerical schemes for difference equations
2018–	Stellar mergers and triple dynamics
2021–	Wind accretion in close binaries

Education

2014–2017	**Doctor of Science**, *Waseda University*, Advanced Research Institute of Science and Engineering.
2012–2014	**Master of Science**, *Waseda University*, Advanced Research Institute of Science and Engineering.
2008–2012	**Bachelor of Engineering**, *Waseda University*, School of Advanced Science and Engineering.

Languages

Japanese	**Mothertongue**	
English	**Fluent**	*Spent 8.5 years of childhood in England*
Mandarin	**Basic**	*Basic words and phrases only*

Research Experience

2019.12–	**Research Fellow**, *at School of Physics and Astronomy*, Monash University.
2017–2019	**JSPS Overseas Research Fellow**, *at Department of Physics*, University of Oxford.
2017.4–10	**JSPS Research Fellow (PD)**, *at Advanced Research Institute of Science and Engineering*, Waseda University.

2016–2017 **JSPS Research Fellow (DC2)**, *at Advanced Research Institute of Science and Engineering*, Waseda University.

Teaching Experience

2021.11– **Facilitator**, *Astrophysics Book Club*, Monash University.

2020.7–10 **Teaching Assistant**, *PHS1022 (Waves and Quantum Physics)*, Monash University.

2014–2017 **Teaching Assistant**, *Introductory Physics*, Waseda University.

Research Supervision

PhD students

2021–2022 **Reinhold Willcox**, *Co-supervised with Ilya Mandel and Eric Thrane*, Monash University, Binary population synthesis, Stripped-envelope supernova fractions.

2020– **Mike Lau**, *Co-supervised with Ilya Mandel and Daniel Price*, Monash University, Smoothed-particle hydrodynamics, Common-envelope evolution.

Honours students

2021– **Andrew Atta**, *Co-supervised with Ilya Mandel and Bernhard Müller*, Monash University, Partially stripped red supergiant appearances.

2022– **Lewis Picker**, *Co-supervised with Ilya Mandel*, Monash University, Implementing the two-stage common-envelope prescription into population synthesis codes.

Undergraduate students

2022 **Alvaro Herrera**, *Co-supervised with Ilya Mandel*, Monash University, Searching for black hole binaries in Gaia DR3.

2021–2022 **Andrew Atta**, *Co-supervised with Ilya Mandel*, Monash University, Partially stripped red supergiant appearances.

2021 **Amir Kashapov**, *Co-supervised with Ilya Mandel*, Monash University, Radial evolution of naked helium stars.

2021 **Bayley Tranter**, *Co-supervised with Ilya Mandel*, Monash University, Three-body scattering.

Grants

2018 **Hayakawa Satio Fund, Astronomical Society of Japan**, *∼210000 JPY*.

2016–2017 **JSPS Research Fellow (DC2), Fellowship + Grant**, *1200000+1100000 JPY*.

2015 **Research Grant for Young Scientists, Early Bird Program from Waseda Research Institute for Science and Engineering**, *400000 JPY*.

Invited Talks

2022.11 **Invited talk**, *Supernovae in the Gravitational Wave Detection Era*, Australia.

2022.11 **Seminar**, *University of Melbourne*, Australia.

2022.10 **Seminar**, *University of Delaware (online)*, USA.

2022.9 **Seminar**, *Heidelberg Institute for Theoretical Studies*, Germany.

2022.9 **Seminar**, *Max Planck Institute for Astrophysics*, Germany.
2022.9 **Seminar**, *European Southern Observatory*, Germany.
2022.3 **Seminar**, *Rikkyo University*, Japan.
2022.3 **Seminar**, *Institute of Cosmic Ray Research, University of Tokyo*, Japan.
2021.6 **Seminar**, *Macquarie University (online)*, Australia.
2021.6 **Invited talk**, *European Astronomical Society Annual meeting 2021 (online)*, Netherlands.
2021.4 **Colloquium**, *Heidelberg (online)*, Germany.
2021.3 **Seminar**, *Technion (online)*, Israel.
2020.12 **Seminar**, *Hebrew University of Jerusalem (online)*, Israel.
2020.11 **Seminar**, *Kyoto University + Yukawa Institute (online)*, Japan.
2020.11 **Colloquium**, *SWIFAR, Yunnan University (online)*, China.
2020.11 **Colloquium**, *National Astronomical Observatory of Japan (online)*, Japan.
2020.10 **Invited talk**, *Stellar alchemy to galactic archaeology (online)*, Japan.
2020.5 **Seminar**, *RESCEU, University of Tokyo (online)*, Japan.
2020.4 **Colloquium**, *Monash University (online)*, Australia.
2020.2 **Invited talk**, *Phantom workshop*, Australia.
2019.11 **Colloquium**, *Tohoku University*, Japan.
2019.9 **Colloquium**, *JAXA*, Japan.
2019.9 **Seminar**, *Waseda University*, Japan.
2019.9 **Colloquium**, *University of Tokyo*, Japan.
2019.9 **Seminar**, *Peking University*, China.
2019.9 **Seminar**, *Yunnan National Astronomical Observatory*, China.
2019.4 **Seminar**, *Sheffield University*, UK.
2019.3 **Seminar**, *Anton Pannekoek Institute*, Netherlands.
2019.3 **Seminar**, *Heidelberg Institute of Theoretical Physics*, Germany.
2018.12 **Seminar**, *Chiba Institute of Technology*, Japan.
2018.10 **Seminar**, *Department of Earth Sciences, University of Oxford*, UK.
2018.9 **Seminar**, *University of Delaware*, USA.
2018.6 **Colloquium**, *Department of Physics, University of Oxford*, UK.
2018.1 **Seminar**, *Department of Physics, University of Oxford*, UK.
2017.12 **Seminar**, *Albert Einstein Institute*, Germany.
2017.11 **Seminar**, *Argelander Institute, University of Bonn*, Germany.
2017.10 **Colloquium**, *National Astronomical Observatory of Japan*, Japan.
2017.10 **Seminar**, *RIKEN*, Japan.
2017.5 **Colloquium**, *Institute of Cosmic Ray Research, University of Tokyo*, Japan.
2016.7 **Seminar**, *Kyoto University*, Japan.
2016.1 **Seminar**, *RESCEU, University of Tokyo*, Japan.
2015.7 **Seminar**, *KEK*, Japan.

2015.6 **Seminar**, *Kyoto University*, Japan.
2014.4 **Seminar**, *RIKEN*, Japan.

Contributed talks/posters

2022.12 **Contributed talk**, *Gravitational Wave Physics and Astronomy Workshop*, Australia.
2022.11 **Contributed talk**, *Supervirtual 2022*, Fully online.
2022.6 **Contributed talk**, *ASA Annual science meeting 2022*, Australia.
2022.3 **Contributed talk**, *Spring ASJ Annual meeting (online)*, Japan.
2021.12 **Contributed talk**, *34th Rironkon Symposium (online)*, Japan.
2021.10 **Contributed talk**, *Asymmetrical Post-main-sequence Nebulae 8 (online)*, Spain.
2021.9 **Contributed talk**, *Autumn ASJ Annual meeting (online)*, Japan.
2021.8 **Contributed talk**, *Neutron star workshop 2021 (online)*, Japan.
2021.7 **Contributed talk**, *ASA Annual science meeting 2021 (online)*, Australia.
2021.3 **Contributed talk**, *Spring ASJ Annual meeting (online)*, Japan.
2021.3 **Contributed poster**, *Triple Evolution and Dynamics (online)*, Israel.
2021.2 **Contributed talk**, *ANITA workshop 2021 (online)*, Australia.
2021.1 **Contributed talk**, *Binary/Variable star workshop 2020 (online)*, Japan.
2021.1 **Contributed poster**, *43rd COSPAR Assembly (online)*, Australia.
2020.2 **Contributed talk**, *ANITA workshop 2020 (online)*, Australia.
2019.9 **Contributed talk**, *Autumn ASJ Annual meeting*, Japan.
2019.5 **Contributed talk**, *FOE19 Fifty-one Erg*, USA.
2018.12 **Contributed poster**, *31st Rironkon Symposium*, Japan.
2018.11 **Contributed talk**, *Massive stars and supernovae*, Argentina.
2018.7 **Contributed talk**, *Frontiers of the Physics of Massive stars*, Mexico.
2017.9 **Contributed talk**, *Autumn ASJ Annual meeting*, Japan.
2017.7 **Contributed talk**, *Ringberg Workshop*, Germany.
2017.7 **Contributed poster**, *FOE17 Fifty-One Erg*, USA.
2017.3 **Contributed talk**, *Spring ASJ Annual meeting*, Japan.
2017.3 **Contributed talk**, *Ultraluminous X-ray source workshop*, Japan.
2017.1 **Contributed talk**, *Workshop on Transient Universe in the Big Survey Era*, Japan.
2016.12 **Contributed talk**, *29th Rironkon Symposium*, Japan.
2016.10 **Contributed talk**, *Binary/Variable star workshop 2016*, Japan.
2016.9 **Contributed talk**, *Autumn ASJ Annual meeting*, Japan.
2016.7 **Contributed talk**, *NAOJ-ECT workshop*, Japan.
2015.12 **Contributed poster**, *28th Rironkon Symposium*, Japan.
2015.9 **Contributed talk**, *Numazu workshop*, Japan.
2015.6 **Contributed talk**, *Fifty-One Erg*, USA.
2015.3 **Contributed talk**, *Spring ASJ Annual meeting*, Japan.
2014.12 **Contributed poster**, *27th Rironkon Symposium*, Japan.

2014.10 **Contributed talk**, *2nd DTA Symposium*, Japan.
2014.9 **Contributed poster**, *Binary systems, their evolution and environments*, Mongolia.
2014.9 **Contributed talk**, *Autumn ASJ Annual meeting*, Japan.
2014.2 **Contributed talk**, *Binary star workshop*, Japan.
2013.12 **Contributed poster**, *Multi-Messengers from Core-Collapse Supernovae*, Japan.
2013.9 **Contributed talk**, *Autumn ASJ Annual meeting*, Japan.

Service

2022– **Referee**, *Astronomy & Astrophysics*.
2022– **Referee**, *The Astrophysical Journal*.
2021– **Referee**, *Publications of the Astronomical Society of Australia*.
2021– **Referee**, *The Astrophysical Journal Letters*.
2021– **Program chair**, *ARC Centre of Excellence for Gravitational Wave Discovery (OzGrav), Relativistic Astrophysics program*.
2021– **Referee**, *Galaxies*.
2021.7 **Conference organiser**, *Nuclear burning in massive stars – towards the formation of binary black holes* -, (Monash hub leader).
2020– **Seminar/Colloquia organiser**, *Monash University*.
2020– **Referee**, *Publications of the Astronomical Society of Japan*.
2019– **Referee**, *Monthly Notices of the Royal Astronomical Society*.
2018–2019 **SPI-MAX seminar series organiser**, *University of Oxford*.
2015–2017 **Seminar organiser**, *Waseda University*.

Membership

2016– **Rironkon (Theoretical astrophysics society of Japan)**.
2015– **Astronomical Society of Japan**.

Outreach

2022.6 **Public Talk**, *Free Public Astronomy Lecture at Swinburne University of Technology*.
2022.5 **High School Talk**, *Melbourne High School*.
2021.8 **High School Talk**, *Hikawa High School*.
2021.3 **High School Talk**, *Waseda Jitsugyo High School*.
2019.4 **Public Talk**, *Oxbridge Japanese Society meet-up*.
2019.1 **Public event**, *Stargazing Oxford 2019*.
2018.1 **Public event**, *Stargazing Oxford 2018*.
2015.6 **High School Talk**, *Waseda Jitsugyo High School*.

Publications

First Author

[11] **A two-stage formalism for common-envelope phases of massive stars**
Ryosuke Hirai, Ilya Mandel
The Astrophysical Journal Letters, Volume 937, Issue 2, id.L42, 7 pp. (2022)

[10] **Neutron stars colliding with binary companions: formation of hypervelocity stars, pulsar planets, bumpy superluminous supernovae and Thorne-Żytkow objects**
Ryosuke Hirai, Philipp Podsiadlowski
Monthly Notices of the Royal Astronomical Society, Volume 517, Issue 3, pp.4544-4556 (2022)

[9] **Conditions for accretion disc formation and observability of wind-accreting X-ray binaries**
Ryosuke Hirai, Ilya Mandel
Publications of the Astronomical Society of Australia, Volume 38, article id. e056 (2021)

[8] **Simulating the formation of η Carinae's surrounding nebula through unstable triple evolution and stellar merger-induced eruption**
Ryosuke Hirai, Philipp Podsiadlowski, Stanley Owocki, Fabian R. N. Schneider, Nathan Smith
Monthly Notices of the Royal Astronomical Society, Volume 503, Issue 3, pp.4276-4296 (2021)

[7] **Formation pathway for lonely stripped-envelope supernova progenitors: implications for Cassiopeia A**
Ryosuke Hirai, Toshiki Sato, Philipp Podsiadlowski, Alejandro Vigna-Gómez, Ilya Mandel
Monthly Notices of the Royal Astronomical Society, Volume 499, Issue 1, pp.1154-1171 (2020)

[6] **Comprehensive study of ejecta-companion interaction for core-collapse supernovae in massive binaries**
Ryosuke Hirai, Philipp Podsiadlowski, Shoichi Yamada
The Astrophysical Journal, Volume 864, Issue 2, article id. 119, 17 pp. (2018)

[5] **The Origin of the Possible Massive Black Hole in the Progenitor System of iPTF13bvn**
Ryosuke Hirai
Monthly Notices of the Royal Astronomical Society: Letters, Volume 469, Issue 1, p.L94-L98 (2017)

[4] **Formation Scenario of the Progenitor of iPTF13bvn Revisited**
Ryosuke Hirai
Monthly Notices of the Royal Astronomical Society, Volume 466, Issue 4, p.3775-3783 (2017)

[3] **Hyperbolic Self-Gravity Solver for Large Scale Hydrodynamical Simulations**
Ryosuke Hirai, Hiroki Nagakura, Hirotada Okawa, Kotaro Fujisawa
Physical Review D, Volume 93, Issue 8, article id.083006 (2016)

[2] **Possible Signatures of Ejecta-Companion Interaction in iPTF 13bvn**
Ryosuke Hirai, Shoichi Yamada
The Astrophysical Journal, Volume 805, Issue 2, article id. 170, 7 pp. (2015)

[1] **The Outcome of Supernovae in Massive Binaries; Removed Mass, and its Separation Dependence**
Ryosuke Hirai, Hidetomo Sawai, Shoichi Yamada
The Astrophysical Journal, Volume 792, Issue 1, article id. 66, 15 pp. (2014)

Co-Author

[18] **The Galactic underworld: The spatial distribution of compact remnants**
David Sweeney, Peter Tuthill, Sanjib Sharma, Ryosuke Hirai
Monthly Notices of the Royal Astronomical Society, Volume 516, Issue 4, pp.4971-4979 (2022)

[17] **Common envelopes in massive stars II: The distinct roles of hydrogen and helium recombination**
Mike Y. M. Lau, Ryosuke Hirai, Daniel J. Price, Ilya Mandel
Monthly Notices of the Royal Astronomical Society, Volume 516, Issue 4, pp.4669-4678 (2022)

[16] **Common envelope binary interaction simulations between a thermally-pulsating AGB star and a low mass companion**
Miguel González-Bolívar, Orsola De Marco, Mike Y. M. Lau, Ryosuke Hirai, Daniel J. Price
Monthly Notices of the Royal Astronomical Society, Volume 517, Issue 3, pp.3181-3199 (2022)

[15] **An environmental analysis of the Type Ib SN 2019yvr and the possible presence of an inflated binary companion**
Ning-Chen Sun, Justyn R. Maund, Paul Crowther, Ryosuke Hirai, Amir Kashapov, Ji-Feng Liu, Liang-Duan Liu, Emmanouil Zapartas
Monthly Notices of the Royal Astronomical Society, Volume 510, Issue 3, pp.3701-3715 (2022)

[14] **Common envelopes in massive stars: The role of radiation pressure and recombination energy in ejecting red supergiant envelopes**
Mike Lau, Ryosuke Hirai, Miguel González-Bolívar, Daniel J. Price, Orsola De Marco and Ilya Mandel
Monthly Notices of the Royal Astronomical Society, Volume 512, Issue 4, pp.5462-5480 (2022)

[13] **Rapid stellar and binary population synthesis with COMPAS**
Team COMPAS: Riley et al. (including Ryosuke Hirai)
The Astrophysical Journal Supplement Series, Volume 258, Issue 2, id.34, 30 pp. (2022)

[12] **COMPAS: A rapid binary population synthesis suite**
Team COMPAS: Riley et al. (including Ryosuke Hirai)
Journal of Open Source Software, vol. 7, issue 69, id. 3838 (2022)

[11] **Stellar Core-Merger-Induced Collapse: new Formation Pathways for Black Holes, Thorne-Żytkow objects, Magnetars and Superluminous Supernovae**
Iminhaji Ablimit, Philipp Podsiadlowski, Ryosuke Hirai, James Wicker
Monthly Notices of the Royal Astronomical Society, Volume 513, Issue 4, pp.4802-4813 (2022)

[10] **Supernova explosions in active galactic nuclear discs**
Evgeni Grishin, Alexey Bobrick, Ryosuke Hirai, Ilya Mandel, Hagai B. Perets
Monthly Notices of the Royal Astronomical Society, Volume 507, Issue 1, pp.156-174 (2021)

[9] **The observability of inflated companion stars after supernovae in massive binaries**
Misa Ogata, Ryosuke Hirai, Kotaro Hijikawa
Monthly Notices of the Royal Astronomical Society, Volume 505, Issue 2, pp.2485-2499 (2021)

[8] **Wind Mass-loss Rates of Stripped Stars Inferred from Cygnus X-1**
Coenraad J. Neijssel, Serena Vinciguerra, Alejandro Vigna-Gómez, Ryosuke Hirai, James C. A. Miller-Jones, Arash Bahramian, Thomas J. Maccarone, Ilya Mandel
The Astrophysical Journal, Volume 908, Issue 2, id.118, 9 pp. (2021)

[7] **Neutron Star Extreme Matter Observatory: A kilohertz-band gravitational-wave detector in the global network**
Ackley et al. (including Ryosuke Hirai)
Publications of the Astronomical Society of Australia, Volume 37, article id. e047 (2020)

[6] **The sensitivity of presupernova neutrinos to stellar evolution models**
Chinami Kato, Ryosuke Hirai, Hiroki Nagakura
Monthly Notices of the Royal Astronomical Society, Volume 496, Issue 3, pp.3961-3972 (2020)

[5] **A Subsolar Metallicity Progenitor for Cassiopeia A, the Remnant of a Type IIb Supernova**
Toshiki Sato, Takashi Yoshida, Hideyuki Umeda, Shigehiro Nagataki, Masaomi Ono, Keiichi Maeda, Ryosuke Hirai, John P. Hughes, Brian J. Williams, Yoshitomo Maeda
The Astrophysical Journal, Volume 893, Issue 1, id.49, 9 pp. (2020)

[4] **Origins of Type Ibn SNe 2006jc/2015G in interacting binaries and implications for pre-SN eruptions**
Ning-Chen Sun, Jusytn R. Maund, Ryosuke Hirai, Paul A. Crowther, Philipp Podsiadlowski
Monthly Notices of the Royal Astronomical Society, Volume 491, Issue 4, p.6000-6019 (2020)

[3] **Hydrodynamical simulations and similarity relations for eruptive mass loss from massive stars**
Stanley P. Owocki, Ryosuke Hirai, Philipp Podsiadlowski, Fabian R. N. Schneider
Monthly Notices of the Royal Astronomical Society, Volume 485, Issue 1, p.988-1000 (2019)

[2] **The W4 method: a new multi-dimensional root-finding scheme for nonlinear systems of equations**
Hirotada Okawa, Kotaro Fujisawa, Yu Yamamoto, Ryosuke Hirai, Nobutoshi Yasutake, Hiroki Nagakura, Shoichi Yamada
Applied Numerical Mathematics, Volume 183, p.157-172 (2023)

[1] **Formation pathway of Population III coalescing binary black holes through stable mass transfer**
Kohei Inayoshi, Ryosuke Hirai, Tomoya Kinugawa, Kenta Hotokezaka
Monthly Notices of the Royal Astronomical Society, Volume 468, Issue 4, p.5020-5032 (2017)

Other Articles

[2] **Science Cases for the Keck Wide-Field Imager**
J. Cooke et al. (including R. Hirai)
arXiv: 2207.11698

[1] **水素欠乏超新星の親星の起源(The Origin of the Progenitors of Stripped-Envelope Supernovae)**
平井 遼介 (Ryosuke Hirai)
天文月報*(The Astronomical Herald)*, Volume 111, Issue 9, p.580-588 (2018)