Isobel Kolbé

Lecturer

Wits School of Physics

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I am a Lecturer at the Wits School of Physics in Johannesburg, South Africa. I received my **Ph. D. in theoretical high energy nuclear and particle physics** from the University of Cape Town in **2019** and held postdoctoral positions at the Institute for Nuclear Theory in Seattle, USA, as well as the Galician Institute for High Energy Physics in Santiago de Compostela, Spain. I am fascinated by the properties of matter under extreme temperatures and densities, with particular focus on the fragmentation region and partonic energy loss in small colliding systems. I have broad expertise in both **analytical calculations** and **Monte Carlo simulations**.

Professional Affiliations

Mandelstam Institute for Theoretical Physics
Member — Sep '23 –present

The National Institute for Theoretical and Computational Sciences (NITheCS)
Associate — Nov '23 –present

SA-CERN
Theory Member — Sep '23 –present

Research Experience

Galician Institute for High Energy Physics (IGFAE), Santiago de Compostela (Spain)
Postdoctoral Research Associate — Sep '22 –Aug '23

Institute for Nuclear Theory (INT), Seattle, WA, (USA)
Postdoctoral Research Associate — 2020 –2022

Brookhaven National Laboratory, Upton, NY, (USA)
Visiting Postdoctoral Research Associate — Aug –Dec 2019

European Center for Nuclear Research (CERN), Geneva (Switzerland)
SA-CERN-funded research visit — Feb –Jul 2019

Education

University of Cape Town
Ph.D. in Theoretical Physics, Advisor: W. A. Horowitz — 2016 –2018

- Thesis: pQCD Energy-loss and Thermal Field Theory in small systems

University of Cape Town
M.Sc. in Theoretical Physics **(with distinction)**, Advisor: W. A. Horowitz — 2015

- Thesis: Short Path Length pQCD Corrections to Energy Loss in the Quark Gluon-Plasma

University of Pretoria
B.Sc. (Hons.) Physics, Advisor: C. Zander — 2010–2014

Publications - For Peer Review

[1] **I. Kolbé**, Chiara Le Roux, and Korinna Zapp. "Colour coherence in small collision systems" (Oct. 2025). arXiv: 2510.17570 [hep-ph].

[2] Wilke van der Schee, **I. Kolbé**, Govert Nijs, Kumail Ruhani, Ishtiaq Ahmed, and Shahin Iqbal. "Three models for charged hadron nuclear modification from light to heavy ions" (Sept. 2025). arXiv: 2509.04299 [nucl-th].

[3] **I. Kolbé**. "JEWEL on a (2+1)D background with applications to small systems and substructure" (Mar. 2023). arXiv: 2303.14166 [nucl-th].

[4] **I. Kolbé** and Mawande Lushozi. "Gluon radiation from a classical point particle: recoil effects". *Eur. Phys. J. C* 83.10 (2023), p. 886. arXiv: 2109.01736 [hep-ph].

[5] **I. Kolbé**, M. Lushozi, L. D. Mclerran, and G Yu. "Distribution of Nuclear Matter and Radiation in the Fragmentation Region". *Phys. Rev. C* 103 (2021), p. 044908. arXiv: 2009.05680 [hep-ph].

[6] **I. Kolbé**, K. Roy, F. Salazar, B. Schenke, and R. Venugopalan. "Inclusive prompt photon-jet correlations as a probe of gluon saturation in electron-nucleus scattering at small x". *JHEP* 01 (2021), p. 052. arXiv: 2008.04372 [hep-ph].

[7] Sylvain Mogliacci, **I. Kolbé**, and W. A. Horowitz. "Geometrically confined thermal field theory: Finite size corrections and phase transitions". *Phys. Rev. D* 102.11 (2020), p. 116017. arXiv: 1807.07871 [hep-th].

[8] M. Kitazawa, S. Mogliacci, **I. Kolbé**, and W.A. Horowitz. "Anisotropic pressure induced by finite-size effects in SU(3) Yang-Mills theory". *Phys. Rev. D* 99.9 (2019), p. 094507. arXiv: 1904.00241 [hep-lat].

[9] **I. Kolbé** and W.A. Horowitz. "Short path length corrections to Djordjevic-Gyulassy-Levai-Vitev energy loss". *Phys. Rev. C* 100.2 (2019), p. 024913. arXiv: 1511.09313 [hep-ph].

Presentations - Talks

Public Talk: NITHeCS — Stellenbosch, South Africa
Title: *"High-Energy Heavy-Ion Collisions in the Oxygen Era"* — Nov 2025

Contributed Talk: Initial Stages 2025 — Taipei, Taiwan
Title: *"Small Systems with JEWEL and Trajectum"* — Sep 2025

Invited Seminar: Niels Bohr Institute — Copenhagen, Denmark
Title: *"Modeling jets in heavy-ion collisions on a realistic background"* — May 2025

Invited Theory Seminar: NIKHEF — Amsterdam, Netherlands
Title: *"Modeling jets in heavy-ion collisions on a realistic background"* — Apr 2025

Seminars tour: University of Utrecht; Lund University — Utrecht, Netherlands; Lund, Sweden
Title: *"Modeling jets in heavy-ion collisions on a realistic background"* — Apr, May 2025

Invited Conference Talk: Rencontres de Moriond — Italy
Title: *"Simulating jets using a realistic medium model"* — Mar 2025

Invited Workshop Talk: Light Ion Collisions at the LHC — CERN
Title: *"JEWEL on a fluctuating medium"* — Nov 2024

CTMP Seminar (x2) — (Remote) Cape Town, RSA
Title: *"Monte Carlo event generators for jet physics in heavy-ion collisions"* — Nov 2024

Invited Workshop Talk: SoftJet24 — Tokyo, Japan
Title: *"Jet substructure in small systems with JEWEL"* — Sep 2024

Invited Plenary: Hard Probes 2024 — Nagasaki, Japan
Title: *"Jets: in-medium parton evolution with finite size effects"* — Sep 2024

Invited Workshop Talk: QCD collectivity at the smallest scales — Qingdao, China
Title: *"Jet quenching and RAA in small systems: theory"* — Jun 2024

Seminar: MITP/NITheCS — Johannesburg, RSA
Title: *"The quark-gluon plasma in small systems"* — Apr 2024

Invited Lecture: CHACAL 2024 — Johannesburg, RSA
Title: *"Monte Carlo Event Generation for Heavy Ions"* — Jan 2024

Invited Plenary: Initial Stages — Copenhagen, Denmark
Title: *"Jet quenching and heavy flavor dynamics in small systems: theoretical overview"* — Jun 2023

Fourth Joint Workshop IGFAE/LIP — Lisbon, Portugal
Title: *"JEWEL for small systems"* — Apr 2023

Invited Triangle Nuclear Theory Colloquium — Duke University, USA
Title: *"Matter and Radiation in the Fragmentation Region"* — Feb 2022

Joint UCLA-Berkeley Lab Nuclear Physics Seminar — Los Angeles, Berkley, USA
Title: *"The problem with a small droplet of quark-gluon plasma"* — Dec 2020

Invited nuclear theory seminar at BNL — Upton, USA
Title: *"Matter and Radiation in the Fragmentation Region"* — Oct 2020

Invited heavy-ion theory seminar at CERN — Geneva, Switzerland
Title: *"Matter and Radiation in the Fragmentation Region"* — Oct 2020

64^{th} **Annual Conference of the South African Institute of Physics** — Polokwane, RSA
Title: *"A $2+1D$ Monte Carlo generator for jets in heavy ion collisions"* — Jul 2019

Invited "Collider Cross-Talk" at CERN — Geneva, Switzerland
Title: *"Partonic energy loss from hadron suppression"* — May 2019

University of Pretoria and **University of the Witwatersrand** seminars — RSA
Title: *"Is there energy loss in a small droplet of quark-gluon plasma?"* — Sep 2018

High Energy Particle Physics Workshop — Johannesburg, RSA
Title: *"The thermodynamics of a geometrically confined small system"* — Feb 2018

High Energy Particle Physics Workshop — Johannesburg, RSA
Title: *"A generalization to all system sizes of DGLV energy loss in the quark-gluon plasma"* — Feb 2017

Quark Matter — Chicago, USA
Title: *"Is pQCD Energy Loss in trouble?"* — Feb 2017

International Workshop on Discovery Physics at the LHC — Kruger National Park, RSA
Title: *'A pQCD sized problem in small systems'* — Dec 2016

61^{st} **Annual Conference of the South African Institute of Physics** — Cape Town, RSA
Title: *"Short Separation distance energy loss in the QGP"* — Jul 2016

University of Cape Town and **University of Johannesburg** — RSA
Title: *"Small System Energy Loss in the QGP"* — May 2016

Presentations - Posters

Hard Probes — Aschaffenburg, Germany
Title: *"JEWEL and jet substructure in any collision system"* — Mar 2023

Quark Matter — Kraków, Poland (Remote)
Title: *"JEWEL for small systems"* — Apr 2022

Quark Matter — Kraków, Poland (Remote)
Title: *"The fragmentation region"* — Apr 2022

Quark Matter — Kobe, Japan
Title: *"Short Path Length pQCD corrections to Energy Loss in the Quark Gluon Plasma"* — Sep 2015

Hard Probes — Montreal, Canada
Title: *"Short Path Length Energy Loss in the QGP from pQCD"* — Jul 2015

Strangeness in Quark Matter — Dubna, Russia
Title: *"Short Path Length Energy Loss in the QGP from pQCD"* — Jul 2015

South African Institute of Physics — Johannesburg, RSA
Title: *"The composition of Uranus from New Horizons data"* — Jul 2014

Publications - Conference Proceedings

[10] **I. Kolbé**. "Jets: In-medium parton evolution with finite size effects". *EPJ Web of Conferences* 339 (Nov. 2025), p. 01001.

[11] **I. Kolbé**, W.A. Horowitz, and S. Mogliacci. "Small System Corrections to Thermal Field Theory and pQCD Energy Loss". *J. Phys. Conf. Ser.* 1271.1 (2019), p. 012019.

[12] **I. Kolbé** and W. A. Horowitz. "Is pQCD energy loss in trouble?" *Nucl. Phys. A* 967 (2017). Ed. by Ulrich Heinz, Olga Evdokimov, and Peter Jacobs, pp. 848–851.

[13] **I. Kolbé** and W.A. Horowitz. "A generalization to all system sizes of DGLV energy loss in the quark-gluon plasma". *J. Phys. Conf. Ser.* 889.1 (2017), p. 012008.

[14] **I. Kolbé** and W.A. Horowitz. "A pQCD sized problem in small systems". *J. Phys. Conf. Ser.* 878.1 (2017), p. 012025.

[15] **I. Kolbé** and W.A. Horowitz. "Short path length pQCD corrections to energy loss in the quark gluon plasma." *J. Phys. Conf. Ser.* 802.1 (2017), p. 012006.

[16] **I. Kolbé** and W.A. Horowitz. "Short path length pQCD corrections to energy loss in the quark gluon plasma". *J. Phys. Conf. Ser.* 668.1 (2016). Ed. by David Alvarez-Castillo, David Blaschke, Vladimir Kekelidze, Victor Matveev, and Alexander Sorin, p. 012107.

[17] **I. Kolbé** and W.A. Horowitz. "Short Path Length Energy Loss in the Quark Gluon Plasma". *61st Annual Conference of the South African Institute of Physics*. 2016, pp. 501–506.

[18] **I. Kolbé** and W.A. Horowitz. "Short Path Length Energy Loss in the Quark-Gluon Plasma from pQCD". *J. Phys. Conf. Ser.* 645.1 (2015). Ed. by Alan S. Cornell and Bruce Mellado, p. 012004.

Teaching and Mentoring

- **Lecturing (Wits University)** 2023 - present
  - (2024 - present) PHYS1000/32/27 *Physics Major and Engineering Physics,* $\mathcal{O}(250)$ *students.*
  - (2024 - present) PHYS1000/32/27 *Physics Major and Engineering Physics, Laboratory Co-coordinator,* $\mathcal{O}(1600)$ *students.*
  - (2023) PHYS1001A *First year support course, algebra based, "Modern Physics" section,* $\mathcal{O}(150)$ *students.*
- **Students** 2022 - present
  - *MSc:*
    - Dario van den Berg *(MSc) - 2025 - present*
    - Ofentse Mathlakola *(MSc) - 2024 - present*
  - *BSc (Hons):*
    - Thapelo Leboho - *present*
    - Sita Singh *(BSc hons) - Distinction (2024)*
  - *Undergraduate:*
    - Farelanani Makatu *(BSc) - Distinction (2024)*
    - Lluvia Garcia *(Undergraduate, Louis Stokes Alliance for Minority Participation (LSAMP) program) - 2022*
- **Tutor** at University of Cape Town 2015 –2018
  - *BSc. Hons. Relativistic Quantum Mechanics*
    (Two years, textbook: "An Introduction to Quantum Field Theory", M. E. Peskin and D. V. Schroeder)
  - 2^{nd} *year Classical Mechanics for Physics majors,*
    (Two years, textbook: "Classical Mechanics", J. R. Taylor)
  - 1^{st} *year for Physics majors,*
    (Calculus based, textbook: "Matter and Interactions", R. Chabay and B. Sherwood,)
  - *First year service physics courses*
    - *PHY1031F:* General algebra-based introductory course.
    - *PHY1012F/S:* For Engineers A, algebra-based introductory course.
    - *PHY1013F/S:* For Engineers B, algebra-based introductory course.
    - *PHY1023H:* Extended degree program.
- **Teaching Assistant** Science Clinic 2012 –2014
  - *High school physics workshops*
- **Tutor** at University of Pretoria 2011 –2014
  - *Main stream first year physics (2011)*
  - *Physics for the life sciences.*

Grants and Funding

- Thuthuka ($\mathcal{O}$(R100k - R200k p/a for three years) 2025
- Science Faculty Startup Grant (R40k p/a for three years) 2024

Scholarships and Awards

- Postdoctoral Research Position at the Galician Institute for High Energy Physics, Santiago de Compostela, Spain (YoctoLHC Advanced ERC grant), to start in Sep 2022. 2022
- Visiting fellow funding by the University of Jyväskylä (Finland) for two-month visit. 2022
- Funding from the Research University Alliance for a research visit to the University of California at Los Angeles (USA). 2022
- Funding from SA-CERN to conduct research at CERN for 6 months. 2019
- Joseph Stone Post Graduate Bursary 2017

- DAAD-NRF Joint in-country Doctoral Scholarship 2016
- National Institute for Theoretical Physics Ph.D. Scholarship (declined) 2016–2018
- University of Cape Town Doctoral Scholarship 2016–2018
- Funding from Women in Physics in South Africa (WiPiSA) for overnight trip for female undergraduate students to visit the South African National Space Agency (SANSA) and Houw-Hoek Satellite testing facility. 2015
- National Institute for Theoretical Physics MSc. Scholarship (partial) 2015

Schools and Training

JETSCAPE Jul 2021
"JETSCAPE Summer School 2021"

27^{th} **Chris Engelbrecht Summer School (RSA)** Jan 2016
"Hot and Dense Matter in Heavy Ion Collisions and Astrophysics: Connecting Quarks with the Cosmos"

26^{th} **Chris Engelbrecht Summer School (RSA)** Jan 2015
"Physics of the LHC"

24^{th} **Jyväskylä Summer School (Finland)** Aug 2014
"Introduction to Relativistic Heavy Ion Collisions"

National Institute for Theoretical Physics (NIThePh) Internship Jul 2014
"pQCD Energy Loss in a Quark-Gluon Plasma"
- Advisor: W. A. Horowitz

South African National Space Agency (SANSA) Winter School Jul 2013
(Competitive attendance)

Outreach and Service

Service

- **Rising Researchers Seminar Series** 2022-2024
  Co-Creator and Chair of the Executive Committee
- 13^{th} **International Workshop on Multiple Partonic Interactions at the LHC (MPI@LHC)** 2022
  Convener: Heavy-ions
- **S@INT Seminars** 2020-2021
  Main organiser of the online version of the Institute for Nuclear Theory's seminar and colloquium series.
- **RHIC AGS Annual Meeting** 2021
  Co-organiser of the "Jets" session.
- **Peer Reviewing** Present
  - Annals of Physics
  - Physical Review D
  - Zeitschrift für Naturforschung A
  - South African Institute for Physics Conference Proceedings

Outreach

- **Wits**, Johannesburg, RSA 2024
  Student Physics Council Panel Discussion - panelist
- **CERN**, Switzerland 2019
  Presented talks on theory aspects of CERN physics to high school students visiting CERN.
- **High School presentations** 2016
  Presented a series of talks at a girls' high school (Roedean School) on women in science.
- **Escom Science Expo** 2016
  Escom Science Expo Judge for Cape Town region - Includes a day of supervision, mentoring and advice followed weeks later by a day of assessment and support for finalists.
- **WiPiSA** 2015
  Helped obtain funding - from Women in Physics in South Africa (WiPiSA) - and organise overnight trip for female undergraduate students to visit the South African National Space Agency and Houw-Hoek Satellite testing facility.