

Hadronic physics and heavy quarks on the lattice

Welcome to the Hamilton Mathematics Institute @TCD

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Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin



HAMILTON
MATHEMATICS
INSTITUTE



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FOUNDATION

JUNE 4-7, 2024



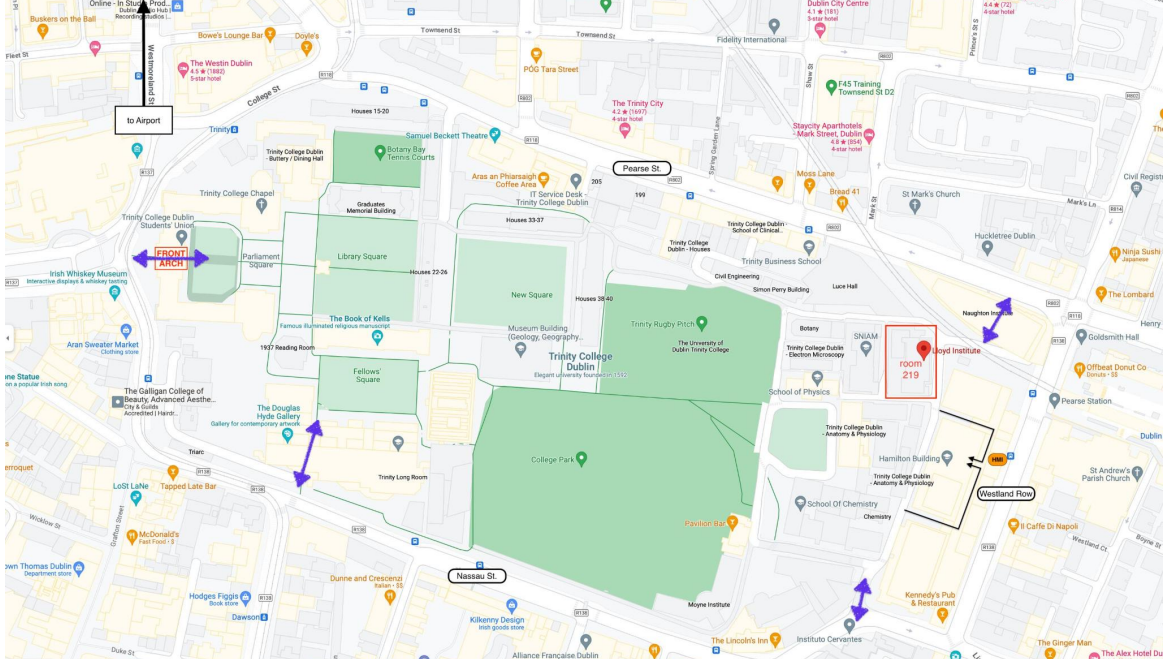
TRINITY COLLEGE (THE UNIVERSITY OF) DUBLIN

- Founded in 1592 by royal charter (Queen Elizabeth I)
- Organised into three faculties (23 schools)
- \simeq 12 000 undergraduate & 5 000 postgraduate students
- Largest Library of Ireland, housing the *Book of Kells* since 1661.

HAMILTON MATHEMATICS INSTITUTE

- Founded in 2005, marking the 200th anniversary of the birth of William R. Hamilton
- Enhances mathematics activities: visitor programmes, conferences, workshops
- Supports economic, cultural and societal benefits of mathematics and fundamental science





■ PRESENTATIONS:

09:30–10:15 (Tue-Fri)

10:45–12:15 (Tue-Fri)

14:00–14:45 (Tue-Thu)

Your talk:

- Format: pdf
- Upload to indico, or
- Mail to LatticeQFT@maths.tcd.ie
- **At least 30 min before your session!!!**
- Use your laptop only if necessary.

■ OPEN PANEL DISCUSSIONS:

15:15–17:00 (Tue, Wed, Thu)

- P1 Higher-order perturbation theory / Heavy quark cutoff effects
- P2 Precision scale setting with t_0
- P3 Spectroscopy

Panelists & Participants: *Interact, engage, discuss!*

Our aim

- Discuss latest developments/advances in spectroscopy and HQ physics.
- Accuracy & precision physics: current & future state-of-the-art calculations?
- Find common ground for collaboration. E.g.: continuum/lattice PT; combined continuum limits w/ > 1 action
- Improve understanding of heavy quark mass-effects in physical observables and decoupling.
- ...



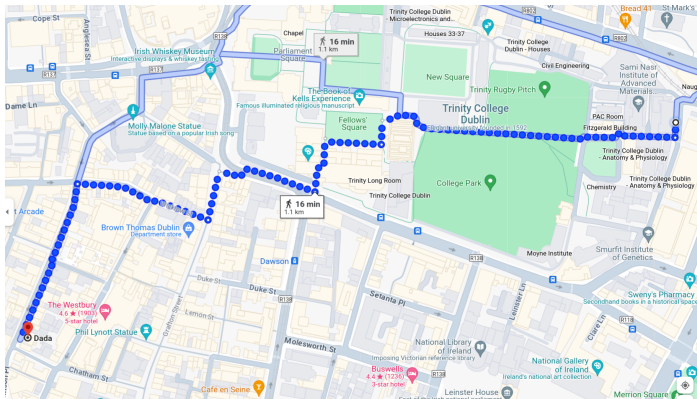
Dada – Moroccan Cuisine



Address: 45 William St S, Dublin, IE D02 WT04



<https://www.dadarestaurant.ie>



- CUISINES: African, Moroccan, International, Fusion, Middle Eastern
- SPECIAL DIETS: Vegetarian Friendly, Halal, Vegan & Gluten Free Options

Your reimbursement (if applicable)



- We will contact you personally in due time.
- As usual: keep all receipts.

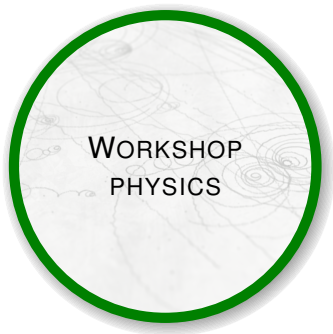
Working space



- Working space is extremely limited at TCD.
- If temporarily required (e.g. an important call), tell us time and duration.



Write to LatticeQFT@maths.tcd.ie,
or ask any of the local organisers in-person.





STANDARD: massless renormalisation scheme

- *continuum*:
modified minimal subtraction (MS-bar)
- *lattice*:
Regularisation-indep. momentum sub. (RI-mom),
Schrödinger Functional (SF)

Advantageous for light quarks!

NOT-SO-STANDARD: massive renormalisation scheme

- *continuum*:
on-shell scheme (OS)
- *lattice*:
massive RI-mom
massive SF

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Precision physics

Requires common reference scheme and scale!

- perturbative vs non-perturbative matching
- control of effective theory parameters (lattice as well as continuum)
- control of mass-independent + massive cutoff effects
- control of mass-effects on the accuracy of PT

Do we stick to status quo, or can we find a common ground to push forward everyone's research?

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— What's the impact of the gradient flow as a tool for precision physics? —

Key tool: Symanzik effective theory for lattice cutoff effects

Guides our understanding of asymptotic behaviour when $a \rightarrow 0$

- need to include higher dimensional operators compatible with lattice symmetries
- #SymEFT parameters/counterterms $\mathcal{C}_i(g_0^2)$ increase rapidly
- non-PT determination or PT truncation ?
- especially important for massive cutoff effects
- ...

Key tool: Symanzik effective theory for lattice cutoff effects



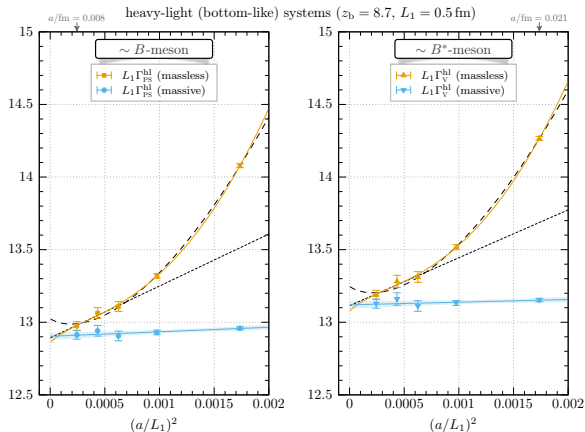
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Determining $C_i(g_0^2)$ pays off!

E.g.: heavy valence Wilson fermions

- relativistic b -quark
- proof-of-concept study in small volume



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4–7 Jun 2024

Hamilton Mathematics Institute, TCD

Europe/Dublin timezone



Overview

Timetable

Contribution List

Registration

Participant List

Directions

Accommodation

Visas & Contact

Contact

 LatticeQFT@maths.tcd.ie



