Gong-show

8-9 January 2019

James Alvey

James **Alvey**

Theoretical Particle Physics and Cosmology,
King's College, London

Supervisor: **Prof. Malcolm Fairbairn**

James Alvey

Research Interests

Neutrino Physics

Propagation of high energy neutrinos from high energy sources such as blazars

Vacuum Dynamics

Bubble nucleation and percolation in gauge theories

Big Bang Nucleosynthesis

Big Bang Nucleosynthesis in BSM theories and experimental constraints

Giovanni Banelli

born in Cividale del Friuli, 20 km far from both Udine (NE Italy) and Kobarid (Slovenia)
high school matura at Liceo Classico “Paolo Diacono” in same town

- BSc Physics & Astronomy - Univerza v Ljubljani (2012-2016)
- MSc High Energy Physics - Universiteit van Amsterdam (2016-2018)
- PhD Theoretical Particle Physics - Technische Universität München (2018-)
- BA Accordion performance - Conservatorio di Trieste (2011-2016)

Univerza *v Ljubljani*
Fakulteta za *matematiko in fiziko*

UNIVERSITY OF AMSTERDAM

TECHNISCHE UNIVERSITÄT MÜNCHEN

Conservatorio di musica Giuseppe Tartini Trieste

Giovanni Banelli

research

past (Master thesis): flavour physics

arXiv:1809.09051 [hep-ph] (Eur.Phys.J. C)

- B meson* phenomenology, Effective Field Theory analyses of anomalies
- also experimental aspects of it (had summer internship at LHCb)

now: TECHNISCHE UNIVERSITÄT MÜNCHEN

supervisor: Prof. Dr. Andreas Weiler
group of theoretical physics at colliders

- Beyond the Standard Model (model building and pheno)
- also neural network* improved BSM searches (new strategies for particle detection in model independent way & reconstruction for specific collision processes*, analysis recasting*)

as ESR in Marie Curie ITN:

Salvatore Bottaro

Student gong-show

Salvatore Bottaro, 1^{st} year PhD student
Advisor: Prof. Roberto Contino

Scuola Normale Superiore

Salvatore Bottaro

Research interests

- Master's thesis: "Study of the axion potential in effective models around the chiral phase transition" (advisor: Prof. Enrico Meggiolaro, Unipi)
- PhD (just started) on axion cosmology in different scenarios: PQ symmetry broken during or after inflation. In the latter case, contributions to DM come also from topological structures (strings, domain walls).
- General interests: dark matter phenomenology, BSM model building.

Igor Broeckel

Igor Broeckel

- University of Bologna
- Supervisor: Prof. Michele Cicoli
- PhD thesis: String Theory Phenomenology
  (dark matter, inflation,...)

Igor Broeckel

Master Thesis

- University of Heidelberg
- Master thesis: Application of susy QM to cosmological structure formation

Cari Cesarotti
Harvard University

Advisor: Matt Reece

Matt Strassler (Harvard), Jesse Thaler (MIT)

Cari Cesarotti
Harvard University

Beyond the Standard Model Phenomenology

Data to motivate/understand new physics signals

- Interpreting the Electron EDM Constraint (arXiv:1810.07736)
  CC, Q. Lu, Y. Nakai, A. Parikh, M. Reece
- Searching for dimuon resonances at substantial pT with CMS Open Data
  CC, Y. Soreq, M. Strassler, J. Thaler, W. Xue
- Simulating jetty to spherical new physics events using AdS/CFT
  CC, M. Reece, M. Strassler

Siyu Chen

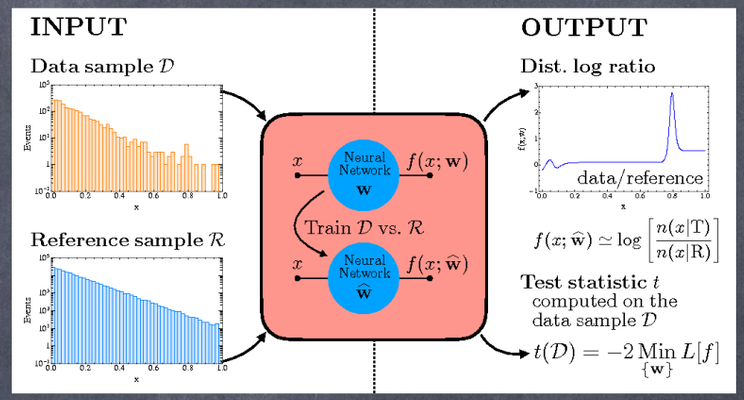
GGI 2019

- Siyu (Sue) Chen
- école polytechnique fédérale de Lausanne (EPFL), Switzerland
- Supervisor: Prof. Andrea Wulzer

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Siyu Chen

- Research Interest:
  - Search for new Physics beyond the Standard Model
  - High energy diboson process
  - Machine learning



Learning New Physics from a Machine - D'Agnolo. Raffaele Tito *et al.* arXiv: 1806.02350 [hep-ph]

Andrei Dashko

The shadow of dark matter as a shadow of string theory (U_Y portals to dark matter)

Andrii Dashko
Supervisor: prof. Rainer Dick

Taras Shevchenko National University of Kyiv, Ukraine
University of Saskatchewan, Canada

arXiv:1809.01089

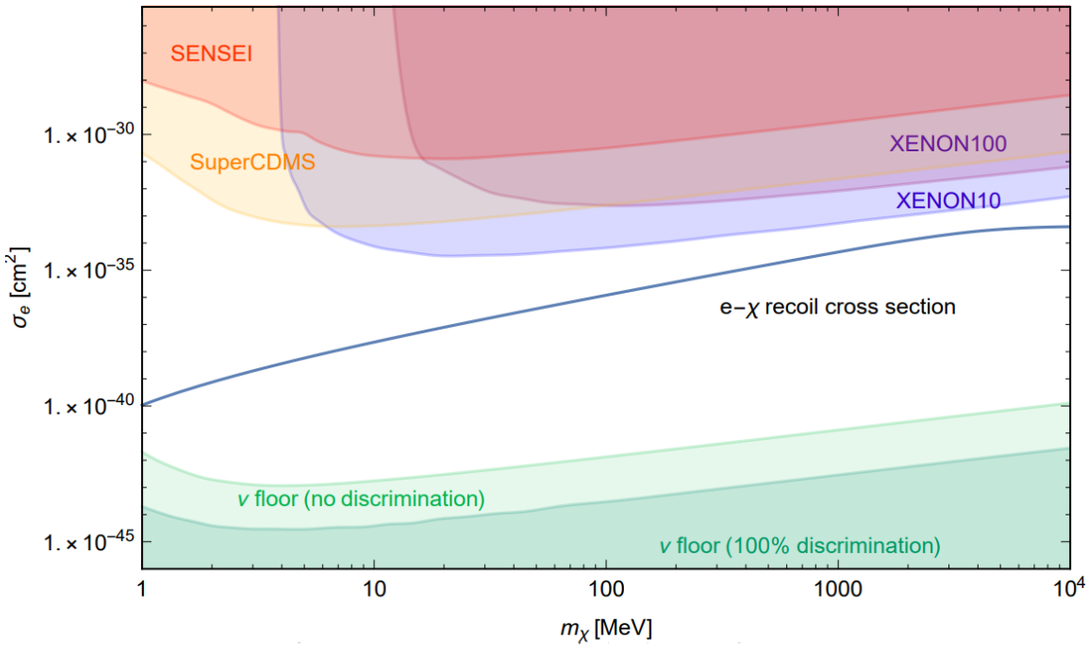
Andrei Dashko

Research results

- Gauge invariant interactions of strings require the Kalb-Ramond field to couple to the field strength tensors of U(1) gauge fields.

$$\mathcal{L}_{B\chi} = \frac{1}{M} B_{\mu\nu} \overline{\chi} \sigma^{\mu\nu} \chi$$

- We analysed in particular the case of a single dark matter component, and found that the MeV-GeV mass range for dipole coupled dark matter remains viable under recent constraints from direct searches in electron recoils, and has a high discovery potential due to yielding recoil cross sections above the neutrino floor.



Prasanna K. Dhani

The Institute of Mathematical Sciences, Chennai, India

Supervisor: Prof. V. Ravindran

Currently, I am a postdoc at INFN section of Florence, Italy

Prasanna K.Dhani

- **Higher order corrections to scattering amplitudes and cross-sections in SM and beyond using pQCD.**

- **Resummation Procedures:**
  - ✦ **Soft gluon resummation**
  - ✦ **Transverse momentum resummation (Interest)**

- **Infrared structure of scattering amplitudes.**

Gaètan Facchinetti

Gaétan Facchinetti

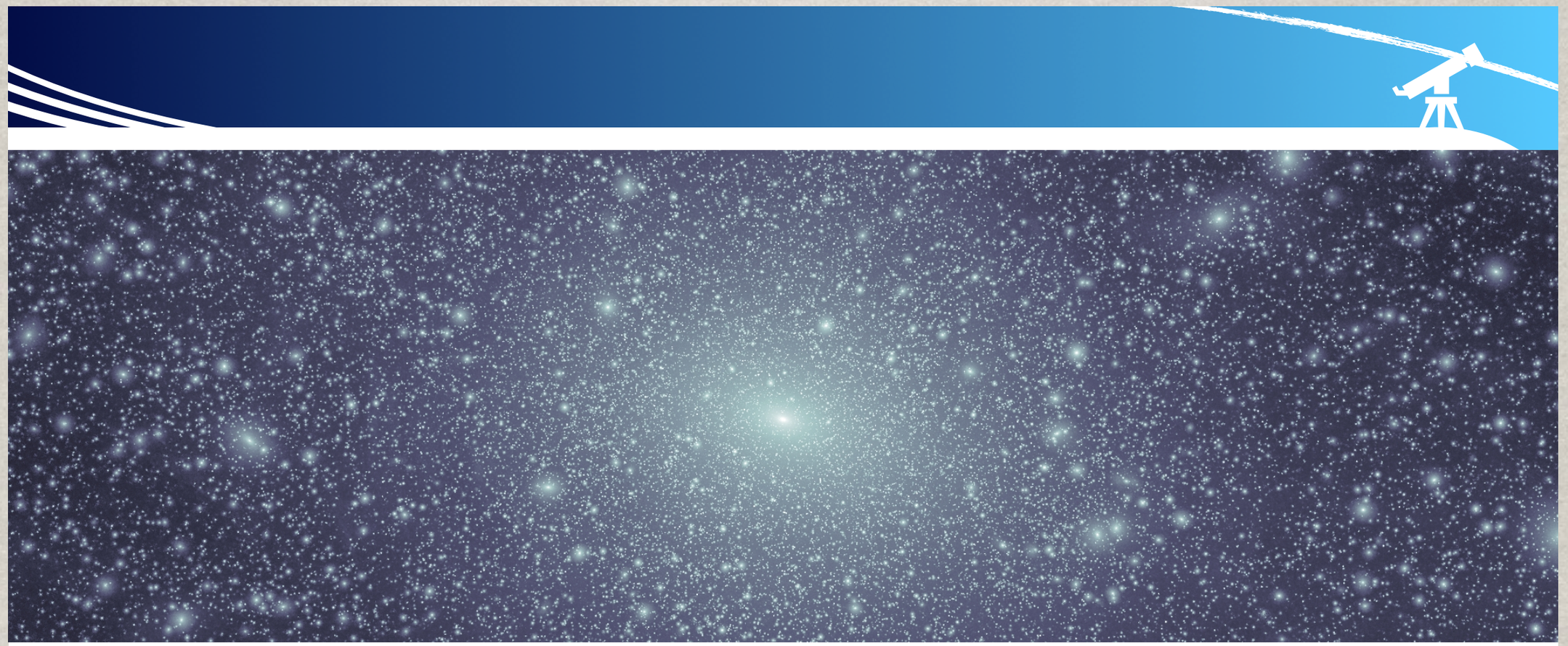
Ph.D. student - 1st year

Supervisor: Julien Lavalle

Impact of the small scale structuring of dark matter on its potential detection

Laboratoire Univers et Particules Montpellier (LUPM)

Gaètan Facchinetti



The Via Lactea project - Diemand et al. 2008

- Abundance of dark matter and minimal mass of the subhalos *(particle physics in the early Universe)*
  → Study of a generic WIMP model ⊕ NMSSM - N_2MSSM specific processes
- Modeling of the subhalo distribution in the Milky Way *(cosmology, structure formation)*
- Detectability of *point* subhalos using dark matter emission in gamma *(astrophysics)*
- Effects of stars on the subhalo population

Darius A. Faroughy

Darius A. Faroughy

Venezuela

PhD:

Jožef Stefan Institute
Slovenia

Advisor:
Jernej F. Kamenik

Post-Doc (Fall 2019):

Universität Zürich[UZH]

BSM Particle Phenomenology

- Colliders (LHC)
- B-meson anomalies
- Top Physics
- BSM model building
- Leptoquarks

Would like to explore:

- Machine Learning for BSM

Selected Publications:

- Confronting lepton flavor universality violation in B-decays with high-pT tau lepton searches at LHC [1609.07138]
- Four tops for LHC [1611.05032]
- Anomalies in Bottom from New Physics in Top [1805.04917]
- Scalar leptoquarks from GUT to accommodate the B-physics anomalies [1805.04917]

Darius A. Faroughy

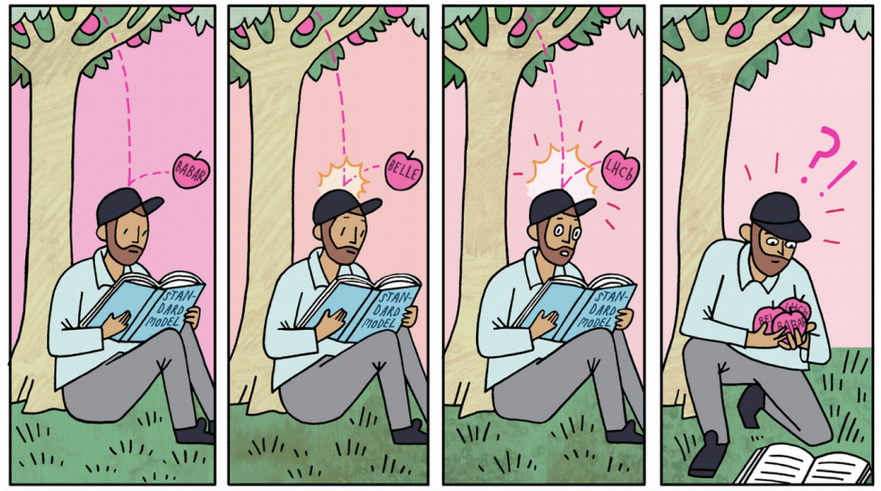
The SM is Lepton Flavor Universal (LFU) $\longrightarrow$ **Deviations from LFU implies BSM physics**

The B-anomalies:

$$R_{D^{(*)}} = \frac{\mathrm{Br}(B \to D^{(*)}\,\tau\bar{\nu})}{\mathrm{Br}(B \to D^{(*)}\,\ell\bar{\nu})}\Big|_{\ell=e,\mu} \qquad 3.8\sigma \text{ excess!}$$

$$R_{K^{(*)}} = \frac{\mathrm{Br}(B \to K^{(*)}\,\mu\bar{\mu})}{\mathrm{Br}(B \to D^{(*)}\,e\bar{e})} \qquad 2.5\sigma \text{ deficit!}$$

Evidence for **LFU** violation at B-factories!

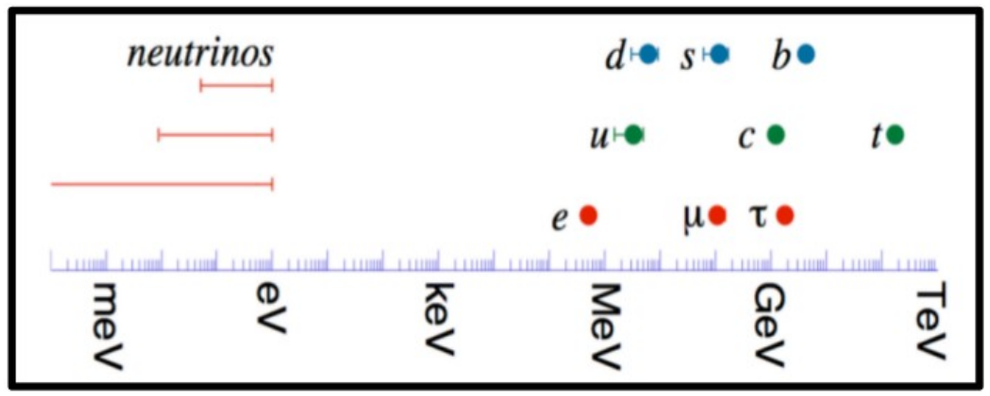


Artwork by Sandbox Studio, Chicago with Corinne Mucha

Can the LHC probe BSM models explaining the anomalies? For the RD(*) anomaly yep

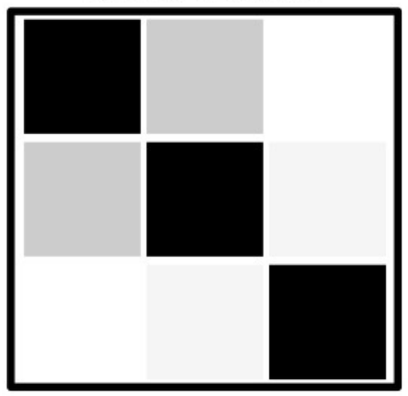
e.g. Di-tau production at the LHC

Connection with the SM Flavor Puzzle?



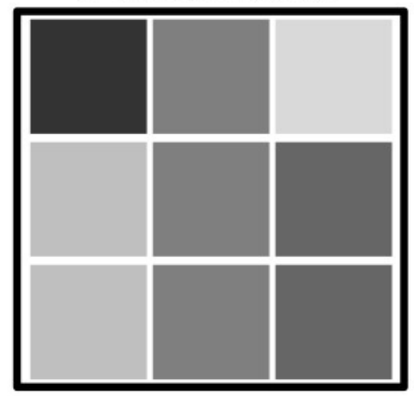
see-saw? symmetry?

CKM matrix



symmetry?

PMNS matrix



anarchy?

Damiano Fiorillo

University of Naples "Federico II"

- 10/2016 - Bachelor Thesis: "Complete topological characterization of different phases of a photonic quantum walk"; Advisor – Lorenzo Marrucci
- 06/2018 - Master Thesis: "Study of connections between neutrino phenomenology and leptogenesis in an SO(10) inspired context"; Advisor – Gennaro Miele

Publications

- "Neutrino phenomenology from leptogenesis", with F. Buccella, G. Miele, S. Morisi, O. Pisanti, P. Santorelli, Eur.Phys.J. C78 (2018) no.10, 817
- "Investigating two heavy neutral leptons neutrino seesaw mechanism at SHiP", with M. Chianese, G. Miele, S. Morisi, 1812.01994

Damiano Fiorillo

Work in progress

- Neutrino telescopes, simulations with Python

Research interests

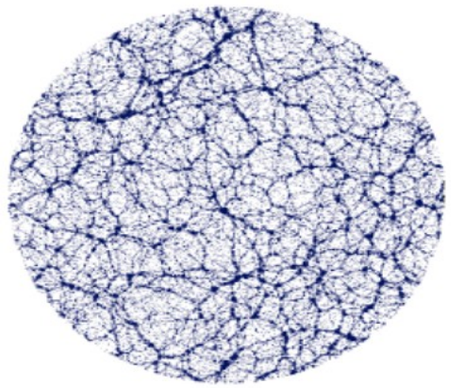
- Astroparticle and neutrino physics
- Baryon Asymmetry
- Dark Matter
- Axions

Clustering and redshift-space distortions beyond ΛCDM

Jorge Enrique García-Farieta
Universidad Nacional de Colombia

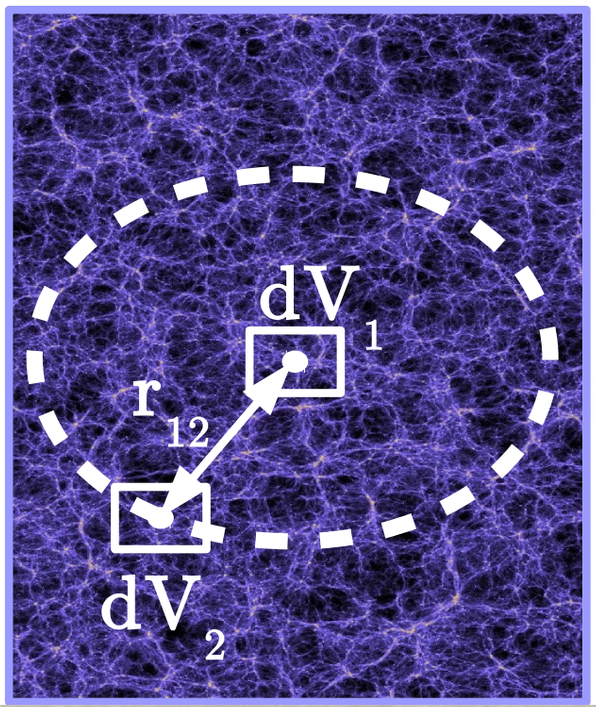
Supervisor: Rigoberto Casas
In collaboration with Lauro Moscardini

Real-space distribution



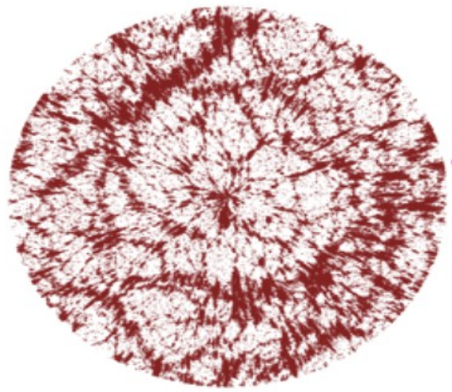
Redshift Space Distortions

- f(R) gravity
- Interacting Dark Energy
- N-body Simulations

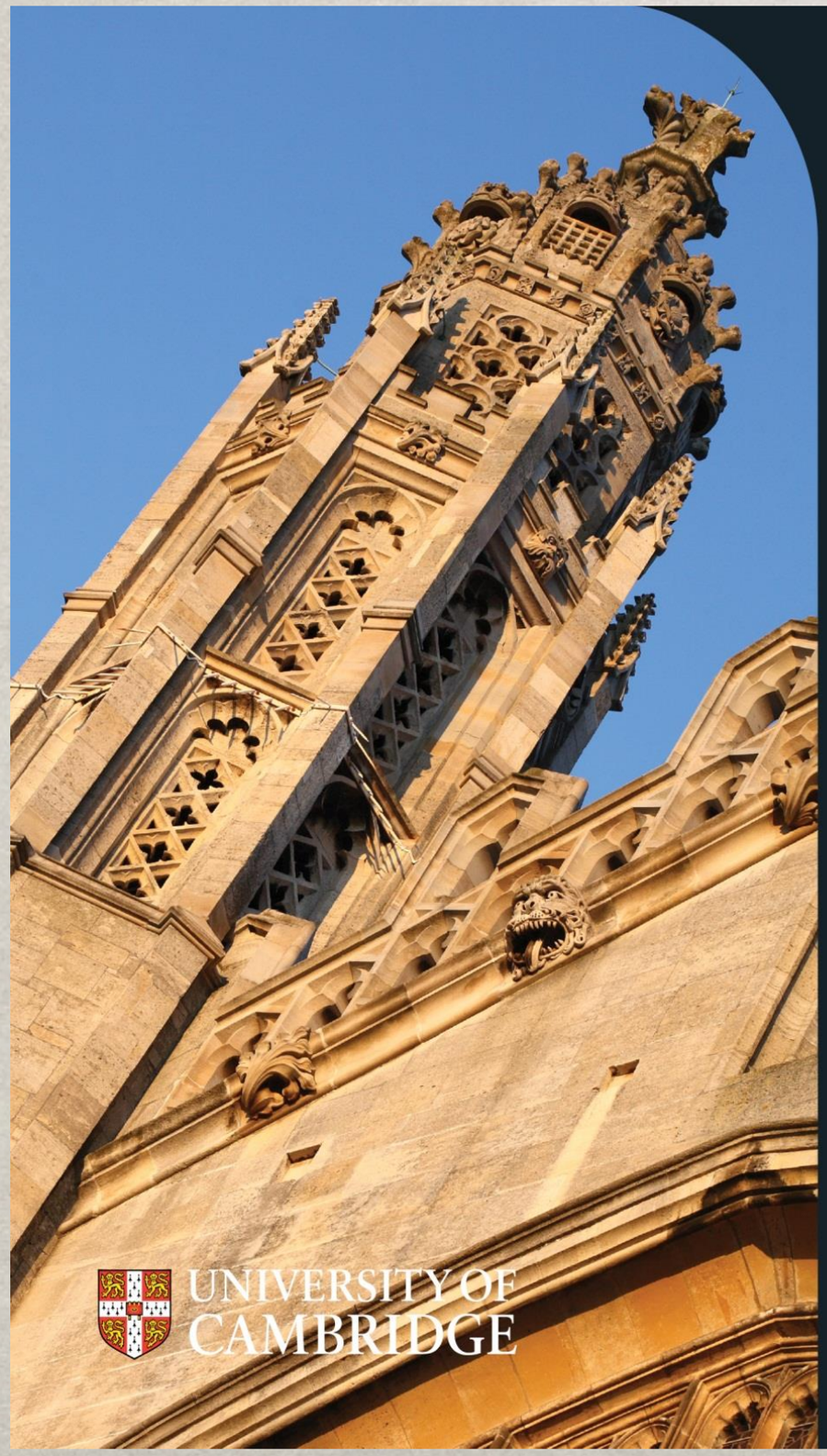


$$\mathbf{s} = \mathbf{r} + \frac{v_{\parallel}(\mathbf{r})\hat{e}_{\parallel}}{aH(a)}$$

Redshift-space distribution



Ben Geytenbeek



UNIVERSITY OF CAMBRIDGE

GATES Cambridge

Research Fields:

- Effective Field Theory Models of Higgsinos
- Higgsino-dominated Dark Matter
- Stellar Dark Matter
- Energy Transport in the Sun

Ben Geytenbeek

Supervisor: Ben Gripaios

Ben Geytenbeek

ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Alfredo Glioti

Supervisor: Riccardo Rattazzi

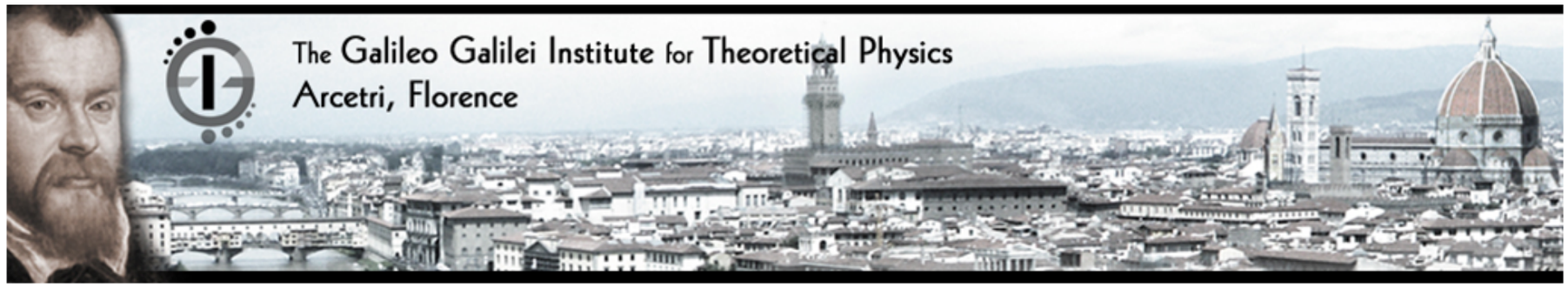
Research interest: Physics Beyond the Standard Model

Electroweak Baryogenesis above the Electroweak Scale: **arXiv:1811.11740 [hep-ph]** (AG, RR, Luca Vecchi)

Machine learning to find new physics in LHC data (Work in Progress… AG, Andrea Wulzer, …)

Confining SU(N) and composite dark matter at Large-N (Future…)

Néstor Gonzáles Gracia



Student's presentation for the

GGI Lectures on the Theory of Fundamental Interactions

- **Student's name:** Néstor González Gracia
- **Country:** Spain
- **Institution:** University of Salamanca
- **Field of research:** *Theoretical Particle Physics*
- **PhD proyect:** *Top Quark Mass Determination through Event Shapes*
- **Supervised by:** Dr. Vicent Mateu Barreda
- **Research topics:** *Quantum Chromodynamics, Effective Theories, Soft Collinear Effective Theory, Jet Physics, Renormalons*

Effective Field Theories:

EFT's are used in situations with different **energy scales**.

☺ To expand physical quantities in the small ratio of the scales, Λ_S/Λ_H, and separate the different energy contributions.
☺ To derive all-order **factorization** theorems.
☺ To **resum logharithmically enhanced** contributions at all orders using **Renormalization Group (RG)** equations.

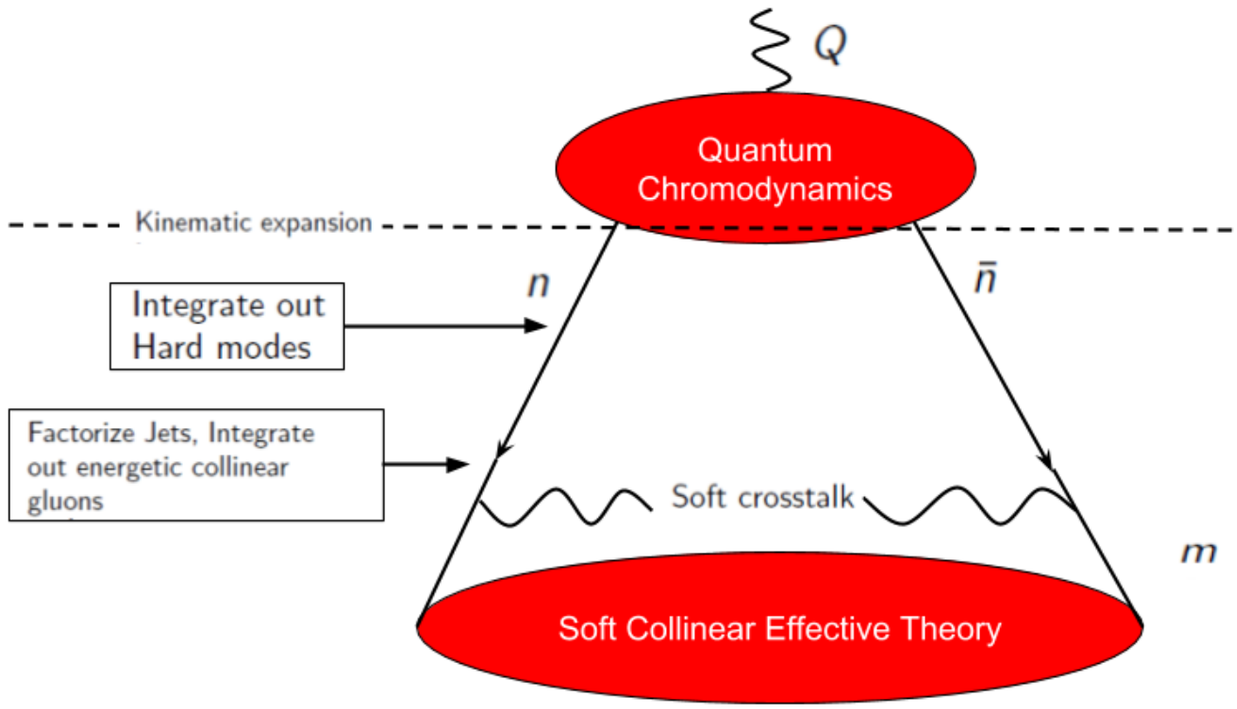


Figure partially based on S. Fleming, A. Hoang, S. Mantry, I. Stewart 07104205v1 hep-ph

Alfredo Grillo

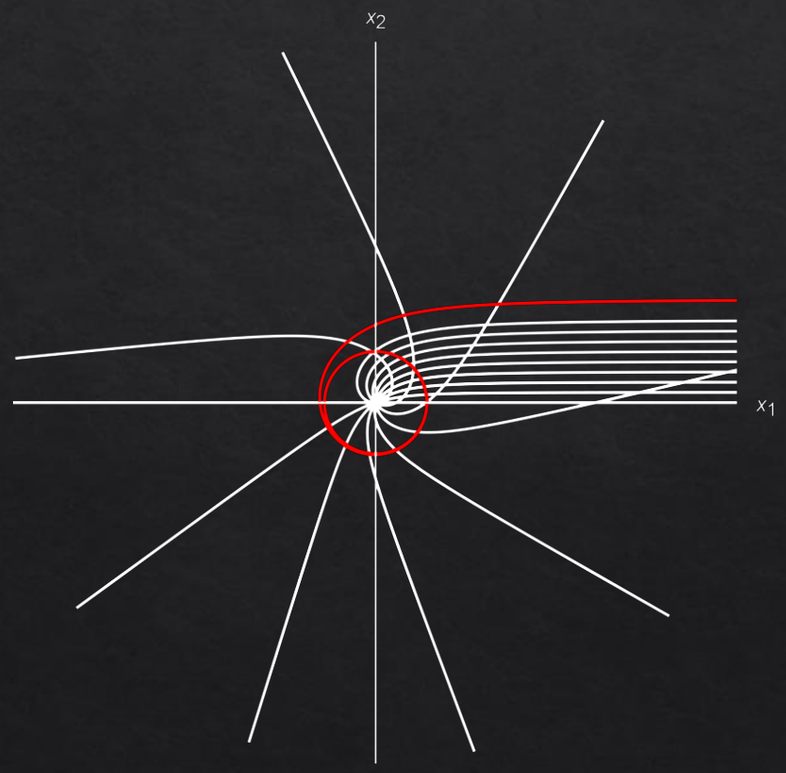
University of Rome Tor Vergata

Francisco Morales

Alfredo Grillo

Master thesis:

Probing Fuzzballs with massless particles



Fuzzball proposal for black holes

Interests:

String theory

Quantum gravity / Field theory dualities

Quantum Field Theories

Conformal field theories

GGI Gong Show 2019

Alfredo Guerrera
Affiliations: Università di Padova & INFN
Supervisor: prof. Stefano Rigolin

January 2019

Alfredo Guerrera

Research interests

Past Research

Semi-classical quantum gravity
Phase Space Path-integral QFT's on curved spaces and IR behaviour
Non-commutative Quantum Mechanics and phase space stability

Future Research

BSM
Strong CP problem
Axions and invisible axions
Composite Higgs models

Luigi Guerrini

Gong show

- **Name**: Luigi Guerrini
- **Institution**: University of Parma
- **Supervisor**: Luca Griguolo
- **Interests**: Exact results in QFT, Supersymmetry, Wilson loops

Luigi Guerrini

Wilson loops

(non abelian
Aharonov-Bohm phase)

non local observables,
containing the full information
about the gauge theory

$$W[\Gamma] = \frac{1}{\dim(R)} \mathrm{Tr}_R P \exp\left(i \oint_\Gamma \mathrm{d}x^\mu A_\mu(x) \right)$$

SUSY gauge theory —> toy models of physical theories

(Localization)

Exact computation of SUSY Wilson loops

(tests of dualities and of AdS/CFT)

Sam Junius

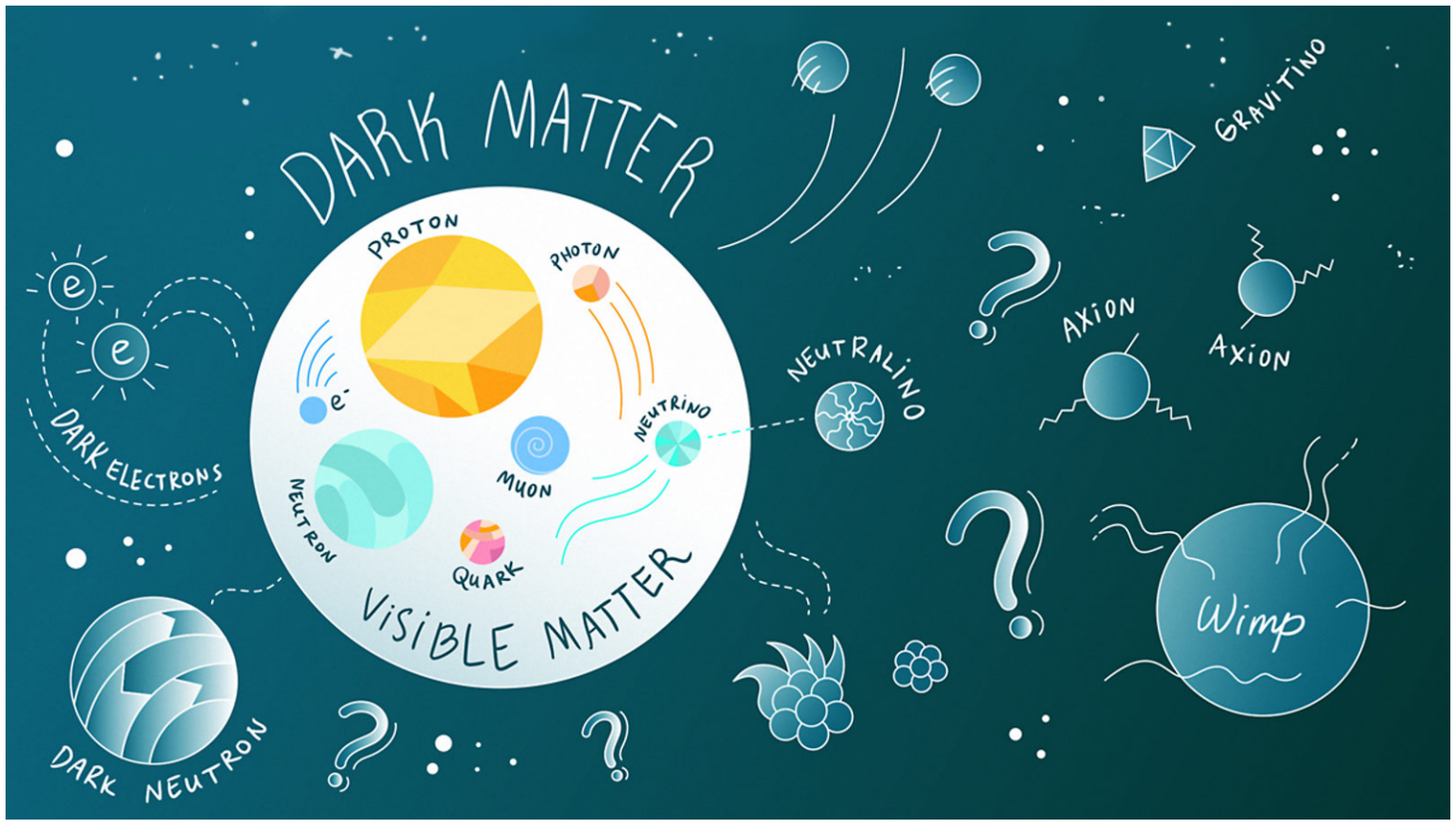
- Belgium
- Vrije Universiteit Brussel (VUB)
- Université Libre de Bruxelles (ULB)
- Advisors:
  - *Prof. Dr. Alberto Mariotti*
  - *Prof. Dr. Laura Lopez Honorez*

VRIJE UNIVERSITEIT BRUSSEL

UNIVERSITÉ LIBRE DE BRUXELLES

Research Interest

- Dark Matter
  - *Simplified Particle Physics models*
  - *WIMP*
  - *FIMP*
- Signatures at the LHC
  - *Long-lived particles*
- Cosmological implications



Shu-Yu Ho

Personal Information

- **Name : Shu-Yu Ho**
- **Nationality : Taiwan**
- **Institution : Tohoku University, Japan**
- **Status : The second year of PhD program**
- **Supervisor : Prof. Fuminobu Takahashi**
- **Research Interest : Particle physics & Particle cosmology**

  (dark matter, neutrino physic, axion,...)

TOHOKU UNIVERSITY

GP.PU GRADUATE PROGRAM ON PHYSICS FOR THE UNIVERSE

宇宙創成物理学
国際共同大学院

Shu-Yu Ho

Academic Career

- 2005-2009 B.S., Physics, National Taiwan Normal University
- 2009-2011 M.S., Physics, National Taiwan University
- 2011-2012 High school intern teacher
- 2012-2013 Research assistant,
  National Center for Theoretical Science, Taiwan
- 2014-2017 Doctoral program (withdrawal), Physics,
  California Institute of Technology
- 2017-2019 Doctoral program, Physics, Tohoku University

The GGI school on Fundamental Interactions

Jan H. Kwapisz [1]

[1] University of Warsaw

Thesis supervisor: prof. dr hab. Krzysztof A. Meissner

8th January 2019

What if we combine them together?

- Standard Model supplemented by the gravitational corrections can be a fundamental theory, yet not a complete one
- Applying the gravitational corrections can give the quantitive predictions for new particles
- Can gravity be non-perturbatively renormalisable? With / without matter?

Gaetan Lafforgue-Marmet

Gaëtan LAFFORGUE-MARMET

PhD under the supervision of Karim BENAKLI

Laboratoire de Physique Théorique et Hautes Énergies (LPTHE)
Sorbonne Université, Paris, France

Gaetan Lafforgue-Marmet

- Two Higgs doublet Model : Higgs alignment
  - some models with 2H presents what is called an *alignment*
  - where does it come from ?
- Gravitational Waves production from spin 3/2
  - Production of GW during the preheating from the decay of the inflaton in others particles.
  - Is the spectrum of GW from spin 3/2 different from the spectrum of others spin particles ?

SORBONNE UNIVERSITÉ
CRÉATEURS DE FUTURS DEPUIS 1257

LPTHE
LABORATOIRE DE PHYSIQUE THEORIQUE ET HAUTES ENERGIES

Francesco Loparco

Who am I?

Francesco Loparco
from 1st November 2018, PhD student (XXXIV cycle)

Institution

Università degli Studi di Bari
INFN (BA)

Supervisors

Pietro Colangelo
Fulvia De Fazio

Francesco Loparco

My master thesis

«Hadron configurational entropy in a holographic model of QCD»

Results

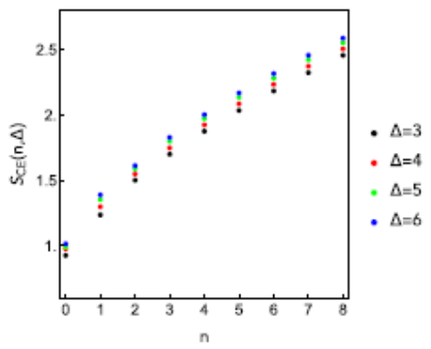


Fig. 1. Configurational Entropy of $J^{PC} = 0^{++}$ mesons described by the QCD operators in Eq. (48) with different Δ. n is the radial quantum number.

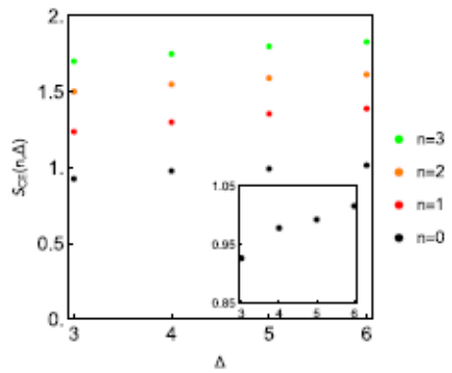


Fig. 2. Configurational Entropy of scalar mesons as in Fig. 1, plotted versus the QCD operator dimension Δ. The results for the radial number $n = 0$ are magnified in the inset.

«Configurational Entropy can disentangle conventional hadrons from exotica»
P. Colangelo and F. Loparco,
Phys.Lett. B788 (2019) 500

PhD project

Standard Model
Physics Beyond the Standard Model → *Starting Point: B anomalies*

Maeve Madigan

UNIVERSITY OF
CAMBRIDGE

Maeve Madigan

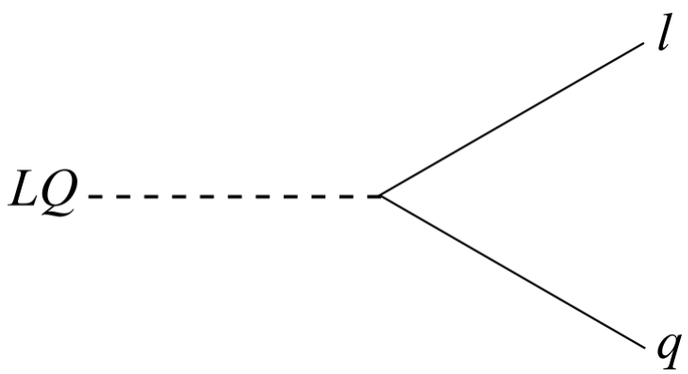
Department of Applied Mathematics and Theoretical Physics
Supervisor: Ben Allanach

Beyond the standard model phenomenology

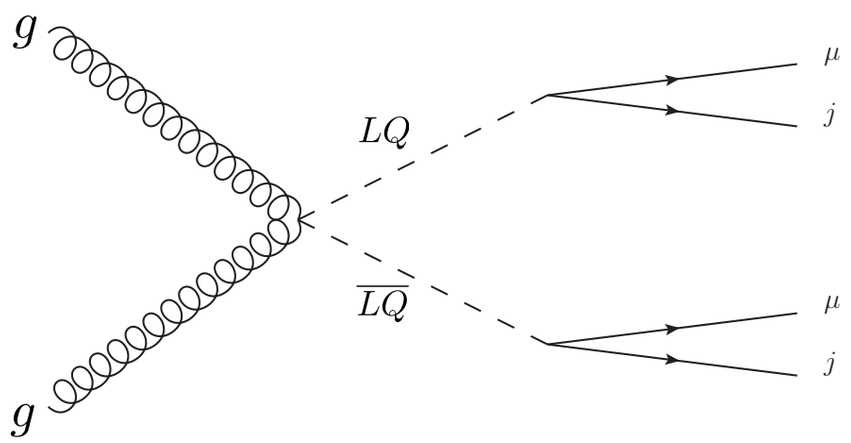
GGI Lectures on the Theory of Fundamental Interactions 2019

Maeve Madigan

Leptoquarks



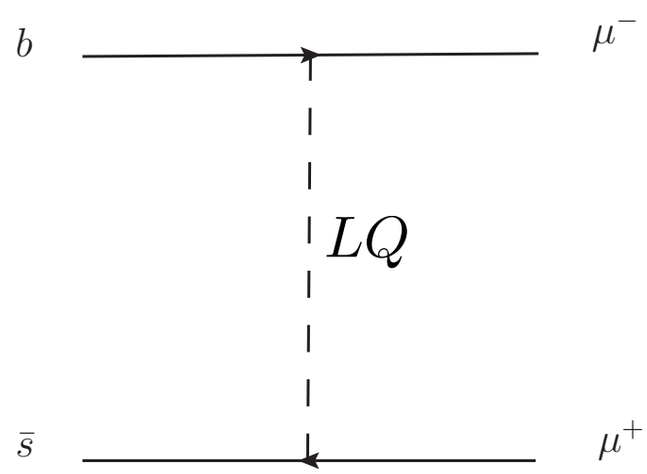
Pair production e.g.



Flavour anomalies

Anomalies observed in $b \to s$ transitions, e.g.

$$R_K = \frac{\mathrm{BR}(B \to K\mu^+\mu^-)}{\mathrm{BR}(B \to Ke^+e^-)}$$



Previous work: 1710.06363

Matteo Marcoli

Personal Information

Matteo Marcoli

University of Milano Bicocca
Master Student

Supervisor: Simone Alioli (Milano Bicocca)

mail: m.marcoli@campus.unimib.it

Matteo Marcoli

Research Topics and Interests

Currently working at my master thesis: a study of subleading Q_T power corrections to color-singlet production (*e.g.* $pp \to H$) at NLO (in the future at NNLO).

Main interests: particle phenomenology, QCD, subtraction mehod, Higgs physics.

Other: symmetries, BSM theories, dark matter.

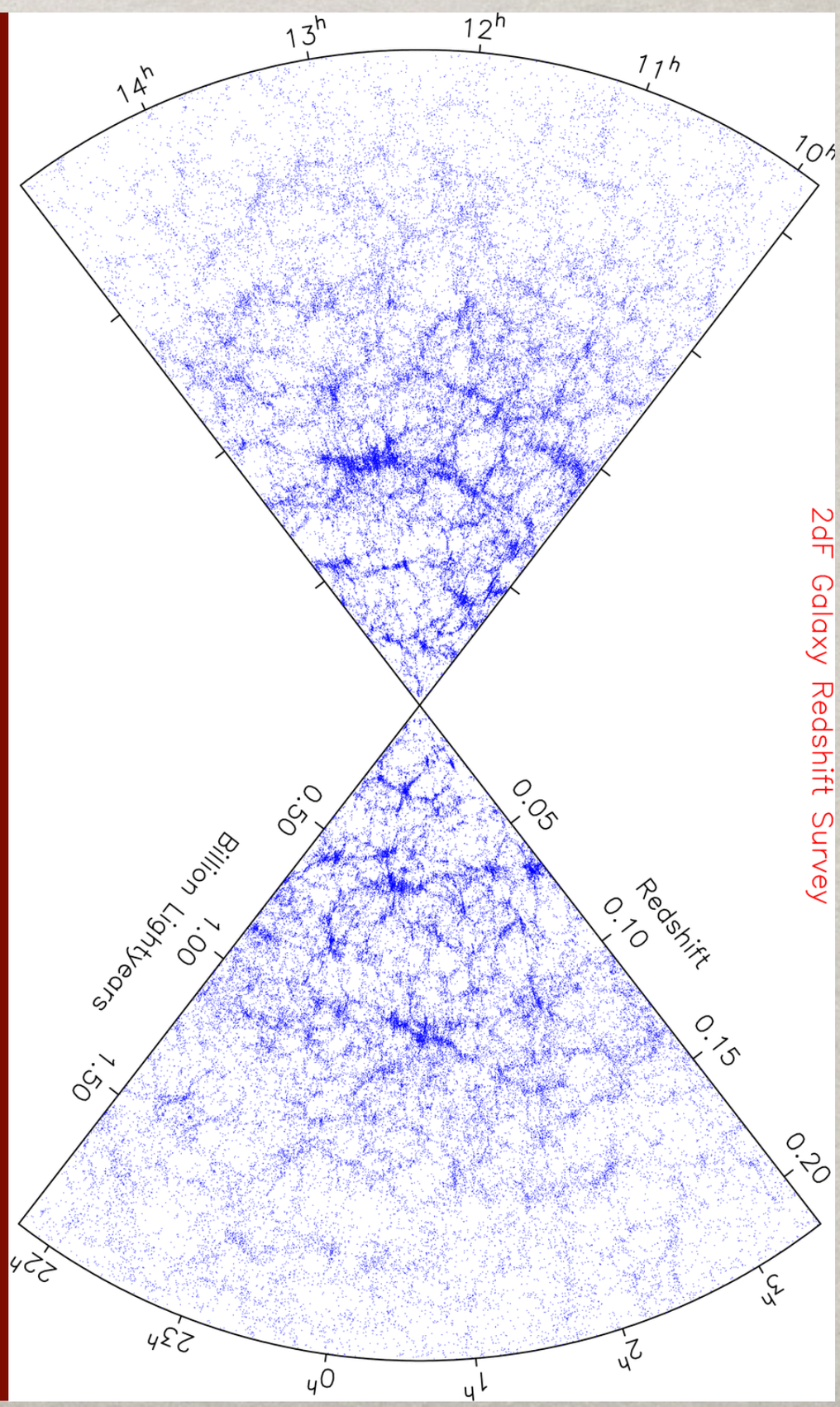
Marco Marinucci

Fundamental Physics from Cosmological Observations

Marco Marinucci
University of Parma - INFN Parma
Supervisor: Prof. Massimo Pietroni

Marco Marinucci

- The Inflation mechanism leaves traces on the actual galaxy distribution
- We analyze the statistical properties of the Large-Scale Structure of the Universe
- The quantity of information (Euclid will map millions of galaxies) is huge! We need new efficient statistical tools
- Knowing how the Inflation acted would give us a lot of information about Fundamental Physics



Giacomo Marocco

UNIVERSITY OF OXFORD

Subir Sarkar

- Lasers
  - Axions?
  - Unruh effect?
  - QED?
- Neutrinos
  - Very high E probe

John Wheater

- Quantum sensors for fundamental physics
  - DM detection?
  - Decoherence – gravitational?

Bianka Meçaj

GGI winter school: "Theory of Fundamental Interactions"

Me: Bianka Meçaj
Institution: Mainz Institute of Theoretical Physics (MITP), Germany
& PRISMA cluster of excellence
Supervisor: Matthias Neubert

Bianka Meçaj

My research area & Interests

SCET
Soft Collinear Effective Field Theory

- New Heavy Resonances
- Glauber Gluons
- $H \to gg$ (2 loops)

- Leptoquarks
- Factorization theorem
- N-point divergences

Analytic estimation of the sensitivity of CODEX-b to neutrino portals

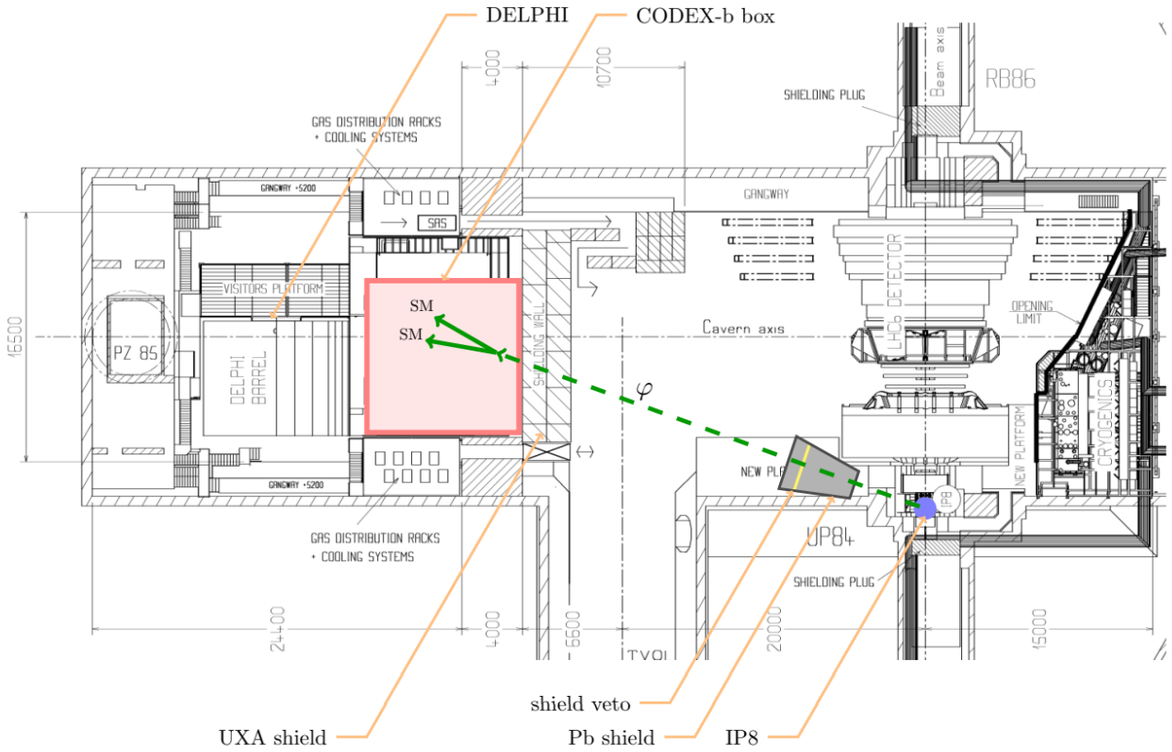
Oleksii Mikulenko
T. Shevchenko National University of Kyiv

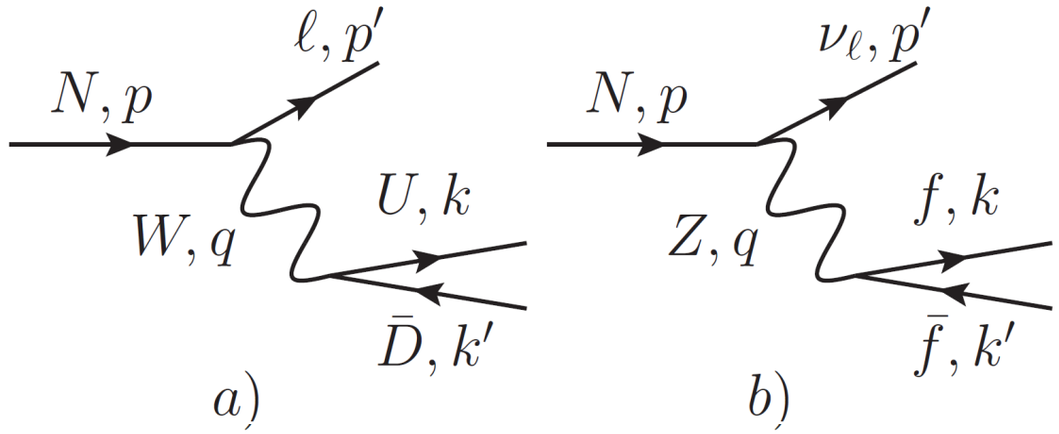
Supervisor: **Alexey Boyarsky**
Leiden University

Oleksii Mikulenko

CODEX-b

COmpact Detector of EXotic on LHCb (CODEX-b) [1708.09395] is a detector in LHCb.





University of Zurich[UZH]

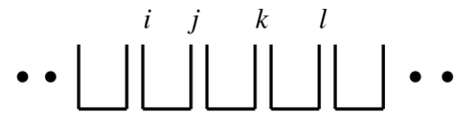
Jonathan Mo
Supervisor: Thomas Gehrmann

University of Zürich

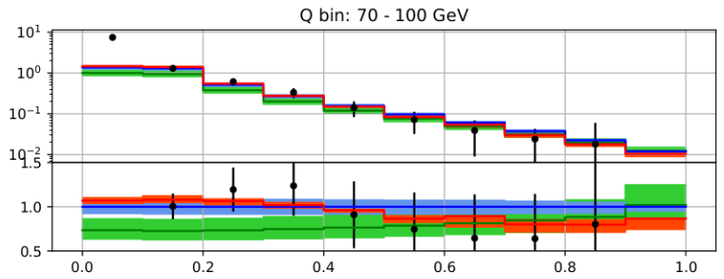
January 8/9, 2019

Jonathan Mo

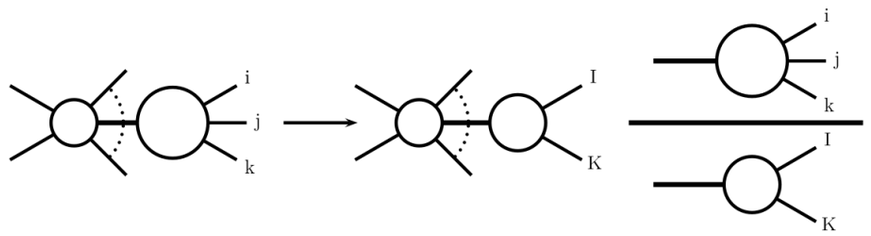
- QCD



- Precision calculation
- Phenomenology



- Antenna subtraction



- Jet production

Presentation at GGI school

Luca Pagani

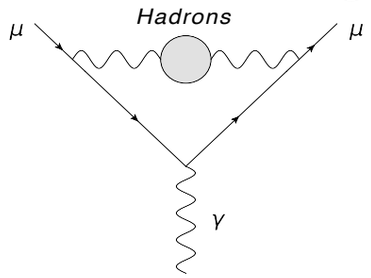
University of Bologna,
Ph.D. advisor: prof. Fabio Maltoni

Arcetri 08/01/2019

Luca Pagani

Master's thesis:

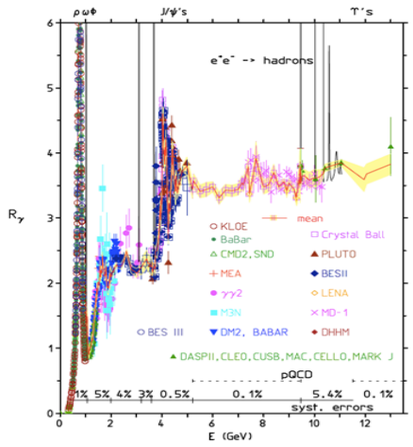
HLO contribution to muon g-2:



$$a_\mu^{HLO} = \frac{\alpha}{\pi^2} \int_0^\infty \frac{ds}{s} K(s)\, Im\, \Pi_{had}(s + i\varepsilon)$$

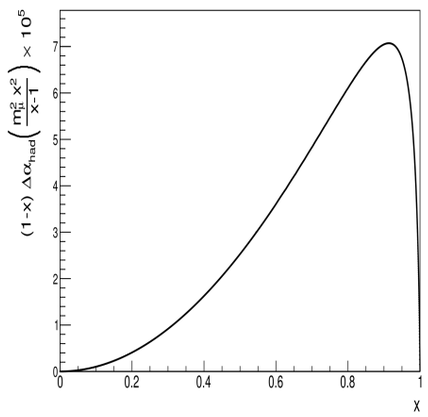
$K(s)$ is the Kernel and $\Pi_{had}(s + i\varepsilon)$ is the hadronic polarization function.

Old methods



$$a_\mu^{HLO} = \frac{1}{4\pi^3} \int_{4m_\pi^2}^\infty ds\, K(s)\, \sigma_{e^+e^- \to had}(s)$$

New method



$$a_\mu^{HLO} = \frac{\alpha}{\pi} \int_0^1 dx\, (1 - x)\, \Delta\alpha_{had}\, [t(x)]$$

Luca Pagani

PhD:

EFT:

processes under investigation

- Ligh by light scattering
- Top quark loops
- Higgs boson decay

Universität Zürich[UZH]

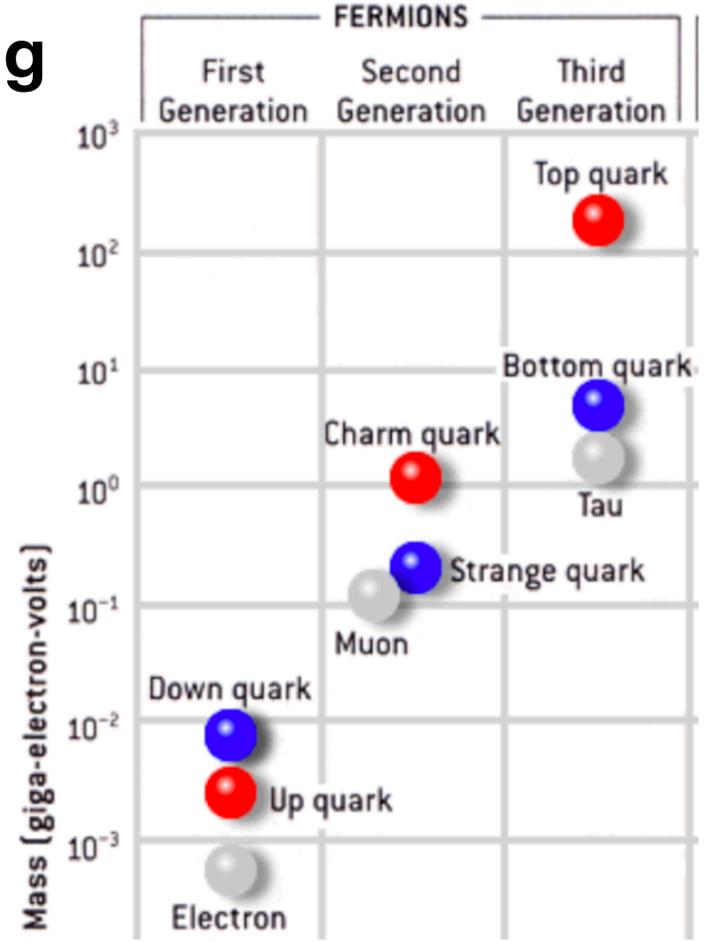
Julie Pagès

Supervisor: Prof. Gino Isidori

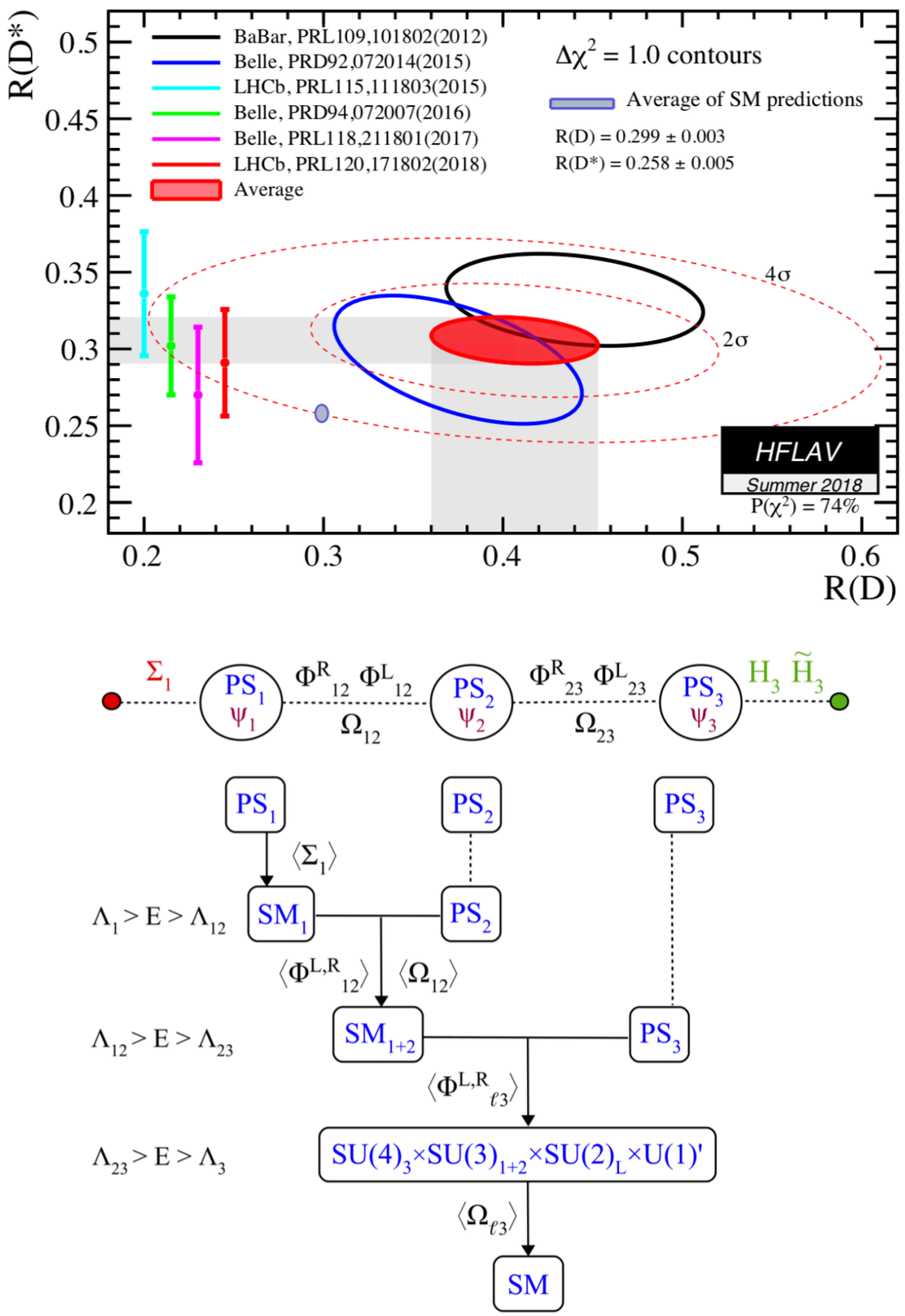
BSM Phenomenology and Model building in Flavour Physics

- Address flavour problem:
  - Hierarchy
  - Yukawa strucure
- B-anomalies
- Neutrino masses

$$Y_U \sim \begin{pmatrix} \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot \\ \cdot & \cdot & \blacksquare \end{pmatrix}$$



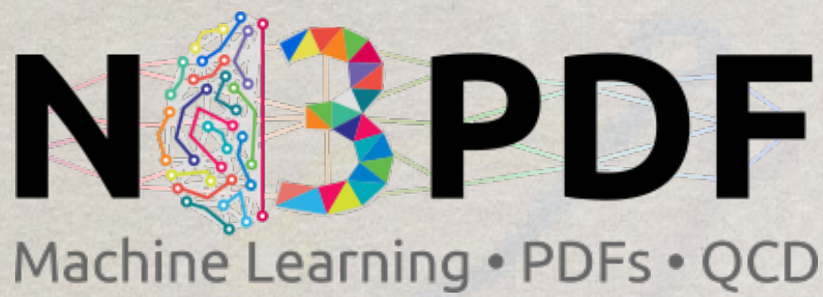
Julie Pagès



Ongoing projects :

- **Lepton Flavour Violation / Lepton Flavour Universality Violation in Kaon decays**
  K. Yamamoto
- **Origin of Neutrino masses in Pati-Salam Cubed model**
  J. Fuentes
- **Radiative Spontaneous Symmetry Breaking**
  R. Houtz, S. Trifinos

Tanjona R. Rabemananjara



Resummation Techniques and Machine Learning for the Precision Determination of Parton Distribution Functions (PDFs)

Tanjona R. Rabemananjara

Supervised by: **Prof. Stefano Forte** & **Dr. Stefano Carrazza**

GGI School, January 2019

UNIVERSITÀ DEGLI STUDI DI MILANO

DIPARTIMENTO DI FISICA

Tanjona R. Rabemananjara

THEORY

Objectives:

• Improve PDFs Accuracy & Quality (All order PDFs)

• Provide PDFs consistent with resummed computations

Approach: Consistently combine transverse momentum, threshold and high energy resummation

MACHINE LEARNING

Objectives:

• Reduce sources of theoretical biases (Get rid of Fixed Functional Forms & Preprocessing)

• Provide sensible estimate of all uncertainties (from theory & experimental data)

Approach: Develop a fully automated NN structure (in particular use SGD as a minimizer)

PDFs

Introduction

Student Gong-show GGI School 2019

Lucas Magno D. Ramos[1]

[1]Curso de Ciências Moleculares (CCM-USP)
DFMA
Universidade de São Paulo

Advisor: Prof. Dr. Enrico Bertuzzo

Lucas Magno D.Ramos

My Research Interests

Current: Dark Matter Models and Phenomenology

- Simplified Models of DM - Abundance of theories with rich UV sector, use EFT formalism to integrate out heavy states and mediator, keeping DM candidate
- Matching constraints on different scales - Compute constraints on collider (LHC) scales, and run the Renormalization to match constraints from DD, ID (D'Eramo, Kavanagh, Panci 2016)
- UV Completion - Find interesting UV complete models which fit in the studied simplified model framework

Past: ALICE phenomenology

- Signatures for bottom production - Search for b signatures in high-multiplicity pp collisions as a toy study for p-Pb and Pb-Pb

Julian Rey

this slide is about me*

- Julian Rey
- Venezuelan
- Doing PhD at IFT in Madrid
- Supervised by Guillermo Ballesteros
- Specializing in C O S M O L O G Y

* the use of comic sans is comedic, intentional, and completely unrelated to the fact that I did this presentation in 5 minutes

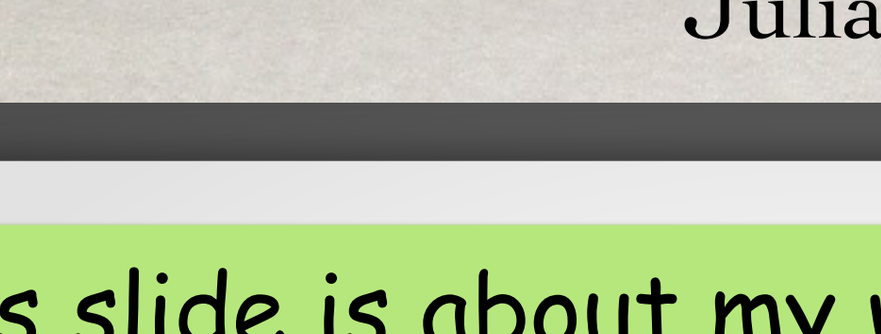
** it was actually more like 30 minutes

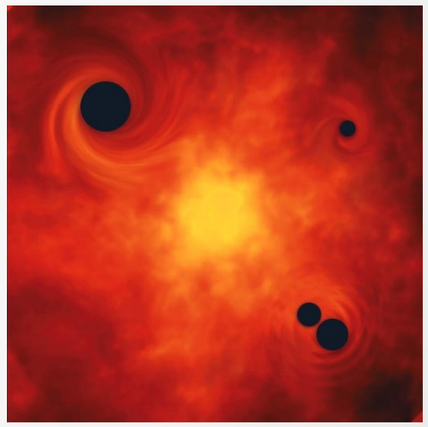
Julian Rey

this slide is about my work*

* or lack thereof

- Currently working on Primordial Black Holes.
- PBH's are very small, and form in the early universe. They come from fluctuations in the inflaton field.





- They could be a substantial component of dark matter**
- They could be detected by LISA***

** they are also super cool

*** seriously, they're really tiny black holes, how cool is that???

GGI Lectures on the Theory of Fundamental Interactions 2019

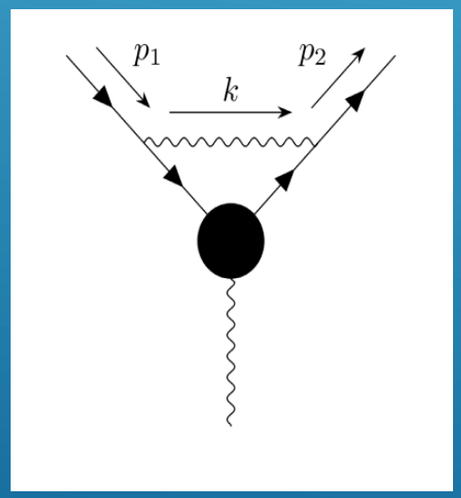
- Lorenzo Ricci
- *École polytechnique fédérale de Lausanne (EPFL)*
- Supervisor: Prof. Andrea Wulzer

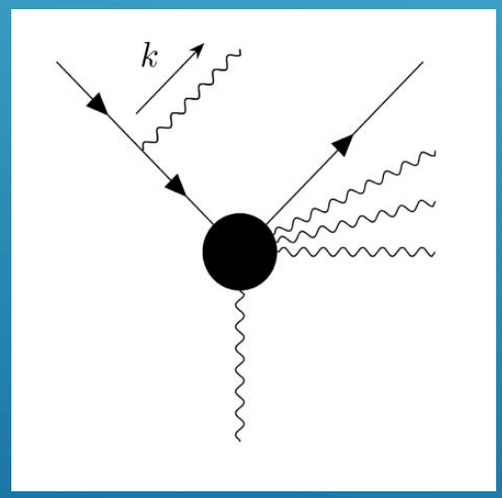
ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Lorenzo Ricci

RESEARCH INTERESTS

- BSM physics
- High-energy phenomenology
- **IR-Resummation**





Gavin Rockwood

About Me!

Gavin Rockwood
School: University of California Santa Cruz
Advisor: Michael Dine

My interests: Analytical aspects of QCD, dynamics of symmetry breaking $\rightarrow$ Why is there a mass difference between η and η'.

Gavin Rockwood

About My Work!

Start with these! (SUSY QCD with N colors and 1 flavor)

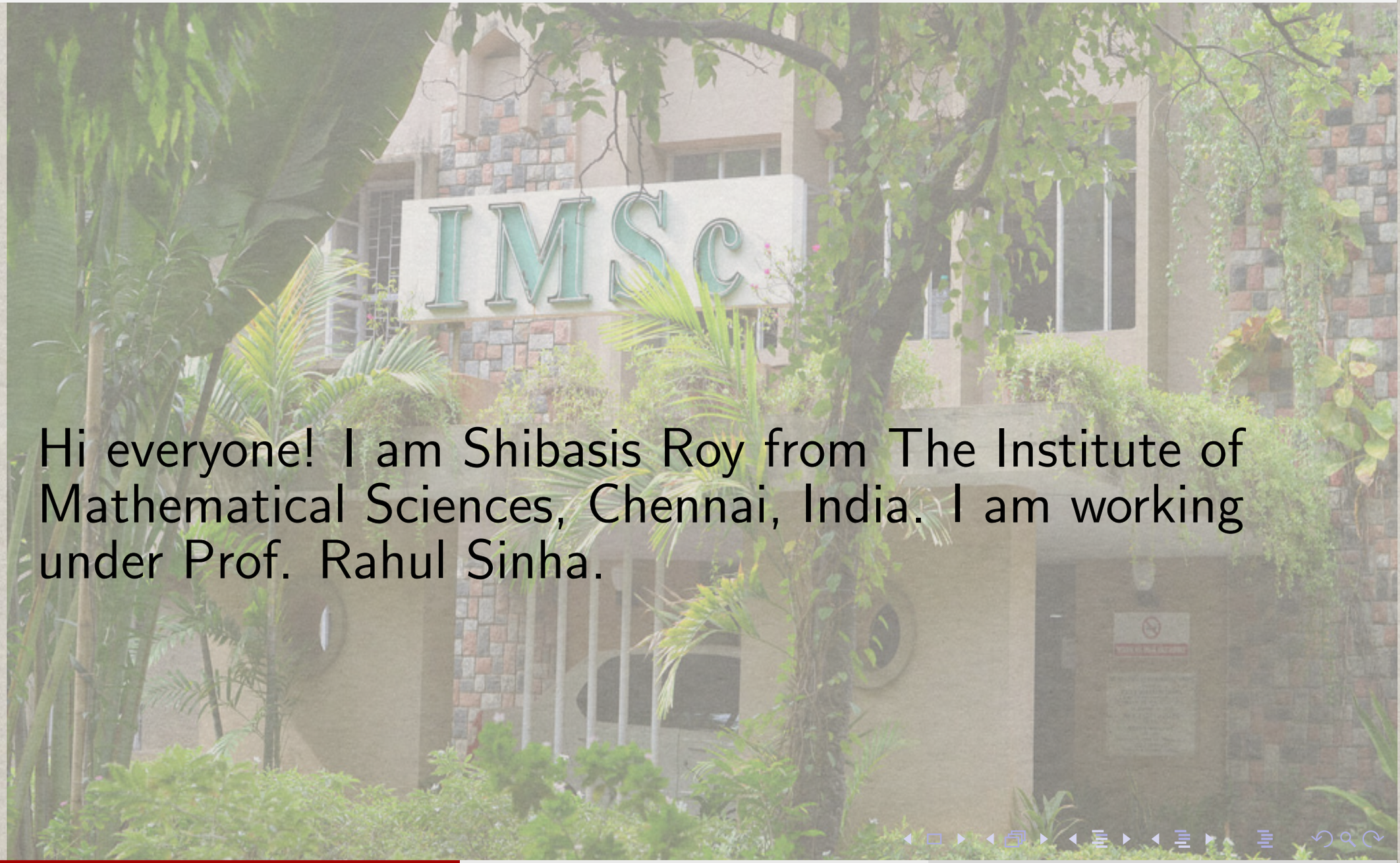
$$\mathcal{L} = \int d^4\theta \left[Q_i^\dagger e^V Q_i + \bar{Q}_i e^V \bar{Q}_i^\dagger \right] - \tag{1}$$

$$\frac{i}{16\pi} \int d^2\theta \tau W^{\alpha a} W_\alpha^a + \text{h.c.} + \int d^2\theta W + \text{h.c.} \tag{2}$$

$$W = \frac{\Lambda_{\text{Hol}}^{\frac{3N-1}{N-1}}}{\left(Q\bar{Q}\right)^{\frac{1}{N-1}}} + mQ\bar{Q} \tag{3}$$

Where Q is left handed and transforms under N_C and $\bar{Q}$ is right handed and transforms under $\bar{N}_C$. Expand around the scalars in the event $\phi = ve^{i\vartheta}$ and $\bar{\phi} = \bar{v}e^{i\bar{\vartheta}}$ and study domain walls between degenerate vacua.

Introduction



Hi everyone! I am Shibasis Roy from The Institute of Mathematical Sciences, Chennai, India. I am working under Prof. Rahul Sinha.

Research interests

In order to understand the recent anomalies observed in B meson decays better, I am studying the analogous decays of Λ_b baryon having the same underlying quark transitions.

Our goal is to construct new observables that are sensitive to different new physics scenarios in the context of Λ_b baryon decay.

I am also working on interesting decay modes of Λ_b where CP violation can be observed experimentally in near future.

Robin Schürmann

Robin Schürmann

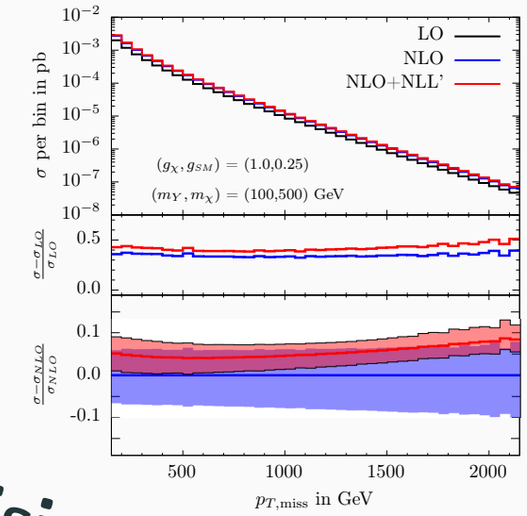
Universität Zürich

Supervisor: Prof. Gehrmann

Robin Schürmann

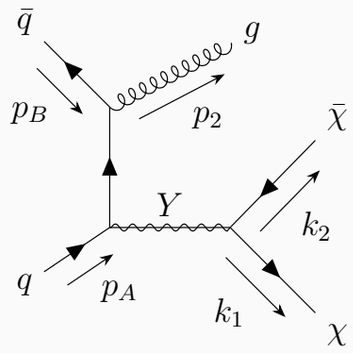
LHC Phenomenology

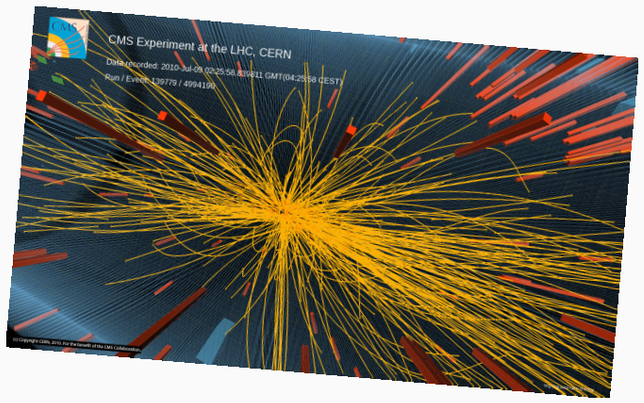
QCD



Precision Calculations

NNLO





Resummation

Standard Model

Aleks Smolkovic

Student Gong-Show

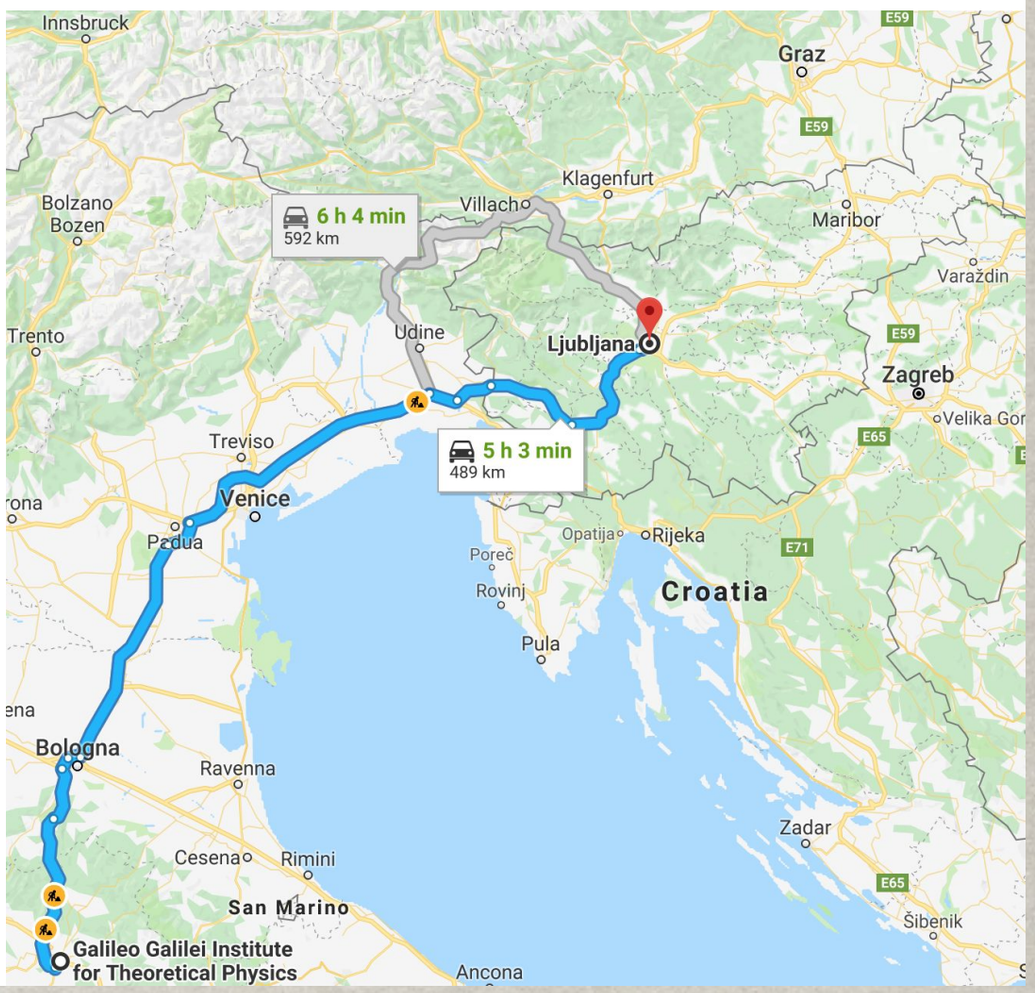
Galileo Galilei Institute for Theoretical Physics
Florence 2019

Aleks Smolkovic

Supervisor: Nejc Kosnik

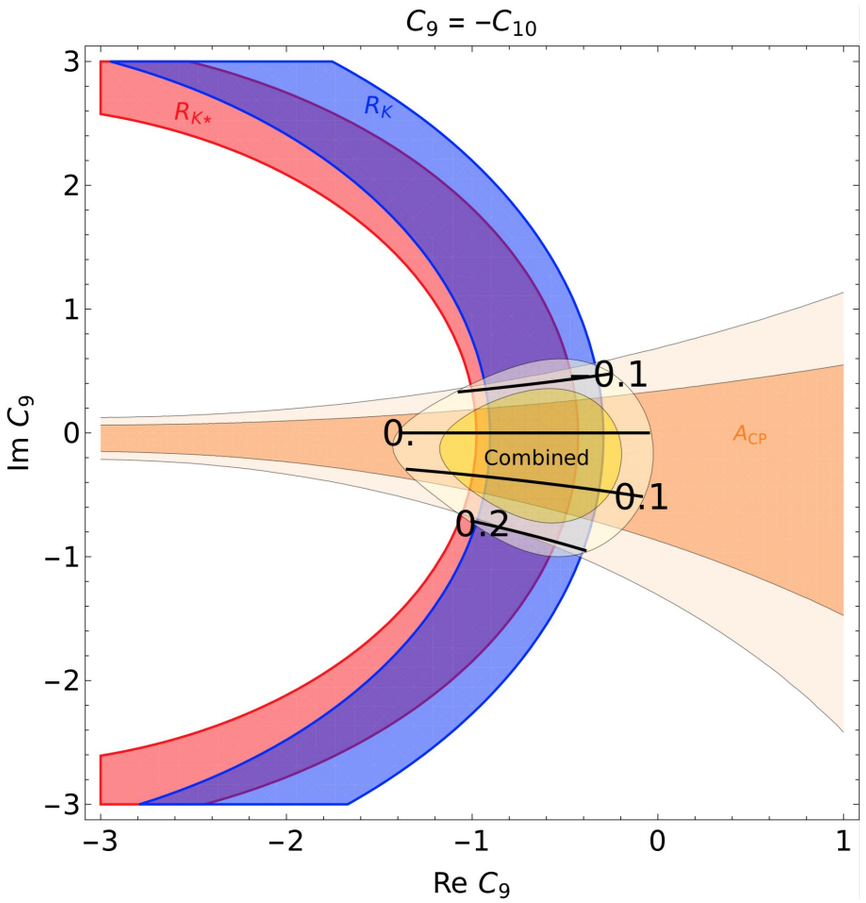
Jozef Stefan Institute

Ljubljana, Slovenia



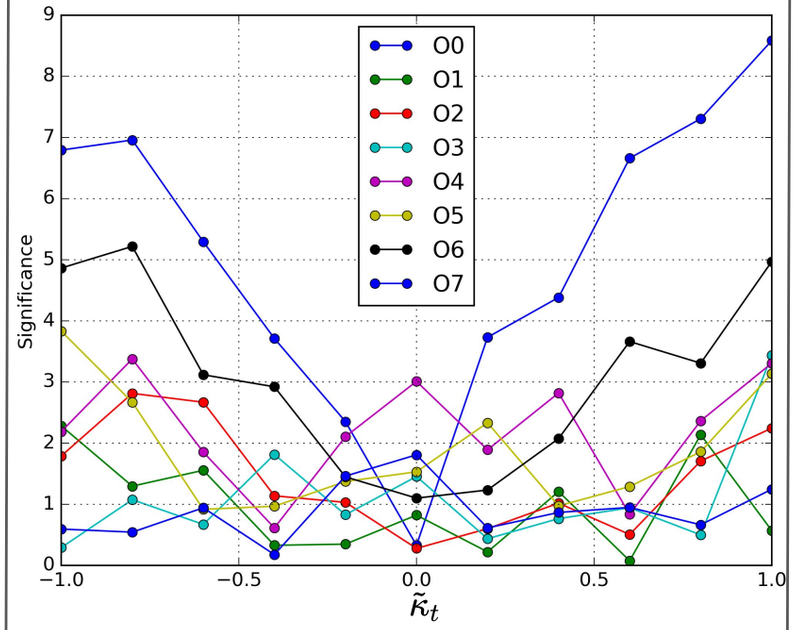
Aleks Smolkovic

A_{CP} in $B \to K\mu\mu$

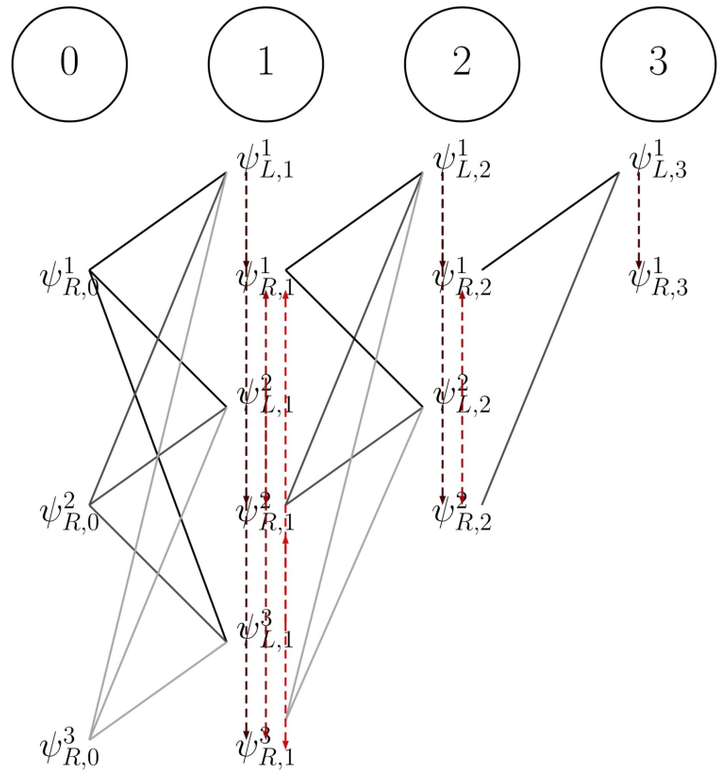


Top Yukawa

$$\mathcal{L}_{ht} = -\frac{m_t}{v}\bar{t}\left(\kappa_t + i\tilde{\kappa}_t\gamma_5\right)th$$



Anomaly free Froggatt-Nielsen



Muyang Song

UNIVERSITY OF Southampton

Light charged Higgs boson with dominant decay to quarks and its search at LHC and future colliders [Phys. Rev. D 98, 115024]

Muyuan Song

University of Southampton

January 8 2019

Supervisors: Prof. Stefano Moretti
Dr.Andrew Akeroyd

Muyang Song

Motivation of charged Higgs and MHDM(Multi-Higgs-Doublets-Model)

- A neutral-charged Spin 0 Higgs Boson has been detected at LHC
- Existence of Charged Higgs boson?

	SPIN 0	SPIN 1/2	SPIN 1
Charge 0	H	ν_e, ν_μ, ν_τ	γ, Z, g
Charge ± 1	$H^\pm$?	$e^\pm, \mu^\pm, \tau^\pm, u, d, c, s, t, b$	$W^\pm$

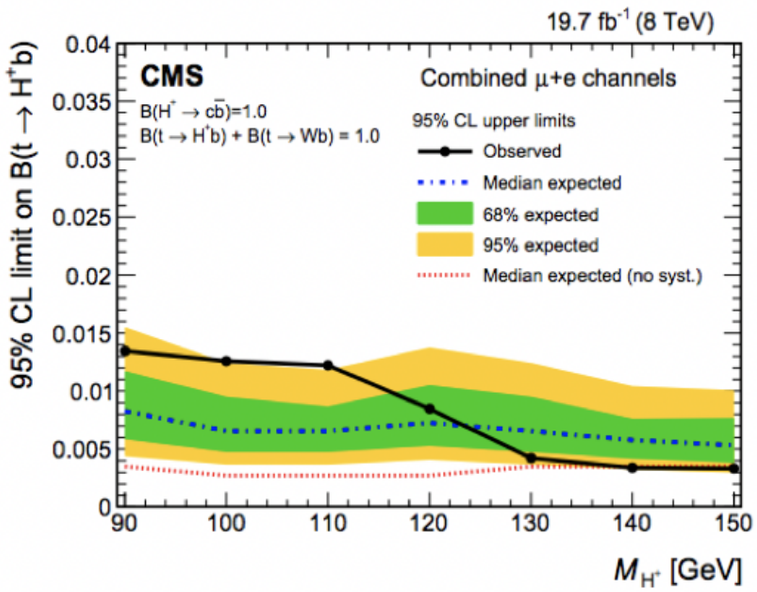
Reason for MHDM:

- Supersymmetry.
- Three generations of fermions. More generations (doublets) of scalars?
- Extra sources of CP-violation.

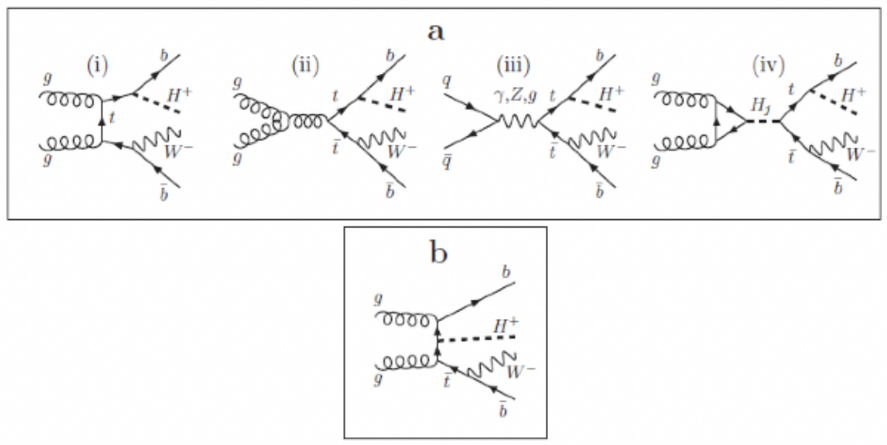
Muyang Song

Charged Higgs production mechanisms

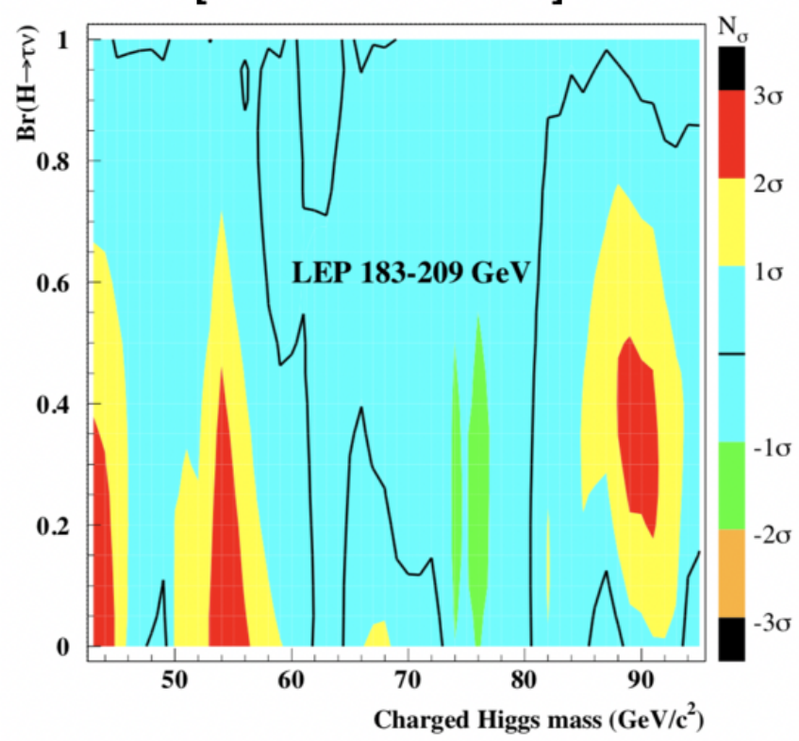
LHC [arXiv:1808.06575]



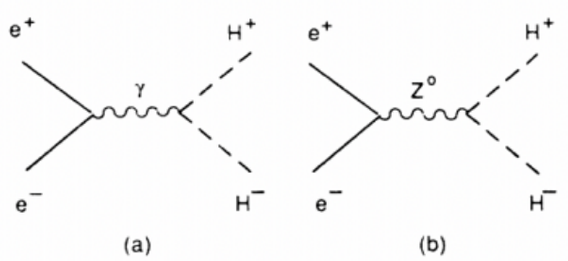
$$gg, q\bar{q}, b\bar{b}(\rightarrow t\bar{t} \rightarrow b\bar{t}H^+) \rightarrow b\bar{b}W^-H^+,$$
$$gg\ (\rightarrow b\bar{t}H^+) \rightarrow b\bar{b}W^-H^+$$



LEP [arXiv:1301.6065]



$$e^+e^- \rightarrow H^+H^-$$



Michael Soughton

Michael Soughton

UNIVERSITY OF SUSSEX (UNITED KINGDOM)

SUPERVISOR: VERONICA SANZ

Michael Soughton

Topic of research:

Interested in understanding the failings of BSM physics to make predictions such as

- Dark matter
- Baryon asymmetry
- A light Higgs

Aim to utilise unsupervised Machine Learning to construct a model which makes these predictions.

Looking to apply Bayesian analysis to model data from the LHC, dark matter experiments and CMB measurements.

So far have used Logistic regression and Deep Neural Networks to distinguish between data from a specific BSM and from SM data.

Wish to use Autoencoders to identify new physics without specifying a model!

Konstantin Springmann

Presentation for the GGI Winter School

- Konstantin Springmann
- Institution: TUM
- Supervisor: Andreas Weiler

January 6, 2019

Axions/ALP's and Axion Cosmology

- Global axial symmetry $U(1)_{PQ}$ gets broken $\rightarrow$ Axion as GB

- Axion DM from e.g. Misalignment Mechanism, Topological Defects

- Axions from super-dense objects: Neutron stars (NS)
  $\rightarrow$ Possibility to probe axions with NS inspirals [Hook]

Jhon Tamanas

SUPERVISOR: STEFANO PROFUMO

INSTITUTION: UC SANTA CRUZ

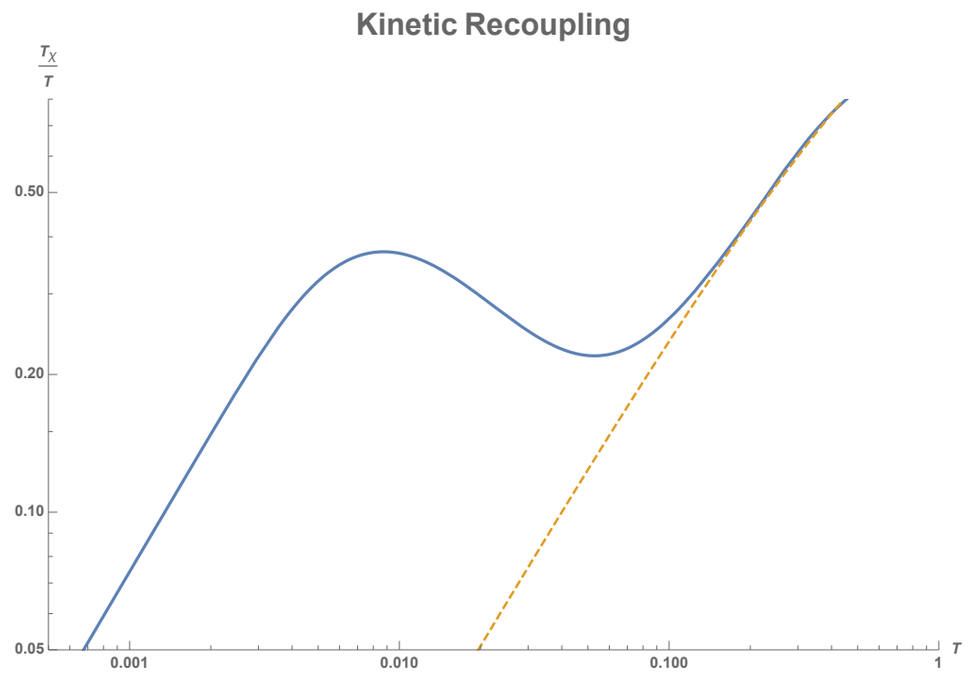
ME: JOHN TAMANAS

Jhon Tamanas

PROJECTS

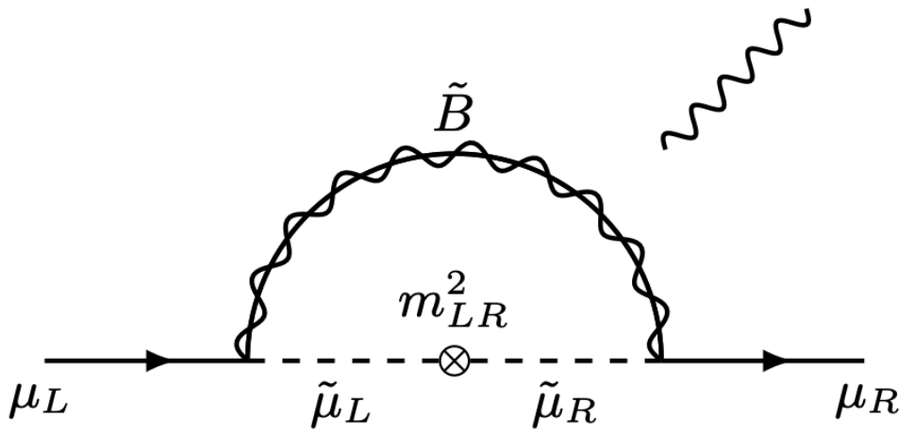
KINETIC RECOUPLING

- We find models with resonances can recouple DM to SM



MUON G-2 + COSMOLOGY + LHC RESULTS = RESTRICTED MSSM PARAMETER SPACE

- We find models with resonances can recouple DM to SM



arXiv:1805.02802

Jesùs Urtasun Elizari

PhD Student:
Jesús Urtasun Elizari, University of Milan

PhD advisors:
Dr. Stefano Forte, University of Milan
Dr. Stefano Carrazza, University of Milan

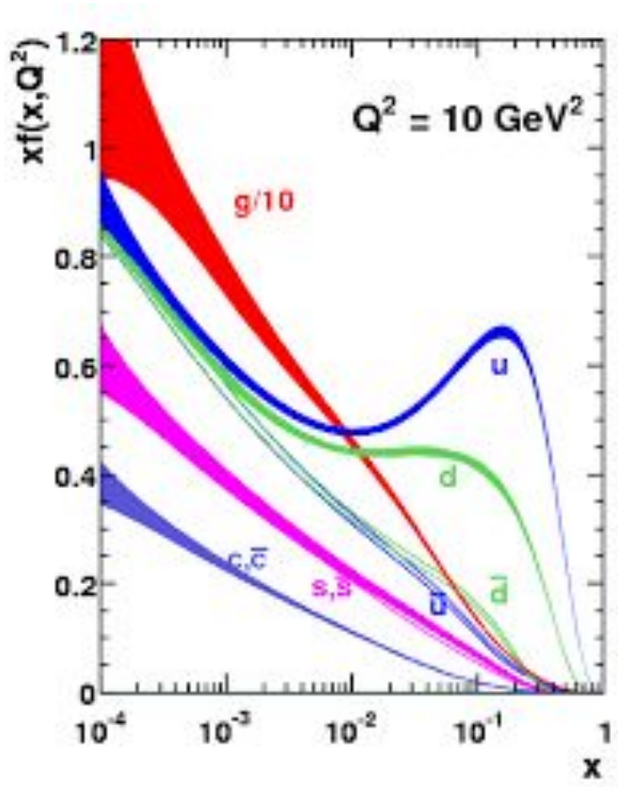
January 2019, GGI School on Theory of the Fundamental Interactions, Firenze, Italy

Jesùs Urtasun Elizari

Machine learning and QCD

- The PhD project lies in the field of High Energy Physics, mainly focussed in Quantum Chromodynamics (QCD), the theory describing the strong interactions

- Two main parts



  - Development of a set of resummation and approximation methods for higher-order QCD computations

  - Application of machine learning techniques to QCD problems and Parton Distribution Functions (PDFs) determination.

Andreas Vasquez

Andrés Vasquez:

Undergraduate at Universidad Nacional de Colombia (Bogotá)

Master at IFT of Universidade Estadual Paulista (Brazil)

Dissertation: Enhancement in the double Higgs boson production by e + e − annihilation and physics Beyond the Standard Model.

Now: **PhD at Universite Catholique de Louvain** (Belgium)
Advisor: Celine Degrande

Higgs coupling determination and interpretation in the SMEFT

Andreas Vasquez

Research Area:

Physics Beyond the Standard Model

Effective Field Theory of the Standard Model

Higgs Sector

Double Higgs production in e+e- colliders

CP-odd Anomalous Couplings of the Higgs

Computational Tools:

FeynRules, MadGraph5_aMC@NLO, FeynArts, FormCalc, LoopTools

Sonali Verma

Scuola Normale Superiore, Pisa

Advisor: Prof. Roberto Contino

Somali Verma

Master's Degree & Thesis

Dual Master's Physics Degree : Université Paris-Sud (France) & Università di Ferrara (Italy)

Thesis: Einstein-Podolsky-Rosen (EPR) Experiment for Lambda Pairs

- Experimental analysis with BESIII experimental group based on Ref. (N. A. Törnqvist, Found. Phys. 11, 171 (1981))
- Study and verification of EPR correlations of the charmonium decay
  $J/\Psi \rightarrow \gamma\eta_c \rightarrow \gamma\Lambda\overline{\Lambda} \rightarrow \gamma\pi^-\, p\, \pi^+\, \overline{p}$
- Angular Distribution of pions coming from the Lambdas was produced
- Work in progress

What next? aka Ph.D. project

- B meson anomalies and Flavour
- Dark Matter (DM) and composite Higgs models for DM

Ludovico Vittorio

PhD Student, Scuola Normale Superiore (SNS), 1st year

PhD Thesis Supervisor: Prof. Roberto Contino

Master Thesis Supervisor: Prof. Guido Martinelli

Exclusive Semileptonic B decays: critical issues?

- V_{cb} puzzle

$$\bar{B} \to X_c \ell^- \bar{\nu}_\ell: \quad |V_{cb}| = (42.19 \pm 0.78) \cdot 10^{-3}$$

$$\bar{B} \to D \ell^- \bar{\nu}_\ell: \quad |V_{cb}| = (39.18 \pm 0.94_{exp} \pm 0.36_{th}) \cdot 10^{-3}$$

$$\bar{B} \to D^* \ell^- \bar{\nu}_\ell: \quad |V_{cb}| = (39.05 \pm 0.47_{exp} \pm 0.58_{th}) \cdot 10^{-3}$$

Y. Amhis et al. (HFLAV), Eur. Phys. J. C (2017) 77: 895

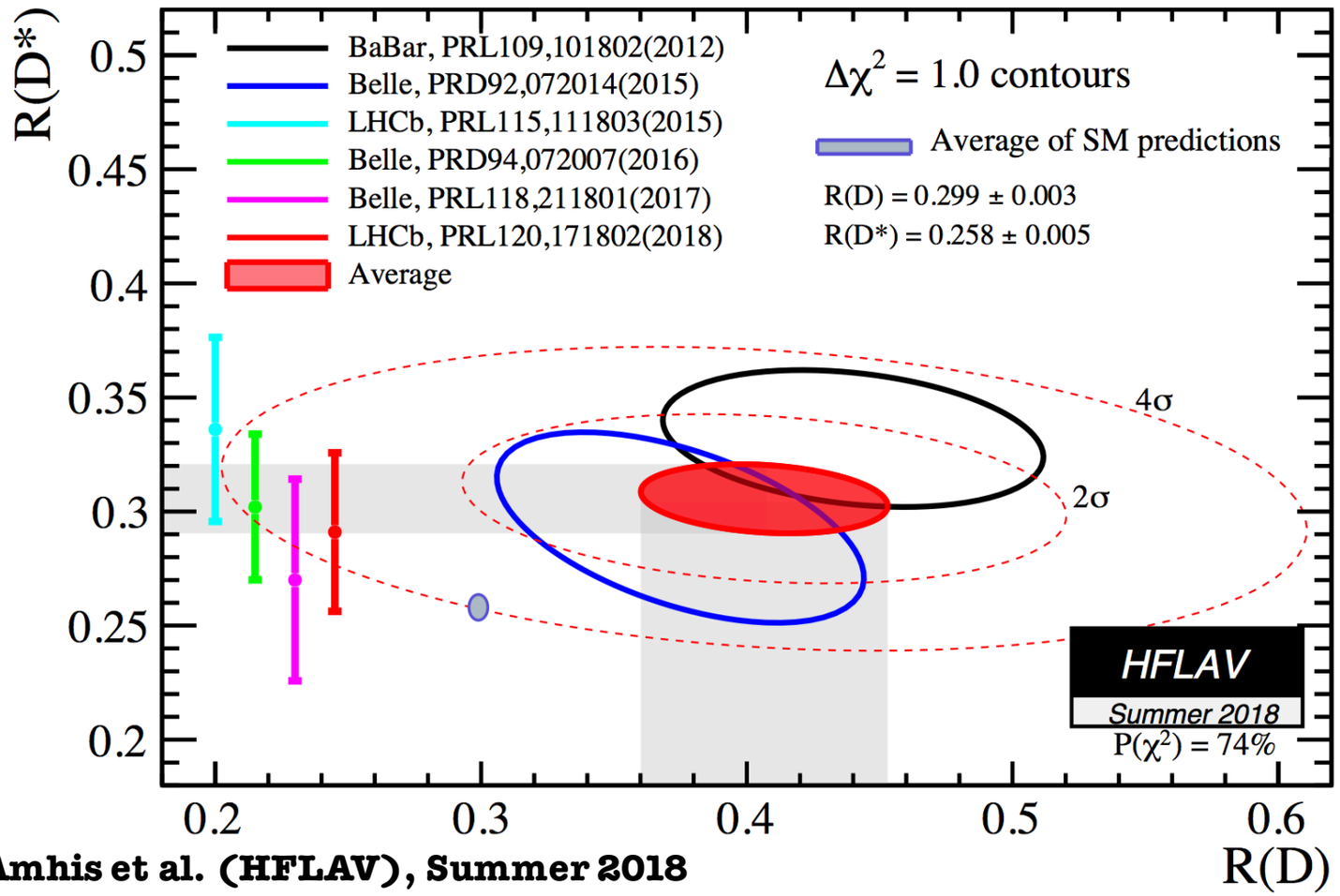
Ludovico Vittorio

- $R_{D^{(*)}}$ anomalies

$$\mathcal{R}(D) = \frac{\mathcal{B}(B \to D\tau\nu_\tau)}{\mathcal{B}(B \to D\ell\nu_\ell)},$$

$$\mathcal{R}(D^*) = \frac{\mathcal{B}(B \to D^*\tau\nu_\tau)}{\mathcal{B}(B \to D^*\ell\nu_\ell)}$$

3.78σ deviation from SM prediction!!!



Y. Amhis et al. (HFLAV), Summer 2018

My research work

1. Building of non-perturbative bounds on form factors entering exclusive semileptonic B decays
2. Analysis of experimental data with known parametrizations (CLN and BGL): necessity to go Beyond the Standard Model?