Ursula Laa

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PROFESSIONAL EXPERIENCE

Assistant professor (tenure track), Institute of Statistics — since 2022
University of Natural Resources and Life Sciences (BOKU)
Vienna, Austria

University assistant (tenure track), Institute of Statistics — 2020–2022
University of Natural Resources and Life Sciences (BOKU)
Vienna, Austria

Research fellow, Department of Econometrics and Business Statistics & School of Physics and Astronomy — 2017–2020
Topic: Statistical visualisation methods for theoretical particle physics
(Advisors: Dianne Cook, German Valencia)
Monash University, Australia

EDUCATION

PhD, Theoretical Particle Physics — 2014–2017
Topic: Understanding LHC Searches for new Physics with Simplified Models
(Supervisors: Genevieve Belanger, Sabine Kraml)
LPSC Grenoble, France

Master of Science, Physics — 2011–2014
Topic: Interpretation of the CMS and ATLAS Simplified Models Results
University of Vienna and HEPHY, Austria
with distinction

Bachelor of Science, Physics — 2007–2011
University of Vienna, Austria
with distinction

RESEARCH VISITS

Research group SOLsTIS, AgroParisTech, France	July 2021
Physics Department and Data Science Centre, New York University, USA	Nov 2019
Statistics Department, University of Pennsylvania, USA	Nov 2019
Theory Group of LPSC Grenoble, France	Mar–Jul 2014
ERASMUS Exchange, Aarhus University, Denmark	2010–2011

AWARDS & SCHOLARSHIPS

ACEMS Centre of Excellence, associate investigator	2019–2021
ENIGMASS Cluster of Excellence, PhD fellowship	2014–2017
Deans List Faculty of Physics, University of Vienna (for outstanding academic performance during the Master's program)	2014
Zonta Club Wien I-Postgraduate Award	2013
FEMtech Scholarship for Master's thesis internship	2013

CONSULTING

Roche Diagnostics Training on exploratory data analysis and automated reporting with R (2 days)	2023

OUTREACH **faculti interview** A Slice Tour for Finding Hollowness in High Dimensional Data 2023

PUBLICATIONS

JOURNAL PUBLICATIONS

Note: authors are sorted alphabetically for particle physics publications (standard in the field), while they are sorted by contribution for publications in statistics journals. Asterix marks publications for which I was first and/or corresponding author.

*** New and simplified manual controls for projection and slice tours, with application to exploring classification boundaries in high dimensions**
U. Laa, A. Aumann, D. Cook, G. Valencia
Journal of Computational and Graphical Statistics, 32:3, 1229-1236
https://doi.org/10.1080/10618600.2023.2206459

cubble: An R Package for Organizing and Wrangling Multivariate Spatio-temporal Data
H. S. Zhang, D. Cook, **U. Laa**, N. Langrene, P. Menendez
under review
https://doi.org/10.48550/arXiv.2205.00259

The state-of-the-art on tours for dynamic visualization of high-dimensional data
S. Lee, D. Cook, N. Da Silva, **U. Laa**, E. Wang, N. Spyrison, H. S. Zhang
WIREs Computational Statistics, 14(4), e1573,
https://doi.org/10.1002/wics.1573

Visual Diagnostics for Constrained Optimisation with Application to Guided Tours
H. S. Zhang, D. Cook, **U. Laa**, N. Langrene, P. Menendez
The R Journal (2021) 13:2,
https://doi.org/10.32614/RJ-2021-105

*** Pandemonium: a clustering tool to partition parameter space – application to the B anomalies**
U. Laa, G. Valencia
European Physical Journal Plus, 137:145,
https://doi.org/10.1140/epjp/s13360-021-02310-1

Casting Multiple Shadows: High-Dimensional Interactive Data Visualisation with Tours and Embeddings
S. Lee, **U. Laa**, D. Cook
Journal of Data Science, Statistics, and Visualisation, https://doi.org/10.52933/jdssv.v2i3

*** Burning sage: Reversing the curse of dimensionality in the visualization of high-dimensional data**
U. Laa, D. Cook, S. Lee
Journal of Computational and Graphical Statistics, 31:1, 40-49,
https://doi.org/10.1080/10618600.2021.1963264

*** Hole or grain? A Section Pursuit Index for Finding Hidden Structure in Multiple Dimensions**
U. Laa, D. Cook, A. Buja, G. Valencia
Journal of Computational and Graphical Statistics, online access,
https://doi.org/10.1080/10618600.2022.2035230

* **A slice tour for finding hollowness in high-dimensional data**
U. Laa, D. Cook, G. Valencia
Journal of Computational and Graphical Statistics, 29:3, 681-687,
https://doi.org/10.1080/10618600.2020.1777140

* **Using tours to visually investigate properties of new projection pursuit indexes with application to problems in physics**
U. Laa, D. Cook
Computational Statistics 35, 1171-1205(2020), https://doi.org/10.1007/s00180-020-00954-8

Connecting R with D3 for dynamic graphics, to explore multivariate data with tours
M. Kipp, **U. Laa**, D. Cook
The R Journal (2019) 11:1, https://doi.org/10.32614/RJ-2019-002

SModelS v1.2: long-lived particles, combination of signal regions, and other novelties
F. Ambrogi, J. Dutta, J. Heisig, S. Kraml, S. Kulkarni, **U. Laa**, A. Lessa, et al.
CPC 251 (2020), https://doi.org/10.1016/j.cpc.2019.07.013

* **Anatomy of a six-parameter fit to the $b \to s\ell^+\ell^-$ anomalies**
B. Capdevila, **U. Laa**, G. Valencia
Eur.Phys.J. C79 (2019) no.6, 462, https://doi.org/10.1140/epjc/s10052-019-6944-8

* **Dynamical projections for the visualisation of PDFSense data**
D. Cook, **U. Laa**, G. Valencia
Eur.Phys.J. C78 (2018) no.9, 742, https://doi.org/10.1140/epjc/s10052-018-6205-2

* **On the coverage of the pMSSM by simplified model results**
F. Ambrogi, S. Kraml, S. Kulkarni, **U. Laa**, A. Lessa, W. Waltenberger
Eur.Phys.J. C78 (2018) no.3, 215, https://doi.org/10.1140/epjc/s10052-018-5660-0

Simplified dark matter models with a spin-2 mediator at the LHC
S. Kraml, **U. Laa**, K. Mawatari, K. Yamashita
Eur.Phys.J. C77 (2017) no.5, 326, https://doi.org/10.1140/epjc/s10052-017-4871-0

SModels v1.1 user manual: Imporving simplified model constraints with efficiency maps
F. Ambrogi, S. Kraml, S. Kulkarni, **U. Laa**, A. Lessa, V. Magerl, J. Sonneveld, M. Traub, W. Waltenberger
CPC 227 (2018) 72-98, https://doi.org/10.1016/j.cpc.2018.02.007

Collider limits on new physics within micrOMEGAs
D. Barducci, G. Belanger, J. Bernon, F. Boudjema, J. Da Silva, S. Kraml, **U. Laa**, A. Pukhov
CPC 222 (2018) 327-338, https://doi.org/10.1016/j.cpc.2017.08.028

* **Scalar versus fermionic top partner interpretations of $t\bar{t} + E_T^{\rm miss}$ searches at the LHC**
S. Kraml, **U. Laa**, L. Panizzi, H. Prager
JHEP 1611 (2016) 107, https://doi.org/10.1007/JHEP11(2016)107

Probing U(1) extensions of the MSSM at the LHC Run I and in dark matter searches
G. Belanger, J. Da Silva, **U. Laa**, A. Pukhov
JHEP 1509 (2015) 151, https://doi.org/10.1007/JHEP09(2015)151

Constraints on sneutrino dark matter from LHC Run 1
C. Arina, M. E. Cabrera Catalan, S. Kraml, S. Kulkarni, **U. Laa**
JHEP 1505 (2015) 142, https://doi.org/10.1007/JHEP05(2015)142

SModelS: A tool for interpreting simplified-model results from the LHC and its application to supersymmetry
S. Kraml, S. Kulkarni, **U. Laa**, A. Lessa, W. Magerl, D. Proschofsky-Spindler, W. Waltenberger
Eur.Phys.J. C74 (2014) 2868, `https://doi.org/10.1140/epjc/s10052-014-2868-5`

BOOK CONTRIBUTIONS

Book chapter **Klassisches maschinelles Lernen** (in German)
U. Laa, F. Leisch
in Moderne Verfahren der Angewandten Statistik. Springer Spektrum
`https://doi.org/10.1007/978-3-662-63496-7_6-1`

SOFTWARE

Main developer of the R packages **spinebil** (for evaluating the performance of projection pursuit index functions), **galahr** (a GUI for the tourr package) and **pandemonium** (a Shiny app for the interactive exploration of hierarchical clustering results). All three packages are available through my GitHub account `github.com/uschiLaa`.

Maintainer of the R packages **binostics** (calculation of graph-theoretic scagnostics) and **tourrGUID3** (D3 based tourr GUI).

Major contributor to the R package **tourr** (implementation of tour algorithms in R), in particular the new display methods for the slice and sage tour, and methods for section pursuit. Contributer to the packages **ferrn** (diagnostics for optimization), **cassowaryr** (re-implementation of scagnostics) and **cubble** (for multivariate spatio-temporal data).

Previously a developer of the Python package **SModelS** for re-interpretation of results in particle physics.

CONFERENCE PAPERS & PREPRINTS

New tour methods for visualizing high-dimensional data
U. Laa, D. Cook
Pearson, Italy, Cladag 2023 Book of Abstracts and Short Papers
ISBN: 978-88-9193-563-2

High-dimensional data visualisation with the grand tour
U. Laa
EPJ Web of Conferences 245, 06018 (2020)

Fitting in or odd one out? Pulls vs residual responses in $b \to s\ell^+\ell^-$
B. Capdevila, U. Laa, G. Valencia
arXiv:1908.03338

SModelS – new developments and applications
U. Laa
PoS ICHEP2018 (2019) 516

Les Houches 2017: Physics at TeV Colliders New Physics Working Group
arXiv:1803.10379

On the coverage of the pMSSM by simplified model results
U. Laa
PoS EPS-HEP2017 (2017) 300, arXiv:1709.10386

Les Houches 2015: Physics at TeV colliders – new physics working group report
arXiv:1605.02684

Interpreting LHC searches for new physics with SModelS
U. Laa
PoS EPS-HEP2015 (2015) 105, arXiv:1510.01999

SModelS v1.0: a short user guide
S. Kraml, S. Kulkarni, U. Laa, A. Lessa, V. Magerl, W. Magerl, D. Proschofsky-Spindler, M. Traub, W. Waltenberger
arXiv:1412.1745

TEACHING

TEACHING EXPERIENCE

Lecturer at BOKU University from 2021
4 hours of teaching per semester, in German and English
Different formats: lecture, exercise classes, seminar
Topics: Statistics introduction, Statistics with R, Introduction to statistical learning, Exploratory data analysis
Development of new teaching material, and fully new course Exploratory data analysis

Tutor at Monash University from 2020
Statistical Learning
Supervision of computational labs

Practical Exercises at University Grenoble Alpes 2015–2017
Nuclear physics for Radioprotection Master
Nuclear physics for Physics Master
Muon measurements for Physics Bachelor

Tutor at University of Vienna 2011–2013
Weekly seminar for first semester physics students

SUPERVISION

Co-advised several PhD, Honours and undergraduate research students

Main advisor for an Honours project on machine learning and visualisation for particle physics searches and in a summer research project on clustering and visualisation

PRESENTATIONS

COLLOQUIA & WORKSHOPS

R Ladies Vienna May 2022
Introduction to shiny – Workshop

R Ladies Vienna May 2021
Introduction to ggplot2 – Workshop

Data Visualisation New York Meetup Nov 2019
High-dimensional data visualisation with tours

Technical Talk Sep 2019
ARC Centre of Excellence for Mathematical & Statistical Frontiers
An Introduction to the Visualisation Ecosystem in R (with Stuart Lee)

Colloquium Apr 2019
School of Physics and Astronomy, Monash University, Australia
High-dimensional data visualisation for physics applications

Workshop Mar 2019
Business Analytics Seminar, Monash University, Australia
An Introduction to gganimate (with Mitch O'Hara-Wild and Nick Spyrison)

CONFERENCE TALKS & POSTERS

Cladag Sept 2023
Salerno, Italy
Talk: New tour methods for visualizing high-dimensional data

DSSV-ECDA July 2023
Antwerp, Belgium
Talk: New tour methods for visualizing high-dimensional data

CompStat Aug 2022
Bologna, Italy (Hybrid)
Invited talk: Different flavors of publishing computational work

JSM Aug 2022
Washington DC, USA
Invited panel contribution: Tours for the dynamic visualization of high-dimensional data

DSSV June 2022
Tainan, Taiwan (Hybrid)
Invited talk: Multivariate visualization for the interpretation of clustering results

Austrian and Slovenian Statistical Days Apr 2022
Graz, Austria
Talk: Scagnostics with the cassowaryR package

CMStatistics Dec 2021
London, UK (Hybrid)
Talk: Section pursuit

Rencontres R July 2021
Paris, France
Talk: Tours for the dynamic visualization of high-dimensional data

UseR! July 2021
virtual
Talk: New displays for the visualization of multivariate data in the tourr package

ACEMS Retreat Nov 2020
ARC Centre of Excellence for Mathematical & Statistical Frontiers virtual retreat
Talk: Reversing the cures of dimensionality in the visualization of high-dimensional data

Conference on Computing in High Energy and Nuclear Physics Nov 2019
Adelaide, Australia
Talk: High-dimensional data visualisation with the grand tour

UseR! July 2019
Toulouse, France
Talk: Visualising high-dimensional data:
new developments of the tourr package using Shiny and plotly

Visualisation Matters May 2019
Canberra, Australia
Invited talk: Visualisation in Physics

Australian Meeting on Accelerator-Based Particle Physics Feb 2019
Melbourne, Australia
Talk: Anatomy of a six-parameter fit to the $b \to s\ell^+\ell^-$ anomalies

International Conference on High Energy Physics Aug 2018
Seoul, Korea
Talk: SModelS - new developments and applications

European Physical Society Conference on High Energy Physics July 2017
Venice, Italy
Talk: On the coverage of the pMSSM by Simplified Model results

Rencontres de Physique des Particules April 2017
Centre de Physique des Particules de Marseille, France
Talk: Simplified dark matter models with a spin-2 mediator at the LHC

Open Questions in Particle Physics and Cosmology April 2017
Convention Centre by the Observatory, Goettingen, Germany
Talk: Simplified dark matter models with a spin-2 mediator at the LHC

(Re)interpreting the results of new physics searches at the LHC Dec 2016
CERN, Geneva, Switzerland
Talk: Scalar versus fermonic top partner interpretations of
$t\bar{t} + E_T^{miss}$ searches at the LHC

(Re)interpreting the results of new physics searches at the LHC Jun 2016
CERN, Geneva, Switzerland
Talk: On the coverage of the pMSSM by Simplified Model results

GDR Terascale May 2016
Subatech, Nantes, France
Talk: SModelS & Simplified Model Sensitivity to Spin Structure

Dark Matter at the Large Hadron Collider 2016 Mar-Apr 2016
Amsterdam, Netherlands
Poster: Interpreting LHC searches for new physics with SModelS

SUSY 2015 Aug 2015
Lake Tahoe, California, USA
Talk: Constraints on sneutrino dark matter from LHC Run 1

European Physical Society Conference on High Energy Physics Jul 2015
Vienna, Austria
Poster: Interpreting LHC searches for new physics with SModelS

GDR Terascale Mar-Apr 2015
Saclay, France
Talk: Constraints on sneutrino dark matter from LHC Run 1

GDR Terascale Jun 2014
Palaiseau, France
Talk: SModelS – Interpreting Simplified Model Results

ÖPG/SPS 2013 Annual Meeting Sept 2013
Linz, Austria
Talk: Application of CMS and ATLAS Simplified Models Results
to Theories Beyond the Standard Model

SEMINARS

WU Statistics and Mathematics Research Seminar Jan 2022
Vienna University of Economics and Business, Austria (Hybrid)
Section pursuit

Particle Physics Group Meeting Nov 2020
Monash University, Australia (virtual)
Hole or grain? Exploring for hidden structure in multiple dimensions with the slice tour

ICRAR/UWA Seminar June 2020
University of Western Australia, Australia (virtual)
Visualisation beyond 3 dimensions

Business Analytics Seminar June 2020
Monash University, Australia (virtual)
Hole or grain? Exploring for hidden structure in multiple dimensions with the slice tour

IFAE Seminar July 2019
Barcelona, Spain
High-dimensional data visualisation for physics applications

HEPHY Seminar July 2019
Vienna, Austria
High-dimensional data visualisation for physics applications

Particle Physics Pheno Seminar June 2019
University of Milan, Italy
High-dimensional data visualisation for physics applications

LPSC Theory Seminar June 2019
Grenoble, France
High-dimensional data visualisation for physics applications

Feast-of-Facts Seminar May 2019
RSAA (ANU) Canberra, Australia
High-dimensional data visualisation for physics applications

Seminar Aug 2018
Ewha Womans University, Seoul, Korea
Statistical visualisation of particle physics data: Sensitivity of parton distribution functions

Business Analytics Seminar June 2018
Monash University, Australia
Statistical visualisation of particle physics data

Particle Physics Seminar March 2018
Monash University, Australia
Understanding LHC searches for new physics with simplified models

PhD Thesis Defence Sept 2017
LPSC Grenoble, France
Understanding LHC searches for new physics with simplified models

Doctoral Seminar Mar 2016
LPSC Grenoble, France
Interpreting LHC searches for new physics with SModelS

SERVICE

Co-organizer of the **Data Science @ BOKU initiative** and associated events and of **R Ladies Vienna**

Program Committee member for UseR! 2024

Referee for the R Journal; the Journal of Computational and Graphical Statistics; the Journal of Data Science, Statistics and Visualisation; the International Journal of Data Science and Analytics; and the Journal of Outdoor Recreation and Tourism

Previously referee for Physical Review D

Seminar organiser for Monash Business Analytics (2020)

Session chair: rstudio::global(2021) conference (co-host), JSM 2022, Cladag 2023

COMPUTING Python, R, git, LaTeX

Author of several open-source software packages

LANGUAGES German (native speaker)
English (fluent)
French (conversant)

NATIONALITY Austrian