

Cristobal Petrovich | Curriculum Vitae

Institute of Astrophysics, Pontificia Universidad Católica de Chile
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Citizenship: Chilean/Croatian

Appointments

Pontificia Universidad Católica de Chile <i>Assistant Professor, Institute of Astrophysics</i>	Santiago, Chile 11/2020 - present
University of Arizona <i>Bart J. Bok Postdoctoral Fellow</i>	Tucson, USA 09/2019 - 10/2020
Canadian Institute for Theoretical Astrophysics (CITA) <i>CITA Postdoctoral Fellow and Gruber Foundation Fellow</i>	Toronto, Canada 09/2015 - 08/2019

Education

Princeton University <i>Ph.D. in Astrophysical Sciences (advisor: Prof. Scott Tremaine)</i>	Princeton, USA 09/2010 - 08/2015
Pontificia Universidad Católica de Chile <i>B. Sc. in Astronomy</i>	Santiago, Chile 03/2004 - 12/2008
Pontificia Universidad Católica de Chile <i>Mathematical Engineering (6-year professional degree)</i>	Santiago, Chile 03/2002 - 12/2009

Awards and Fellowships

Bart J. Bok Fellowship , <i>Steward Observatory, University of Arizona</i>	2019 - 2020
51 Pegasi b Fellowship in planetary science <i>Three-year grant of \$375k awarded by the Heising-Simons Foundation (declined)</i>	2019
Jeffrey L. Bishop Fellowship <i>Awarded every-two years for research excellence in dynamics at CITA</i>	2016 - 2018
ProQuest Distinguished Dissertation award nomination <i>One PhD thesis selected in physical sciences and engineering from Princeton in 2015</i>	2016
The Gruber Foundation Fellowship <i>Prize of \$50k to support research at CITA, selected by the International Astronomical Union and awarded at the opening ceremony of the IAU General Assembly in Honolulu (link)</i>	2015 - 2019
CITA Fellowship , <i>Canadian Institute for Theoretical Astrophysics</i>	2015 - 2019

Grants

Principal Investigator Fondecyt Regular project 1210425 (\approx 100 million CLP)	2021-2025
Subvención a la Instalación en la Academia PAI77200076 (\approx 200 million CLP)	2020-2023

Research Interests

- Orbital migration and dynamical stability
- Exoplanet demographics
- Disk-planet interactions
- Planets in binary systems
- Gravitational wave sources
- Binaries in galactic center and triple systems
- Planetary systems around white dwarfs
- Thermal evolution of neutron stars

Publications

40 papers (33 as first to third author) | [ADS](#) citation count: +1,465, H-index= 20 (+1,680 and 21 in [Scholar](#))

19 first-author or student-led papers | [ADS](#) citation count: : +855, H-index= 13

3 single-author papers with +290 citations in total/ 8 first-author papers with +60 citations

† = student-led paper under my supervision

First-author or student-led.....

19. †Garrido-Deutelmöser, J., **Petrovich, C.** et al. "Substructures in protoplanetary disks imprinted by compact planetary systems", 2022, *AJ* (submitted)
18. †Best, S. & **Petrovich, C.** "The chaotic history of the retrograde multi-planet system in K2-290A driven by distant stars", 2022, *ApJL*, 925, 1 (8 pp, # of citations: 1) [[link](#)] [[AASNova](#)]
17. †Nasim, I. T., **Petrovich, C.**, Nasim, A., Dosopoulou, F., and Antonini, F. "Formation of counter-rotating and highly eccentric massive black hole binaries in galaxy mergers", 2021, *MNRAS*, 503, 1 (12 pp, # of citations: 3) [[link](#)]
16. **Petrovich, C.**, Muñoz, D., Kratter, K. M., & Malhotra, R., "A disk-driven resonance as the origin of high inclinations of close-in planets", 2020, *ApJL*, 902, 2 (10 pp, # of citations: 18) [[link](#)]
15. †Bub, M., & **Petrovich, C.**, "Compact-Object Mergers in the Galactic Center: Evolution in Triaxial Clusters", 2019, *The Astrophysical Journal*, 894, 15 (17 pp, # of citations: 7) [[link](#)]
14. **Petrovich, C.**, Wu, Y., & Ali-Dib, M., "Secular transport during disk dispersal: the case of Kepler-419", 2019, *The Astronomical Journal*, 157, 5 (13 pp, # of citations: 12) [[link](#)]
13. **Petrovich, C.**, Deibert, E. & Wu, Y., "Ultra-short-period planets from secular chaos", 2019, *The Astronomical Journal*, 157, 180, (16 pp, # of citations: 38) [[link](#)]
12. †He, M., & **Petrovich, C.**, "On the stability and collisions in triple stellar systems", 2018, *Monthly Notices of the Royal Astronomical Society*, 474, 1 (12 pp, # of citations: 15), [[link](#)]
11. **Petrovich, C.** & Antonini, F., "Greatly enhanced merger rates of compact-object binaries in non-spherical nuclear star clusters", 2017, *The Astrophysical Journal*, 846, 146 (23 pp, # of citations: 120) [[link](#)]
10. **Petrovich, C.** & Muñoz, D., "Planetary engulfment as a trigger for white dwarf pollution", 2017, *The Astrophysical Journal*, 834, 116 (13 pp, # of citations: 64) [[link](#)]
9. **Petrovich, C.** & Tremaine, S., "Warm jupiters from secular planet-planet interactions", 2016, *The Astrophysical Journal*, 829, 132 (22 pp, # of citations: 77) [[link](#)]
8. **Petrovich, C.** "Stability and fates of hierarchical two-planet systems", 2015, *The Astrophysical Journal*, 808, 120 (15 pp, # of citations: 63) [[link](#)]

7. **Petrovich, C.** “Hot jupiters from coplanar high-eccentricity migration”, 2015, *The Astrophysical Journal*, 805, 75, (16 pp, # of citations: **94**) [[link](#)]
6. **Petrovich, C.** “Steady-state planet migration by the Kozai-Lidov mechanism in stellar binaries”, 2015, *The Astrophysical Journal*, 799, 27 (27 pp, # of citations: **136**) [[link](#)]
5. **Petrovich, C.**, Tremaine, S., and Rafikov, R. “Scattering outcomes of close-in planets: constraints on planet migration”, 2014, *The Astrophysical Journal*, 786, 101, (10 pp, # of citations: **64**) [[link](#)]
4. **Petrovich, C.**, Malhotra, R., and Tremaine, S. “Planets near mean-motion resonances”, 2013, *The Astrophysical Journal*, 770, 24 (16 pp, # of citations: **84**) [[link](#)]
3. **Petrovich, C.** and Rafikov, R. “Disk-satellite interaction in disks with density gaps”, 2012, *The Astrophysical Journal*, 758, 33, (15 pp, # of citations: 20) [[link](#)]
2. **Petrovich, C.** and Reisenegger, A. “Long-period thermal oscillations in superfluid millisecond pulsars”, 2011, *Astronomy and Astrophysics*, 528, A66, (8 pp, # of citations: 8) [[link](#)]
1. **Petrovich, C.** and Reisenegger, A. “Rotochemical heating in millisecond pulsars: modified Urca reactions with uniform Cooper pairing gaps”, 2010, *Astronomy and Astrophysics*, 521, A77, (12 pp, # of citations: 29) [[link](#)]

Second and third-author

14. Muñoz, D., Stone, N., **Petrovich, C.**, & Rasio, F. “Eccentric Mergers of Intermediate-Mass Black Holes from Evection Resonances in AGN Disks”, 2022 (submitted)
13. Chen, C., Li, G., & **Petrovich, C.** ‘Mutual Inclination of Ultra-Short-Period Planets with Time Varying Stellar J2-moment’, 2022, *AJ* (accepted)
12. Stefansson, G., Mahadevan, S., **Petrovich, C.**, et al. “The Warm Neptune GJ 3470b has a Polar Orbit”, 2021, *The Astrophysical Journal* (submitted) [[link](#)]
11. Muñoz, D., & **Petrovich, C.**, “Kozai Migration Naturally Explains the White Dwarf Planet WD1856b”, 2020, *The Astrophysical Journal Letters*, 904, 1, (8 pp) [[link](#)]
10. Ali-Dib, M. & **Petrovich, C.**, “Constraining protoplanetary disks with exoplanetary dynamics: Kepler-419 as an example”, 2020, *Monthly Notices of the Royal Astronomical Society*, 499, 1 (9 pp) [[link](#)]
9. Yalinewich, A., & **Petrovich, C.**, “Nekhoroshev Estimates for the Survival Time of Tightly Packed Planetary Systems”, 2020, *The Astrophysical Journal Letters*, 892, L11 (9 pp) [[link](#)]
8. Zhu, W., **Petrovich, C.**, Wu, Y., et al. “About 30% of Sun-like Stars Have Kepler-like Planetary Systems: A Study of their Intrinsic Architecture”, 2018, *The Astrophysical Journal*, 860, 101 (15 pp) [[link](#)]
7. Antonini, F., Rodriguez, C. L., **Petrovich, C.**, & Fischer, C. “Precessional dynamics of black hole triples: binary mergers with near-zero effective spin”, 2018, *Monthly Notices of the Royal Astronomical Society*, 480, L58 [[link](#)]
6. Hamers, A. S., Bar-Or, B, **Petrovich, C.**, & Antonini, F., “The impact of vector resonant relaxation on the evolution of binaries near a massive black hole: implications for gravitational wave sources”, 2018, *The Astrophysical Journal*, 865, 2 (22 pp) [[link](#)]

5. Huang, C. X., **Petrovich, C.**, & Deibert, E. "Dynamically hot Super-Earths from outer giant planet scattering", 2017, *The Astronomical Journal*, 153, 210 (12 pp) [[link](#)]
4. Tamayo, D., Rein, H., **Petrovich, C.**, & Murray, N. "Convergent Migration Renders TRAPPIST-1 Long-lived", 2017, *The Astrophysical Journal Letters*, 840, L19 (6 pp) [[link](#)]
3. Simbulan, C., Tamayo, D., **Petrovich, C.**, Rein, H., & Murray, N. "Connecting HL Tau to the Observed Exoplanet Sample", 2017, *Monthly Notices of the Royal Astronomical Society*, 469, 3 [[link](#)]
2. Rafikov, R. and **Petrovich, C.** "The origin of the negative torque density in disk-satellite interaction", 2012, *The Astrophysical Journal*, 747, 24, (15 pp) [[link](#)]
1. González-Jiménez, N., **Petrovich, C.**, and Reisenegger, A. "Rotochemical heating of millisecond and classical pulsars with anisotropic and density-dependent superfluid gap models", 2015, *Monthly Notices of the Royal Astronomical Society*, 447, 3, (14 pp) [[link](#)]

Fourth-Author (short author list).....

3. Jackson, J. M., Dawson, R. I., Shannon, A. and **Petrovich, C.**, "Observable Predictions from Perturber-coupled High-eccentricity Tidal Migration of Warm Jupiters, 2021, *The Astronomical Journal*, 161, 4
2. Freikh, R., Jang, H., Murray-Clay, R. A. and **Petrovich, C.** "Signatures of a planet-planet impacts phase in exoplanetary systems hosting giant planets", 2019, *The Astrophysical Journal Letters*, 884, L47 [[link](#)]
1. Dong, R., Stone, J., Rafikov, R. and **Petrovich, C.** "Density waves excited by low-mass planets in protoplanetary disks. I. Linear regime", 2012, *The Astrophysical Journal*, 747, 24, (17 pp) [[link](#)]

Nth-Author.....

4. Jenkins, J., et al. (including **Petrovich, C.**) "TESS Discovery of an Ultra-Hot Neptune", 2020, *Nature Astronomy*, 4 [[link](#)]
3. Brahm, R., et al. (including **Petrovich, C.**) "HD 1397b: a transiting warm giant planet orbiting a $V = 7.8$ mag sub-giant star discovered by TESS", 2019, *The Astronomical Journal*, 158, 45 [[link](#)]
2. Tamayo, D., et al. (including **Petrovich, C.**) "A Machine Learns to Predict the Stability of Tightly Packed Planetary Systems", 2016, *The Astrophysical Journal*, 832L, L22 [[link](#)]
1. Damasso, et al. (including **Petrovich, C.**) "The GAPS programme with HARPS-N at TNG. IX. The multi-planet system KELT-6: Detection of the planet KELT-6 c and measurement of the Rossiter-McLaughlin effect for KELT-6 b", 2015, *Astronomy and Astrophysics*, 581, L6 [[link](#)]

Mentoring

Summary: 15 students supervised, leading to 7 publications (5 student-led)
 (SURP= Summer Undergraduate Research Project)

- o Juan Stutil, bachelor thesis at PUC, 2021 (→ Teaching program at PUC)
 Nearly-resonant planets: effect from accretion and disk-driven damping

- *Fabian Soto*, bachelor thesis at PUC, 2021
Extreme Mass Ratio Inspirals: AGN physics from LISA waveforms
- *Sergio Best*, PhD Student at PUC, 2021 -
Effects of Jovian planets in the formation of close-in exoplanets. (**Best & Petrovich 2022**)
- *Fernanda Correa*, bachelor thesis at PUC, 2021 (→ PhD program at U Chicago)
Planetary instabilities in depleted protoplanetary disks
- *Juan Garrido-Deutelmöser*, Masters student at PUC, 2021 -
Disks morphologies from multi-planet systems. (**Juan Garrido-Deutelmöser, Petrovich et al. 2022**)
- *Juan Espinoza*, PhD Student at PUC, 2021 -
Inclinations from TESS and Gaia
- *Macarena Droguet*, PhD Student at PUC, 2021
Short-term project on gravitational wave sources in Galactic centers
- *Imran Nasim*, PhD student at Surrey University, 2020 (→ Postdoctoral Fellow in Biomedical Informatics, Harvard Medical School)
Mergers of binary SMBHs in centers of galaxies (co-advised with Fabio Antonini; **Nasim, Petrovich, et al 2020**)
- *Mathew Bub*, undergraduate at UofT, SURP 2019 (→ PhD program at Caltech)
Evolution of binaries in nuclear star clusters implementing a new hybrid N-body and secular code (**Bub & Petrovich 2020**)
- *Kai Wu*, undergraduate at Nanking University, 2018 - 2019
N-body experiments of giants impacts and comparison with Kepler planets
- *Mingze Sun*, undergraduate at Nanking University (primarily supervised by Wei Zhu), 2018 - 2019
Forecasting the co-existence of short-period planets and cold Jovians with *TESS* and *Gaia*
- *Ling Kong*, undergraduate at UofT, (SURP 2017, co-supervised with Prof. Wu) 2017
SPH simulations of tidal disruptions of rocky planets
- *Emily Deibert*, PhD student at UofT, 2016 - 2018
SURP 2016: dynamical effects of outer giant planets (**Huang, Petrovich, & Deibert 2017**)
PhD project: secular chaos and ultra-short-period planets (**Petrovich, Deibert & Wu 2019**)
- *Matthias He*, undergraduate at UofT and PhD student at Penn State 2016 - 2017
Orbital stability and collisions in triple stellar systems (**He & Petrovich 2018**)
- *Luis Rodriguez*, Masters student at PUC, Chile 2015
The effect of stellar evolution on secular orbital dynamics of planetary systems in binaries.

Teaching

- *Planets across the Universe*, lecturer (undergraduate-level course, 70 students), 2022
- *Planetary and stellar dynamics*, lecturer (graduate-level course, ~15 students), 2021
- *Star and Planets*, Guest Lecturer at UofT (AST221, Prof. Wu, ~60 science majors), 2018

- *Summer lectures on exoplanets*, undergraduate students UofT (blackboard and slides sessions)
- *Blackboard talks*, pedagogical blackboard talks at CITA (x5), 2015 - 2019
- *Topics in Modern Astronomy*, Teaching Assistant at Princeton University, 2015
- *Statistical Mechanics*, Teaching Assistant at Catolica, 2009
- Teaching Assistant at Catolica for: *General Relativity* (2008), *Quantum Physics II* (2007), *Quantum Physics I* (2006), *Physical Mathematical methods II* (2006), *Statistical Mechanics* (2005), *Mechanics I* (2005)
- High-school teaching *Mathematics and Physics* (volunteering) at the Pre-universitario Social for low-income students in preparation for the national university entry exam, 2003- 2005.

Outreach

- Acrux Festival de Poesía y ciencia del estrecho de Magallanes, 2022 ([link](#))
- Observando el universo desde tu Casa: "Solar System and Exoplanets" (3 modules), 2021, ([link](#))
- IA-PUC te explica: Oumuamua, el primer visitante interestelar, 2021 ([link](#))
- '*Sistemas planetarios: una historia forjada por el caos*', Astro-Conferencias, Astro-Uami (virtual), 2020
- '*Extreme Solar Systems*', public talk at San Jose State University (invited by the Division of Planetary Science, AAS), San Jose, CA, 2018
- '*Life and death of stars*', high-school talks, Santiago, Chile, 2005
- '*Astrophysics as a career path*', high-school talks, Punta Arenas, Chile, 2004

Leadership

- Raynor L. Duncombe Student Research Prizes selection committee, DDA of the AAS (2020-2022)
- UofT Astro-ph Discussion committee member (2018)
- CITA fellowship committee member: reviewer of applications for postdoctoral fellowships (2017, 2018)
- CITA visitor committee member: co-organizer of seminars and visitor program (2017-2019)
- Co-organizer of the bi-weekly Stars and Planets discussion at CITA (2017)
- Co-organizer of the weekly dynamics discussion at CITA (2016)
- Princeton Astrophysics 'Wunch' (Wednesday Lunch) Seminar Organizer (2012)

Professional service

- Reviewer for SFTC grant, UK, 2019
- Reviewer for NASA Earth and Space Science Fellowships program, 2018
- Reviewer for CONICET grant, Argentina, 2017

- o Referee for +30 papers since 2014 in:
 - 'The Astrophysical Journal' (ApJ)
 - 'The Astrophysical Journal Letters' (ApJL)
 - 'The Astronomical Journal' (AJ)
 - 'Planetary Science Journal' (PSJ)
 - 'The Monthly Notices of the Royal Astronomical Society' (MNRAS)
 - 'Astronomy and Astrophysics' (A&A)
 - 'Nature Astronomy' (Nat. Astron)
 - 'Nature Communications Physics' (Nat. Comm. Phys)'
 - 'Physical Review D' (Phys. Rev. D)
 - 'Celestial Mechanics and Dynamical Astronomy' (Celest. Mech. Dyn. Astron)

Presentations

Summary: 24 invited, +20 contributed

Invited conferences and meetings.....

6. Extreme Solar Systems IV, Reykjavík, Iceland, August 2019
5. Astrophysics workshop at T.D. Lee Institute, Shanghai, China, January 2019
4. 49th Annual Meeting of the Division of Dynamical Astronomy (science and public talk), San Jose, CA, April 2018 ([link](#))
3. ICTP-SAIFR 5th Anniversary Symposium, Sao Paulo, Brazil, November 2016 ([link](#) talk)
2. Fellows at the Frontiers, Evanston, IL, August 2016
1. SOCHIAS XIII Annual Meeting, Antofagasta, Chile, March 2016

Invited seminars and colloquia.....

19. Astronomy Colloquium, Universidad de Concepcion, Chile, March 2021 (virtual)
18. Astronomy Colloquium, Pontificia Universidad de Chile, Chile, March 2020
17. Physics and Astronomy forum, UNVL, NV, November 2019
16. Astronomy colloquium, Steward Observatory, Tucson, AZ, August 2019
15. Center for Exoplanets and Habitable Worlds seminar, Penn State University, PA, April 2019
14. Astronomy Colloquium, Universidad de Chile, Chile, March 2019
13. Astronomy Colloquium, Universidad de Valparaiso, Chile, March 2019
12. Niels Bohr International Academy (job talk), Copenhagen, Denmark, January 2019
11. Astrophysical and Planetary Sciences Colloquium, UC Boulder, CO, April 2018
10. TAPIR seminar, Caltech, CA, January 2018
9. Astronomy Colloquium, PUC, Chile, October 2017
8. IAS Seminar, IAS, Princeton, NJ, September 2017
7. Astronomy Colloquium, Diego Portales, Chile, August 2016

6. Cornell Theoretical Astrophysics/Planetary Science Seminar, Ithaca, NY, June 2016
5. Astronomy Colloquium, Pontificia Universidad de Chile, Chile, March 2016
4. CITA Seminar, Toronto, Canada, July 2015
3. Division of Geological and Planetary Sciences Seminar, Caltech, Pasadena, CA, April 2015
2. CIPS Seminar, UC-Berkeley, Berkeley, CA, February 2013
1. Carnegies's DTM Astronomy Group Seminar, Washington, DC, April 2013

Contributed conferences and meetings

15. XX Brazilian Colloquium of Orbital Dynamics, Brazil, December 2021 (virtual)
14. Distorted Astrophysical Discs, KICC, Cambridge, UK, May 2021 (virtual)
13. 51st Meeting of the Division on Dynamical Astronomy, Virtual Meeting August 2020 (virtual)
12. Theoretical and Computational Challenges in Planet Formation, CCA, NY, May 2019
11. New Horizons in Planetary Systems, Victoria, Canada, May 2019
10. Triple Evolution and Dynamics Trendy-2, Leiden, The Netherlands, September 2018
9. Numerical Integration Methods in Planetary Science, Toronto, Canada, July 2017
8. Formation and Dynamical Evolution of Exoplanets, Aspen, CO, March 2017
7. Exoplanets I, Davos, Switzerland, July 2016
6. Triple Evolution and Dynamics, Haifa, Israel, November 2014
5. 46th Annual Meeting of the Division for Planetary Sciences, Tucson, AZ, November 2014
4. IAU-Symposium: 'Complex Planetary Systems', Namur, Belgium, July 2014
3. 45th Meeting of the Division on Dynamical Astronomy, Philadelphia, PA, April 2014
2. Exoplanets in Multi-body systems in the Kepler era, Aspen, CO, February 2014
1. The origin of stars and their planetary systems, McMaster University, Canada June 2012

Contributed seminars (selected)

6. Astronomy Seminar, UCLA, CA, January 2018
5. CfA High Energy Phenomena Seminar, CfA, Cambridge, MA, October 2017
4. CPS Seminar, Toronto, Canada, September 2017
3. Princeton Planet Lunch, Princeton University, Princeton, NJ, June 2017
2. ITC Seminar, Harvard University, Cambridge, MA, November 2014
1. Princeton Astrophysics "Wunch", Princeton University, Princeton, NJ, April 2014