

Alexandre Champagne-Ruel

Ph.D candidate – astrophysics

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RESEARCH INTERESTS

major evolutionary transitions – origin of life – complex systems – information theory

PUBLICATIONS

Manuscripts in preparation:

- Authors list TBD and **A. Champagne-Ruel**, *Tackling the Origin of Life: Converging standards in origins research*, (2023) preprint.
- **A. Champagne-Ruel**, *Diffusion and Pattern Formation in Spatial Games*, (2023) preprint.
- **A. Champagne-Ruel**, *Information-Theoretic Approaches to the Origin of Life*, (2023) preprint.

Under review:

- **A. Champagne-Ruel** and P. Charbonneau, *A Phase Transition to Cooperative Takeover*, (2022) preprint.

Published:

- **A. Champagne-Ruel** and P. Charbonneau, “A Mutation Threshold for Cooperative Takeover”, *Life* **12**, 254 (2022).
- S. Gelin, **A. Champagne-Ruel** and N. Mousseau, “Enthalpy-entropy compensation of atomic diffusion originates from softening of low frequency phonons”, *Nature Communications* **11**, 3977 (2020).

Invited talks:

- **A. Champagne-Ruel**, “Cooperation and the Origin of Life”, Invited Talk, Quantum Photonics Clubhouse Podcast, 2022.
- **A. Champagne-Ruel**, “Coopération, émergence et transitions: comment la physique statistique peut nous éclairer sur la question des origines”, Invited Talk, Qu’est-Ce Qu’expliquer Une Origine En Science ? (CIRST, UQAM), 2022.

Talks:

- **A. Champagne-Ruel**, “Théorie de l’information et origine de la vie”, Talk, 90e Congrès de l’ACFAS, 2023.

- **A. Champagne-Ruel**, “A Mutation Threshold for Cooperative Takeover”, Talk, AbSciCon (Atlanta), 2022.
- **A. Champagne-Ruel**, “Cooperation: an emergent universal feature at the dawn of life”, Talk, Interdisciplinary Origin of Life Meeting for Early Career Researchers (Montréal), 2022.
- **A. Champagne-Ruel**, “Mutation favors the emergence of cooperation”, Talk, Life and Space Poland, 2021.
- **A. Champagne-Ruel**, “La criticalité dans un système évolutif artificiel”, Talk, Centre de Recherche En Astrophysique Du Québec (CRAQ) - Rencontre Annuelle, 2019.

Posters:

- **A. Champagne-Ruel**, A. Demers-Bergeron and P. Charbonneau, “L’émergence de la coopération via l’évolution de réseaux informationnels”, Poster, 90e Congrès de l’ACFAS, 2023.
- **A. Champagne-Ruel**, S. Zakaib-Bernier and P. Charbonneau, “Diffusion, structures spatiales et origine de la vie”, Poster, 90e Congrès de l’ACFAS, 2023.
- S. Asche, **A. Champagne-Ruel**, S. F. Jordan, M. Preiner, A. d. N. Vieira, J. C. Xavier and C. Mathis, “OoLEN - The Origin of Life Early-career Network: Building the community needed to solve the problem”, Poster, AbSciCon Atlanta, 2022.
- **A. Champagne-Ruel** and P. Charbonneau, “Les mutations favorisent la coopération en contexte évolutif”, Poster, Centenaire, Département de Physique, Université de Montréal, 2021.
- **A. Champagne-Ruel** and P. Charbonneau, “Mutation favors the emergence of cooperative behavior”, Poster, Molecular Origins of Life Munich, 2021.
- **A. Champagne-Ruel** and P. Charbonneau, “Mutations promote cooperation in an evolutionary setting”, Poster, XIXth ISSOL Conference, 2021.
- **A. Champagne-Ruel** and P. Charbonneau, “Self-organized criticality : a prelude to avalanche models of solar flares”, Poster, Space Climate 7 Symposium, 2019.

MEDIA

Press coverage:

- A. Riopel, “Comment reconnaître la vie sur d’autres planètes”, [Le Devoir \(2023\)](#).

EDUCATION

| | | |
|---------|--|------------------------|
| ongoing | Ph.D. Astrophysics ADVISOR: Paul Charbonneau | UNIVERSITÉ DE MONTRÉAL |
| 2020 | M.Sc. Astrophysics THESIS: <i>From game theory to exobiology – the emergence of cooperation as a critical phenomenon</i> (link) ADVISOR: Paul Charbonneau | UNIVERSITÉ DE MONTRÉAL |
| 2018 | B.Sc. Physics | UNIVERSITÉ DE MONTRÉAL |
| 2012 | B.Sc. Philosophy | UNIVERSITÉ DE MONTRÉAL |

SCHOLARSHIPS AND AWARDS

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| 2023 | Excellence award | 5 000\$CAD | UNIVERSITÉ DE MONTRÉAL |
| 2022 | Google Cloud Research Grant | 1 000\$USD | GOOGLE |
| 2022 | Excellence Scholarship | 10 000\$CAD | FONDATION J. ARMAND BOMBARDIER |
| 2022 | Doctoral Scholarship | 70 000\$CAD | FRQNT |
| 2021 | Best poster award | 250\$CAD | UNIVERSITÉ DE MONTRÉAL |
| 2021 | Student initiative project | 2 000\$CAD | UNIVERSITÉ DE MONTRÉAL |
| 2020 | Scholarship for transition to PhD | 2 500\$CAD | UNIVERSITÉ DE MONTRÉAL |
| 2020 | Excellence award | 1 000\$CAD | UNIVERSITÉ DE MONTRÉAL |
| 2018 | Excellence award | 10 000\$CAD | UNIVERSITÉ DE MONTRÉAL |
| 2017 | John Low Brebner scholarship | 2 500\$CAD | RQMP |
| 2014 | Excellence scholarship | 4 000\$CAD | UNIVERSITÉ DU QUÉBEC À MONTRÉAL |
| 2011 | Student initiative project | 1 000\$CAD | UNIVERSITÉ DE MONTRÉAL |

SKILLS

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| Languages: | PYTHON/NUMPY/SCIPY/MATPLOTLIB, C/C++, FORTRAN, TEX TEX, MATLAB, ASSEMBLY, BASH SCRIPTING |
| Tools: | MACHINE/STATISTICAL LEARNING, WEB DEVELOPMENT, NETWORK SECURITY |
| Operational: | GIT, LINUX, PARALLEL/HIGH PERFORMANCE COMPUTING |

CONFERENCES & WORKSHOPS

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| 2023 | Origine de la vie : de l'astrophysique à la philosophie | 90E CONGRÈS DE L'ACFAS |
| 2022 | Interdisciplinary Origin of Life Meeting for Early Career Researchers Montréal | OoLEN |
| 2022 | Qu'est-ce qu'expliquer une origine en science? | CIRST/UNIVERSITÉ DU QUÉBEC À MONTRÉAL |
| 2022 | AbSciCon Atlanta | NASA/AMERICAN GEOPHYSICAL UNION |
| 2021 | XIXth ISSOL conference | INTER. SOC. FOR THE STUDY OF THE ORIGIN OF LIFE |
| 2021 | Life and Space Conference | POLISH ASTROBIOLOGICAL SOCIETY |
| 2021 | Molecular Origins of Life Munich | CRC 235 EMERGENCE OF LIFE |
| 2019 | Space Climate 7 | UNIVERSITÉ DE MONTRÉAL |
| 2019 | Annual Meeting | CENTER FOR RESEARCH IN ASTROPHYSICS OF QUÉBEC |

PROFESSIONAL EXPERIENCES

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| 2022— | Member of the Executive Board | ORIGIN OF LIFE EARLY-CAREER NETWORK |
| 2022—2022 | Undergraduate internship supervision | UNIVERSITÉ DE MONTRÉAL |
| 2021—2022 | Conference organizer – <i>OoLEN Annual Meeting</i> | ORIGIN OF LIFE EARLY-CAREER NETWORK |
| 2021—2022 | Teaching assistant – <i>Introduction to astrobiology</i> | UNIVERSITÉ DE MONTRÉAL |
| 2018—2019 | Local organizing committee – Space Climate 7 | UNIVERSITÉ DE MONTRÉAL |
| 2018—2022 | Tutoring – undergraduate level | UNIVERSITÉ DE MONTRÉAL |

MEMBERSHIPS

Center for Research in Astrophysics of Québec (<http://craq-astro.ca/>)
Canadian Association of Physicists (<https://www.cap.ca/>)
Canadian Astronomical Society (<https://casca.ca/>)
Origin of Life Early-career Network (<https://oolen.org/>)
International Society for the Study of the Origin of Life (<https://issol.org>)
Complex Systems Society (<https://cssociety.org>)
Scientific Society for Astrobiology (founding member) (<https://www.astrobiologyssa.org>)