

Theory* Recap**,1

S(h)eyda Ipek
Carleton University

* BSM particle pheno + astroparticle

** June 2023 - June 2024

† for complaints: director@ipp.ca

Theory!

~~Panic!~~ at the
~~Disco~~

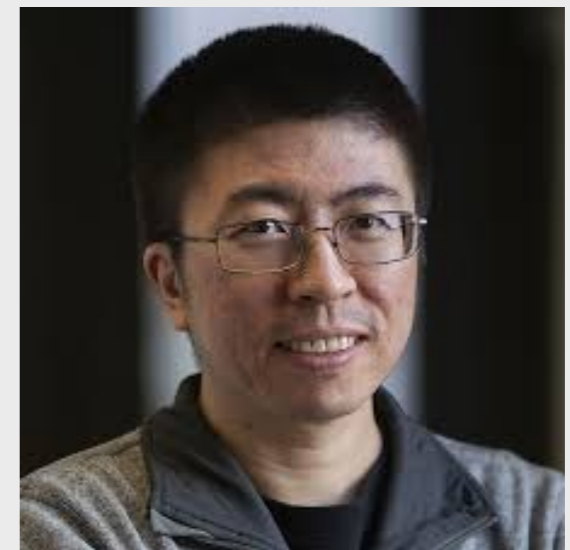
on the IPP Scientific Council



Evan McDonough
Winnipeg



Aaron Vincent
Queen's



Yue Zhang
Carleton

IPP Theorists

WEST-COAST

British Columbia:
 UBC:
 Joanna Karczarek, Moshe Rozali, G. Semenoff, Kris Sigurdson, Mark Van Raamsdonk, A. Zhitnitsky

 U Fraser Valley:
 Derek Harnett

 U Victoria:
 Kristan Jensen, Pavel Kovtun, Adam Ritz

 Simon Fraser U:
 Levon Pogosian

 TRIUMF:
 David McKeen, David Morrissey

PRAIRIES

Alberta:
 U Alberta:
Alberta Center for Particle Physics
 Nassim Bozorgnia, A. Czarnecki, Saeed Rastgoo; Augustana Campus: Blokland, Bouchard, de Montigny

 U Calgary:
 Rachid Ouyed

Saskatchewan:
 U Sask:
 Rainer Dick, Tom Steele

 Regina:
 Nikolay Kolev, Nader Mobed

Manitoba:
Winnipeg Inst. Theoretical Physics

 U Winnipeg:
 Andrew Frey, G. Kunstatter, Evan McDonough

 Brandon:
 Margaret Carrington

SOUTH-EAST MEGATROPOLIS

Ontario:
 Carleton: Bruce Campbell, Steve Godfrey, Thomas Gregoire, Seyda Ipek, Heather Logan, Daniel Stolarski, Yue Zhang
 McMaster: Cliff Burgess
 Perimeter: Jaume Gomis, Rob Myers
 Queen's: Aaron Vincent, Joe Bramante
 U of T: David Curtin, Bob Holdom, Michael Luke, John Moffat, AW Peet, Erich Poppitz
 York: Randy Lewis, Kim Maltman, Sean Tulin
 Waterloo: Achim Kempf, R. Mann
 Western: Alex Buchel, V. Miransky

Quebec:
 Laval: Helmut Kroeger, Luc Marleau, Pierre Mathieu
 McGill: Robert Brandenberger, Simon Caron-Huot, James Cline, Keshav Dasgupta, Alex Maloney, Katelin Schutz
 U de Montreal: David London, Richard MacKenzie, Manu B. Paranjape
 UQAM: Gilles Couture

Evan McDonough
Winnipeg

ATLANTIC

New Brunswick:
 Mohammad Ahmady

Nova Scotia:
 Ruben Sandapen

Newfoundland:
 Aleksander Aleksejevs, Svetlana Barkanova

New theory faculty



Gopolang Mohlabeng
SFU

was a postdoc at Queen's



Nikita Blinov
York University

David Morrissey's
PhD student!

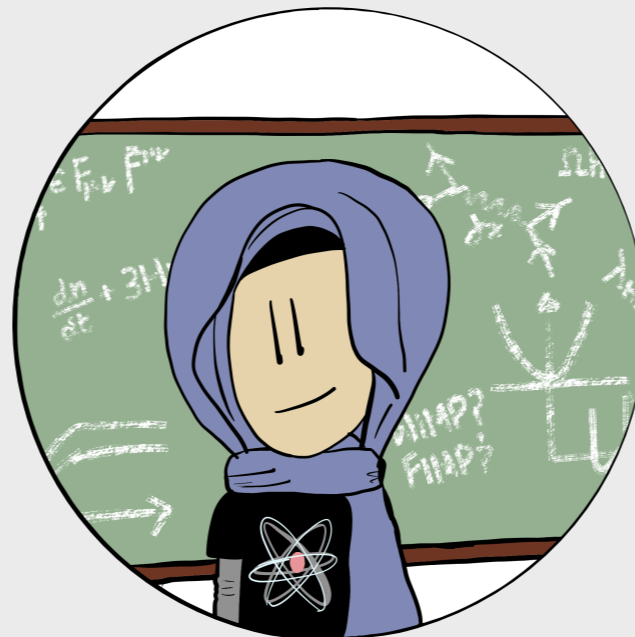


IPP 50th Anniversary Connect Postdoctoral Fellowship

Saniya Heeba (theory)



McGill
UNIVERSITY



Art by Saniya Heeba

Carleton
University



Opening ν -Dark Portals: From Lagrangians to Simulations

Dark (matter) times in theory...

The universe is our oyster



small scale structure, BBN, CMB, large scale structure, astro simulations, ...

Dark Matter Direct Detection on the Moon

Andréa Gaspert,^{1,*} Pietro Giampa,^{2,†} Navin McGinnis,^{2,‡} and David E. Morrissey^{2,§}

¹*Department of Physics, Stanford University, Stanford, CA 94305, USA*

²*TRIUMF, 4004 Wesbrook Mall, Vancouver, BC V6T 2A3, Canada*

Gravitational Production of Completely Dark Photons with Nonminimal Couplings to Gravity

Christian Capanelli,^a Leah Jenks,^b Edward W. Kolb,^{b,c} Evan McDonough^d

Dark Matter Annihilation inside Large Volume Neutrino Detectors

David McKeen,^{1,a} David E. Morrissey,^{1,b} Maxim Pospelov,^{2,3,c} Harikrishnan Ramani,^{4,d} and Anupam Ray^{5,2,e}

Higgs Portal Interpretation of the Belle II $B^+ \rightarrow K^+ \nu \nu$ Measurement

David McKeen,^{1,*} John N. Ng,^{1,†} and Douglas Tuckler^{1,2,‡}

Carleton → TRIUMF

Radiative Corrections to Light Thermal Pseudo-Dirac Dark Matter

Gopolang Mohlabeng,^{1,2,*} Adreja Mondol,^{1,†} and Tim M.P. Tait^{1,‡}

Axion-Induced Patchy Screening of the Cosmic Microwave Background

Cristina Mondino^a, Dalila Pîrvu^{a,b}, Junwu Huang^a, and Matthew C. Johnson^{a,c}

Long-lived particle decays at the proposed MATHUSLA experiment

David Curtin^{ⓑ*} and Jaipratap Singh Grewal^{ⓑ†}

Department of Physics, University of Toronto, Toronto, Ontario M5S 1A7, Canada

Cosmic Ray-Boosted Dark Matter at IceCube

Christopher V. Cappiello,^{1,2,3,*} Qinrui Liu,^{1,2,3,†} Gopolang Mohlabeng,^{4,5,‡} and Aaron C. Vincent^{1,2,3,§}

Identifying Energy-Dependent Flavor Transitions in High-Energy Astrophysical Neutrino Measurements

Qinrui Liu,^{1,2,3,*} Damiano F. G. Fiorillo,^{4,†} Carlos A. Argüelles,^{5,‡} Mauricio Bustamante,^{4,§} Ningqiang Song,^{6,7,¶} and Aaron C. Vincent^{1,2,3,**}

Self-interacting dark matter solves the final parsec problem of supermassive black hole mergers

Gonzalo Alonso-Álvarez,^{1,2,*} James M. Cline,^{2,3,†} and Caitlyn Dewar^{2,‡}

McGill → U Toronto

Looking in the axion mirror: An all-sky analysis of stimulated decay

Yitian Sun,¹ Katelin Schutz,^{2,3} Harper Sewalls,^{2,3,4} Calvin Leung,^{5,6,7,8} and Kiyoshi Wesley Masui^{6,7}

A Dissipative Dark Cosmology: From Early Matter Dominance to Delayed Compact Objects

Joseph Bramante^{1,2,3,*} Christopher V. Cappiello^{1,2,3,†} Melissa Diamond^{1,2,3,‡}
J. Leo Kim^{1,2,§} Qinrui Liu^{1,2,3,¶} and Aaron C. Vincent^{1,2,3,**}

Probing flavor violation and baryogenesis via primordial gravitational waves



Zafri A. Borboruah,^a Anish Ghoshal,^b Seyda Ipek^c

Dissipative Dark Substructure: The Consequences of Atomic Dark Matter on Milky Way Analog Subhalos

CALEB GEMMELL,¹ SANDIP ROY,² XUEJIAN SHEN,^{3,4} DAVID CURTIN,¹ MARIANGELA LISANTI,^{2,5} NORMAN MURRAY,⁶ AND
PHILIP F. HOPKINS⁷

Influence of new states in searches for negative gauge-Higgs couplings

Carlos Henrique de Lima^{1,*} and Daniel Stolarski^{2,†}

Carleton → TRIUMF

The impact of the Large Magellanic Cloud on dark matter direct detection signals

Adam Smith-Orlik,^a Nima Ronaghi,^b Nassim Bozorgnia,^{b,c} Marius Cautun,^d Azadeh Fattahi,^e Gurtina Besla,^f Carlos S. Frenk,^e Nicolás Garavito-Camargo,^g Facundo A. Gómez,^{h,i} Robert J. J. Grand,^{j,k,l} Federico Marinacci,^m and Annika H. G. Peterⁿ

Chiral properties of the nucleon interpolating current and θ -dependent observables

Yohei Ema,^{1,2,*} Ting Gao,^{2,†} Maxim Pospelov,^{1,2,‡} and Adam Ritz^{3,§}

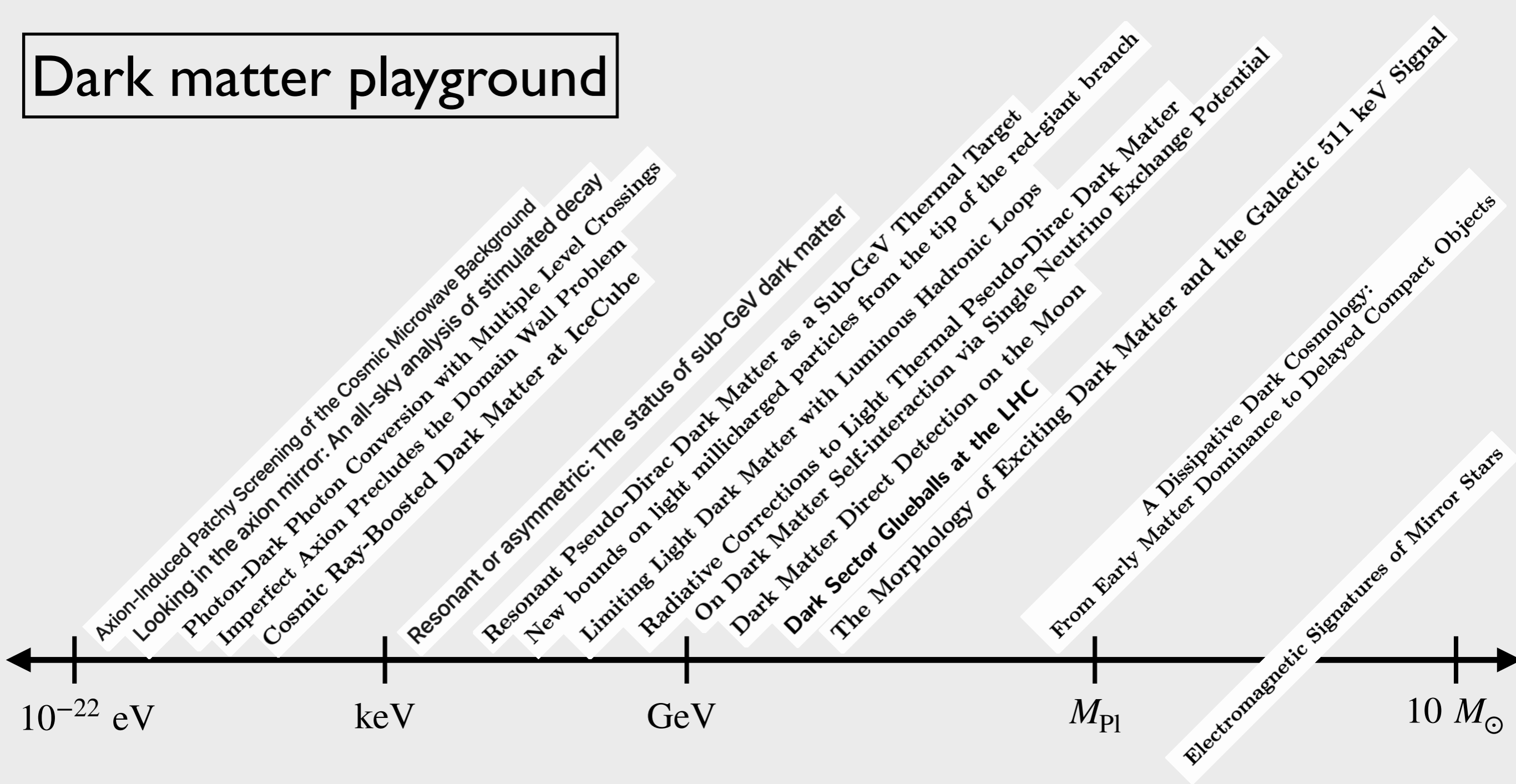
Can CP be conserved in the two-Higgs-doublet model?

Carlos Henrique de Lima^{1,2,*} and Heather E. Logan^{2,†}

On Dark Matter Self-interaction via Single Neutrino Exchange Potential

Yue Zhang

Dark matter playground



axions, ALPs, dark photons...

sterile neutrinos, WIMPs...

dark atoms, dark stars...

primordial black holes...

Theory representation at PPD Symposium at CAP Congress “Dark Matter And Neutrinos”

Origins of (neutrino-ish) Dark Matter in the Matter Power Spectrum

Yue Zhang
Carleton University

CAP Congress 2024, Dark Matter and Neutrinos Symposium
Western University, London Ontario

High speed dark matter particles in our Solar vicinity

Nassim Bozorgnia



2024 CAP Congress, “Dark Matter and Neutrinos” Symposium
Western University
29 May 2024



Canada Research
Chairs

Chaires de recherche
du Canada



Searching for Light Accelerated Dark Matter

Gopolang (Gopi) Mohlabeng

Simon Fraser University

29 May 2024



Canadian Association
of Physicists
Association canadienne
des physiciens et physiciennes

SFU




Theory representation at PPD Symposium at CAP Congress “Dark Matter And Neutrinos”

Origins of (neutrino-ish) Dark Matter
in the Matter Power Spectrum

High speed dark matter
particles in our Solar vicinity

Nassim Bozorgnia

CAP Congress 2024
Wednesday



INSTITUTE OF
PARTICLE
PHYSICS

Quite a few
connections to
IPP
experiments

“Dark Matter And Neutrinos” Symposium



Searching for

Gopolang (Gopi) Mohlabeng

Simon Fraser University

29 May 2024

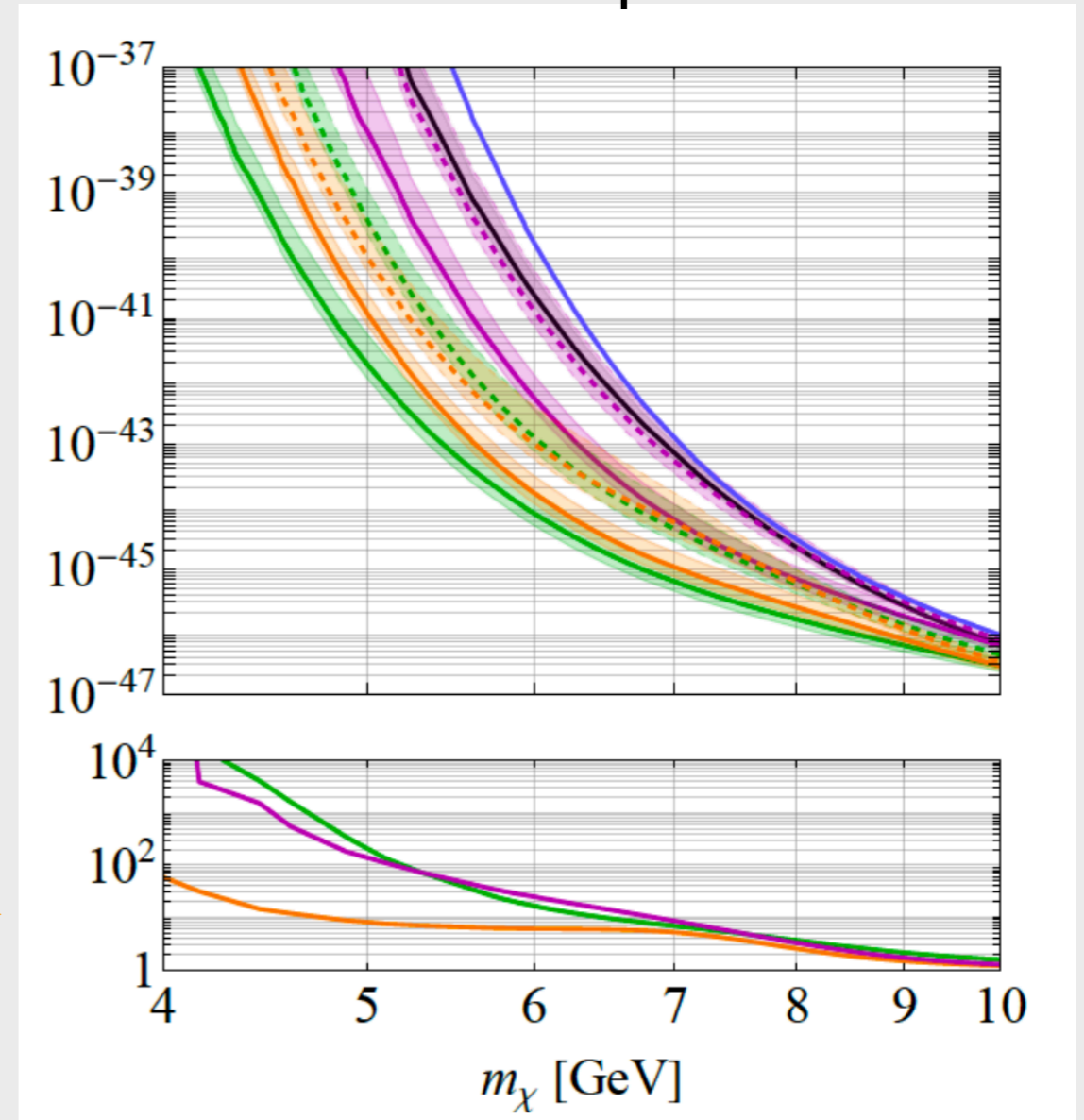
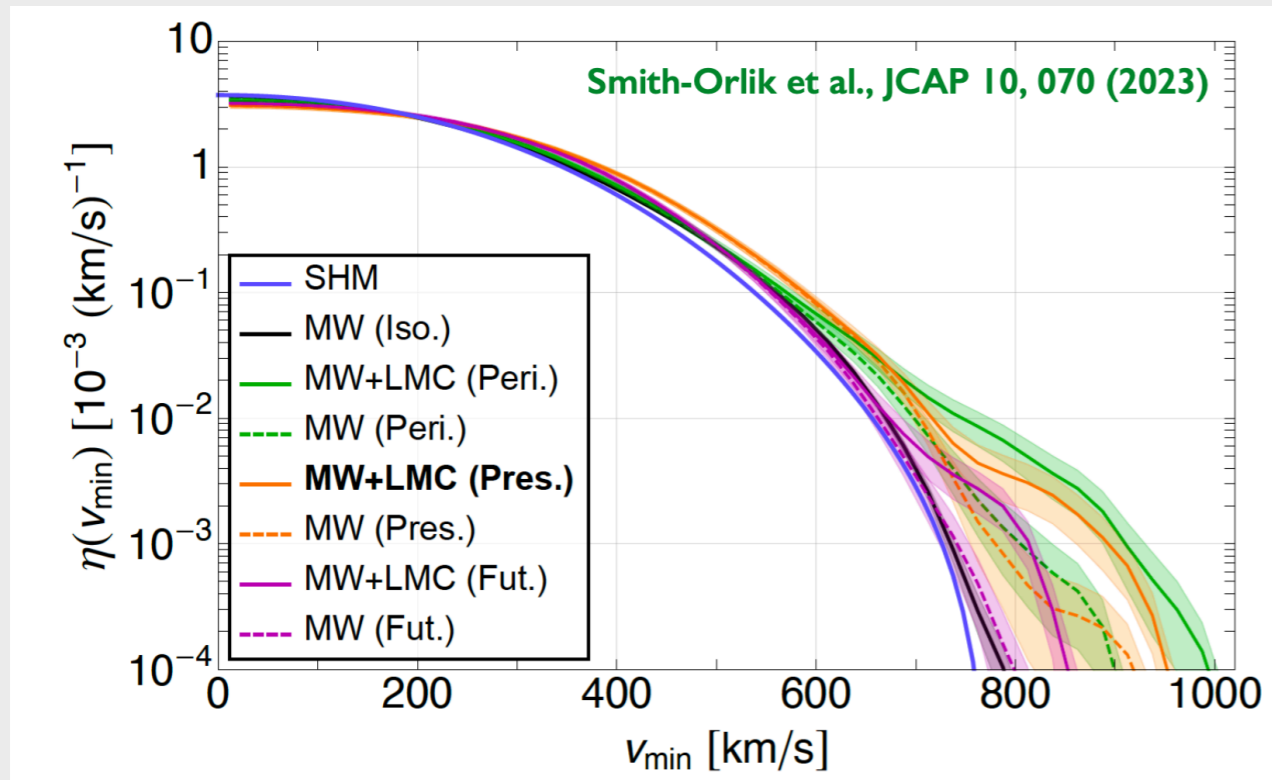


DARK MATTER
@
FINITE TEMPERATURE

SANIYA HEEBA
McGILL U.
CAP CONGRESS 2024

Do we know the DM speed distribution?

idealized liquid Xe detector



fast DM particles
due to the Large Magellanic Cloud

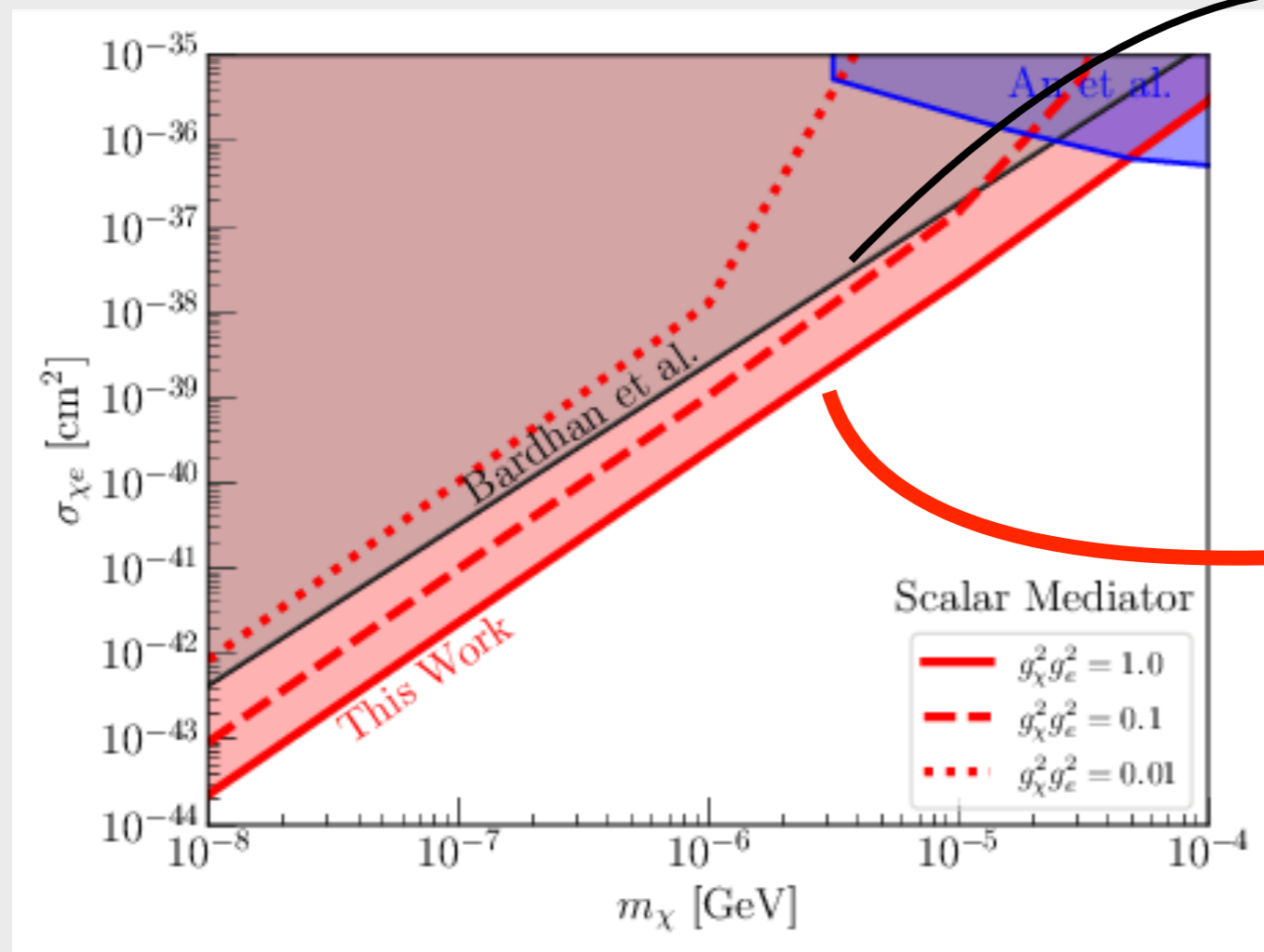
How about Liquid argon detectors?

Nassim Bozorgnia, et al

Do we know the DM speed distribution?

Cosmic Ray-Boosted Dark Matter at IceCube

Christopher V. Cappiello,^{1,2,3,*} Qinrui Liu,^{1,2,3,†} Gopolang Mohlabeng,^{4,5,‡} and Aaron C. Vincent^{1,2,3,§}



SuperK

HyperK?
DUNE?

IceCube

P-ONE?

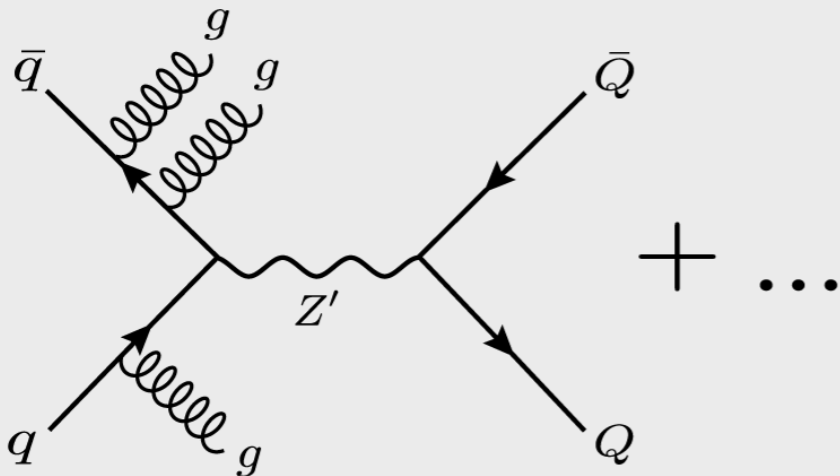
Dark sector
(confining)

scalar, pseudoscalar, vector...



Standard Model

An interesting signal:

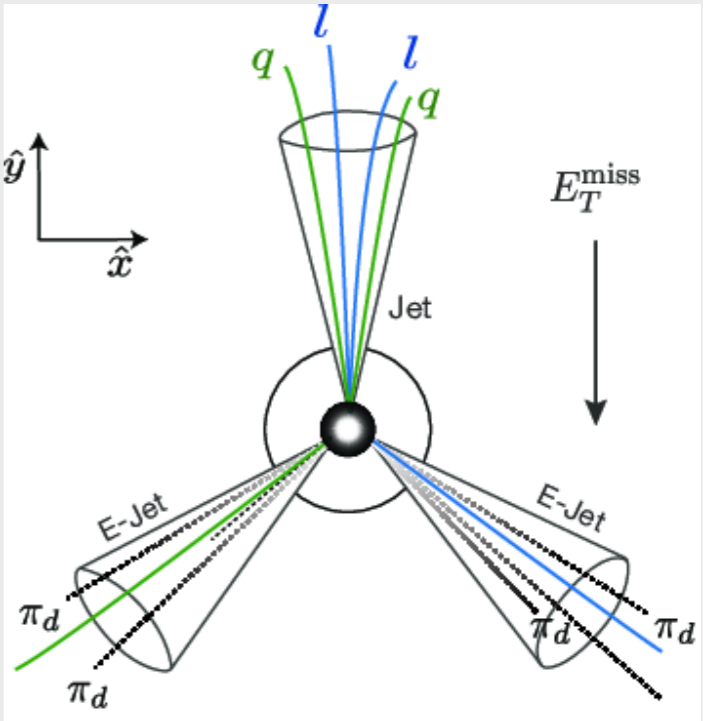


Triggering on Emerging Jets

Dylan Linthorne and Daniel Stolarski
 Ottawa-Carleton Institute for Physics, Carleton University,
 1125 Colonel By Drive, Ottawa, Ontario K1S 5B6, Canada *

2021

I heard that ATLAS search results coming along soon!



Theory (+ experiment) workshops*



Logo by
Saniya Heeba



GUINEAPIG 2023 - Light dark matter
July 11-13, 2023
Université de Montréal

Dark Matter, First Light
February 2024
Perimeter Institute



Neutrinos in Cosmology
and Astrophysics
March 6-8, 2024
TRIUMF


* there might be ones I
wasn't invited to!

Join us
SUN, MOON, AND SCIENCE:
AN AFTERNOON OF CELESTIAL BEAUTY

April 7th, 2024
 2 – 4 pm

2000 St. Patrick Hall, Carleton University




Solar eclipse was a great opportunity for outreach!



McDonald
Institute

