Dr. Francis-Yan Cyr-Racine

Jet Propulsion Laboratory
California Institute of Technology
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PERSONAL

Born: July 25, 1983 in St-Jean-sur-Richelieu, QC, Canada.
Citizenship: Canadian
Languages: English (fluent), French (native).

RESEARCH INTERESTS

Dark Matter
- Impact of self-interacting dark matter on cosmology and astrophysics.
- Impact of self-interaction on direct and indirect dark matter detection.
- Observable gravitational signatures of purely hidden dark-matter sectors.
- Constraints on dark matter substructures from gravitational lensing.
- Particle models of non-WIMP dark matter.

Neutrino Physics
- Interactions beyond the Standard Model and their impact on cosmology and their possible relation to neutrino anomalies.

Theoretical Cosmology
- Impact of beyond Standard Model physics on the cosmic microwave background and the large-scale structure of the Universe.
- Inflationary physics and the origins of primordial fluctuations.

EDUCATION

University of British Columbia, Vancouver, BC, Canada
- Ph.D. in Physics 2008-2012
- Advisor: Kris Sigurdson
- Thesis:"Exploring and Constraining New Physics in the Dark Sector"

McGill University, Montreal, QC, Canada
- M.Sc. in Physics 2006-2008
- Advisor: Robert H. Brandenberger

McGill University, Montreal, QC, Canada
- B.Sc., Honours Physics 2002-2005

EMPLOYMENT

California Institute of Technology, Jet Propulsion Laboratory
W.M. Keck Institute for Space Studies Prize Postdoctoral Fellow 2012-present
Memorial University of Newfoundland, Department of Physics
Research Assistant (Advisor: Len Zedel) May-Aug 2005
University of Waterloo, Institute for Quantum Computation
Research Assistant (Advisor: Raymond Laflamme) May-Aug 2004

RESEARCH PUBLICATIONS

Matthew Buckley, Jesus Zavala, **F.-Y. Cyr-Racine,** *et al.*
"Scattering, Damping and Acoustic Oscillations: Simulating the Structure of Dark Matter Halos with Relativistic Force Carrier,"
Phys. Rev. D 90, 043524 (2014); ArXiv:1405.2075 [astro-ph.CO].

Francis-Yan Cyr-Racine *et al.,*
"Constraints on Large-Scale Dark Acoustic Oscillations from Cosmology,"
Phys. Rev. D 89, 063517 (2014); ArXiv: 1310.3278 [astro-ph.CO].

Francis-Yan Cyr-Racine and Kris Sigurdson,
"Limits on Neutrino-Neutrino Scattering from the Early Universe,"
Submitted to PRD; ArXiv: 1306.1536 [astro-ph.CO].

Francis-Yan Cyr-Racine and Kris Sigurdson,
"The Cosmology of Atomic Dark Matter,"
Phys. Rev. D 87, 103515 (2013); ArXiv: 1209.5752 [astro-ph.CO].

Francis-Yan Cyr-Racine and Fabian Schmidt,
"Oscillating Bispectra and Galaxy Clustering: A Novel Probe of Inflationary Physics with Large-Scale Structure,"
Phys. Rev. D 84, 083505 (2011); ArXiv: 1106.2806 [astro-ph.CO].

Francis-Yan Cyr-Racine and Kris Sigurdson,
"Photons and Baryons before Atoms: Improving the Tight-Coupling Approximation,"
Phys. Rev. D 83, 103251 (2011); ArXiv: 1012.0569 [astro-ph.CO].

Francis-Yan Cyr-Racine, Stefano Profumo and Kris Sigurdson,
"Protohalo Constraints to the Resonant Annihilation of Dark Matter",
Phys. Rev. D 80, 081302 (2009); ArXiv: 0904.3922 [astro-ph.CO].

Francis-Yan Cyr-Racine and Robert H. Brandenberger,
"Study of the Growth of Entropy Modes in MSSM Flat Directions Decay: Constraints on the Parameter Space,"
JCAP 0902:022 (2009); ArXiv: 0811.4457 [hep-ph].

Len Zedel and **Francis-Yan Cyr-Racine,**
"Extracting Fish and Water Velocities from Doppler Profiler Data,"
ICES Journal of Marine Science **66** fsp-168 (2009).

C. Negrevergne, T. S. Mahesh, C. A. Ryan, M. Ditty, **F.-Y. Cyr-Racine**, W. Power, N. Boulant, T. Havel, D. G. Cory, and R. Laflamme,
"Benchmarking Quantum Control Methods on a 12-Qubit System,"
Phys. Rev. Lett. 96, 170501 (2006); ArXiv: quant-ph/0603248.

REVIEWS

Rouzbeh Allahverdi, Robert Brandenberger, **Francis-Yan Cyr-Racine**, and Anupam Mazumdar,
"Reheating in Inflationary Cosmology: Theory and Applications,"

Annu. Rev. Nucl. Part. Sci, 60:27-51 (2010); ArXiv: 1001.2600 [hep-th].

WHITE PAPERS

T. Treu, P. J. Marshall, **F.-Y. Cyr-Racine** *et al.,*
"Dark Energy with Gravitational Lens Time Delays,"
Submitted to the Snowmass 2013 process; ArXiv: 1306.1272 [astro-ph].

POPULAR PRESS

Adam Becker,
"Eavesdropping on Dark Sound Shrinks the Shadow Universe"
New Scientist, Issue 2942, Nov 2013.

INVITED TALKS

"Understanding the Physics Probed by BICEP2"

- University of California, Riverside, CA, May 2014.

"Eavesdropping on the Dark Sound of the Universe"

- University of California, Davis, CA, Oct 2014.
- CCAPP, Ohio State University, OH, Oct 2014.
- PACIFIC 2014, Moorea, French Polynesia, Sep 2014.
- University of California, San Diego, CA, April 2014.
- California Institute of Technology, Pasadena, CA, Mar 2014.
- Ecole Polytechnique Federale de Lausanne, Switzerland, Feb 2014.
- Instituto de Fisica Corpuscular, Valencia, Spain, Feb 2014.

"Cosmological Signatures of Interacting Dark Matter"

- Harvard University, Cambridge, MA, Aug 2013.

"The Cosmology of Atomic Dark Matter"

- Aspen Center for Physics, Aspen, CO, Jan 2013.

"Old Physics, New Tricks and the Theory of Atomic Dark Matter"

- CITA, Toronto, ON, Feb 2012.
- McGill University, Montreal, QC, Jan 2012.
- Perimeter Institute, Waterloo, ON, Jan 2012.

"Study of the Growth of Entropy Modes in MSSM Flat Directions Decay: Constraints on the Parameter Space"

- TRIUMF, Vancouver, BC, Nov 2009.

CONTRIBUTED TALKS

"Limits on Neutrino-Neutrino Scattering from the Early Universe"

- Institut d'Astrophysique de Paris, France, Feb 2014.
- CosPA Conference, Honolulu, HI, Nov 2013.
- Santa Fe Cosmology Institute, Santa Fe, NM, Jul 2013.
- CASCA Conference, Vancouver, BC, May 2013.

"Constraints on Large-Scale Dark Acoustic Oscillations from Cosmology"

- CosPA Conference, Honolulu, HI, Nov 2013.

"Cosmological Signatures of Interacting Dark Matter"
- DaMaSC II Symposium, Caltech, Pasadena, CA, Sep 2013.

"Cosmological Signatures of Nonstandard Dark Matter and Neutrinos"
- Jet Propulsion Laboratory, Pasadena, CA, Feb 2013.

"The Cosmology of Atomic Dark Matter"
- TASC meeting, Carnegie Observatory, Pasadena, CA, Nov 2012.

"Oscillating Bispectra and Galaxy Clustering: A Novel Probe of Inflationary Physics with Large-Scale Structure",
- Institute for Advanced Studies, Princeton, NJ, Jul 2011.

"Protohalo Constraints to the Resonant Annihilation of Dark Matter"
- PASCOS 2009, DESY, Hamburg, Germany, Jul 2009.
- Frontiers of Cosmology, Perimeter Inst., Waterloo, ON, Jun 2009.
- APS NorthWest Conference, UBC, Vancouver, BC, May 2009.

CONTRIBUTED POSTERS

"Limits on Neutrino-Neutrino Scattering from the Early Universe"
- Planck Conference, UC Davis, CA, May 2013.

"The Cosmology of Atomic Dark Matter"
- Dwarf Galaxy Conference, KITP, Santa Barbara, CA, Feb 2012.

AWARDS & HONOURS

- **JPL Award for Outstanding Postdoctoral Research**
  Jet Propulsion Laboratory, California Institute of Technology (2014)
- **W. M. Keck Institute for Space Studies Postdoctoral Fellowship**
  California Institute of Technology, Jet Propulsion Laboratory (2012-2015).
- **NSERC Postdoctoral Fellowship** (declined).
- **NSERC Michael Smith Foreign Study Supplement**
  California Institute of Technology (2011).
- **NSERC Doctoral Canada Graduate Scholarship**
  University of British Columbia (2008-2011).
- **Graduate Entrance Scholarship**
  University of British Columbia (2008-2009).
- **FQRNT Bourse de Doctorat** (declined).
- **NSERC Master Canada Graduate Scholarship**
  McGill University (2007-2008).
- **FQRNT Bourse de Maitrise**
  McGill University (2007).
- **Graduate Entrance Award**
  McGill University (2006).
- **NSERC Undergraduate Summer Research Award**
  Memorial University of Newfoundland (2005).
- **Horace Watson Medal and Prize in Physic** (*highest standing in physics)*
  McGill University (2005).
- **Sigma Xi Excellence in Research Award** *(for best undergraduate thesis)*
  McGill University (2005).

- NSERC Undergraduate Summer Research Award
Institute for Quantum Computation, University of Waterloo (2004).
- Wonton Prize in Physics
McGill University (2003).
- James McGill Scholarship
McGill University (2002-2005).

TEACHING

Teaching Assistant, Department of Physics and Astronomy
University of British Columbia. 2008-2011

Teaching Assistant, Department of Physics
McGill University. 2006- 2008

English Teaching Assistant
Lycée du Haut-Barr, Saverne, France. 2005-2006

STUDENT SUPERVISION

Summer Undergraduate Research Fellowship
- Kevin Sung, Rutgers University. Jun-Aug 2014

Minority Undergraduate Research Fellowship
- Christina Kreisch, Washington University in St. Louis. Jun-Aug 2014

JPL Summer Internship Program
- Daniel Gilman, University of California, Los Angeles. Jun-Aug 2014

NASA Undergraduate Internship
- Daniel Gilman, James Madison University. Sep-Dec 2013

COMMUNITY SERVICE

Conference Organizer
- Dark Matter in Southern California Symposium (DaMaSC). Apr 2014
- Dark Matter in Southern California Symposium (DaMaSC). Sep 2013
- Canadian Undergraduate Physics Conference (CUPC). Nov 2003

Seminar Organizer
- UBC/TRIUMF Particle Cosmology Group Meeting. 2011-2012
- McGill Student Theory Seminar. 2007-2008

Referee
- Physical Review Letters.
- Astrophysical Journal.
- Physical Review D.
- Galaxies.

Membership in Scholarly Societies
- Member, Canadian Association of Physicists. 2011-present
- Member, Canadian Astronomical Society. 2013-present
- Member, Sigma Xi Research Society. 2005-present

Other Key Services to the Community
- Judge, Vancouver Regional Science Fair. 2009

PROPOSALS	**Co-Investigator**, NASA Astrophysical Theory Proposal - PI: L. Moustakas.	2014
	Collaborator, NASA Astrophysical Theory Proposal - PI: M. Vogelsberger.	2014
	Co-Investigator, NASA Astrophysical Theory Proposal - PI: L. Moustakas.	2012
	Collaborator, NASA OMEGA Explorer Mission Proposal - PI: L. Moustakas.	2011

REFERENCES

Kris Sigurdson, Associate Professor, University of British Columbia.
Leonidas Moustakas, Astrophysics Section Manager, JPL.
Charles R. Keeton, Associate Professor, Rutgers University.
Ludovic Van Waerbeke, Associate Professor, Univ. of British Columbia.