

RISE: Uppsala node

Rikard Enberg



UPPSALA
UNIVERSITET



The lab



The university



The town

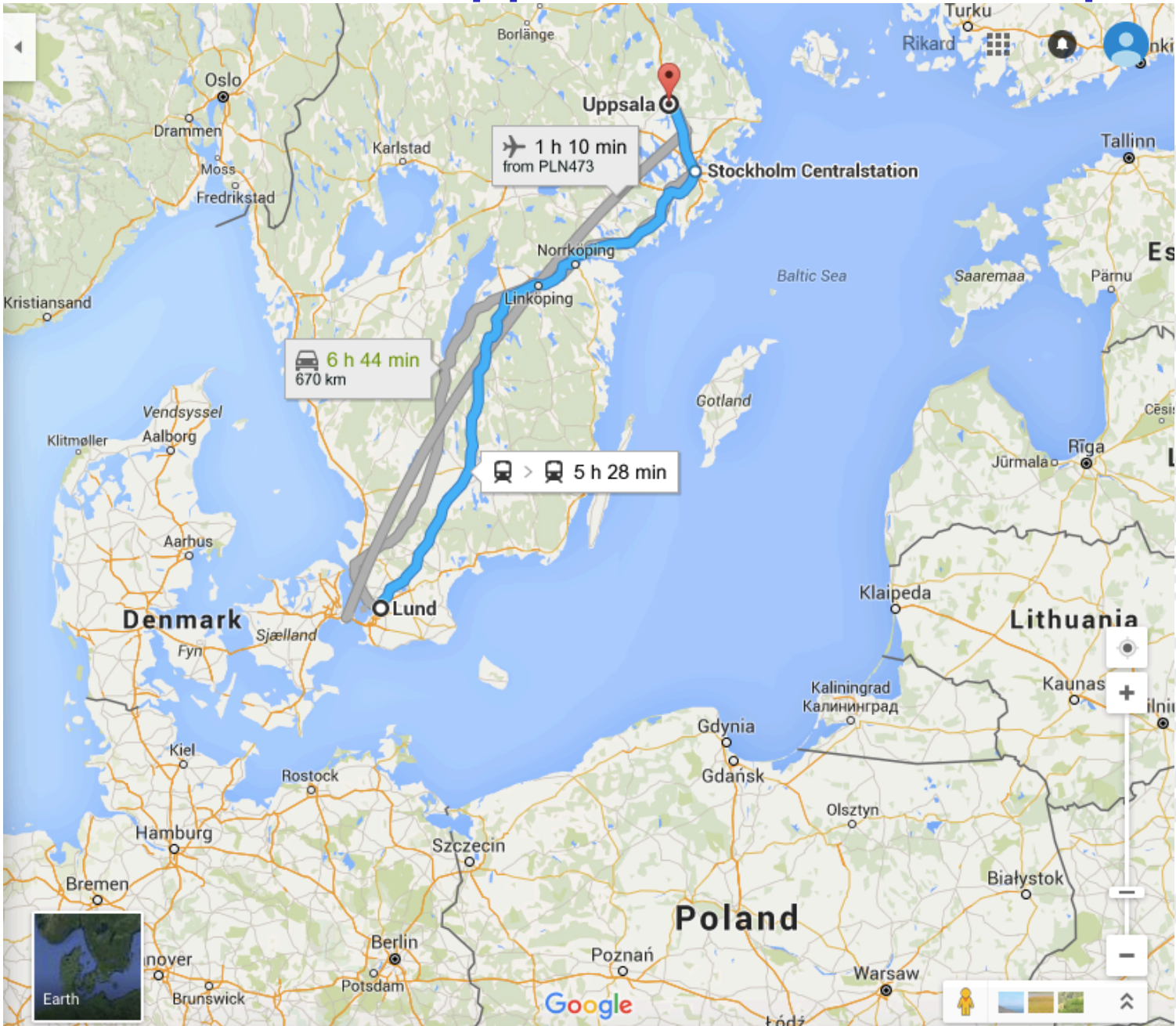


The slogan



To think freely is great;
To think correctly is greater

- Uppsala is ~70 km (40 mi) north of Stockholm and ~35 km from Stockholm Airport (18 min train)
- Lund is 670 km from Uppsala but close to Copenhagen



Uppsala HEP

- Phenomenology group (next slide)
- ATLAS group: working on charged Higgs searches and e.g. $H \rightarrow \tau\tau$, boosted tops, ...
(*E. Bergeås-Kuutmann, R. Brenner, A. Ferrari*)
- Large string/formal theory group
(*U. Danielsson, G. Dibitetto, L. Freyhult, M. Guica, H. Johansson, U. Lindström, J. Minahan, A. Niemi, J. Qiu, M. Zabzine, K. Zarembo*)
- IceCube group
(*spokesperson O. Botner, A. Hallgren, C. de los Heros*)

Uppsala pheno

Faculty:

- Rikard Enberg (Higgs, astro, QCD, colliders...)
- Gunnar Ingelman (QCD, Monte Carlo, colliders...)

Postdocs:

- Ufuk Aydemir (until 2016 — applying now)
- Tanumoy Mandal (from 2015):

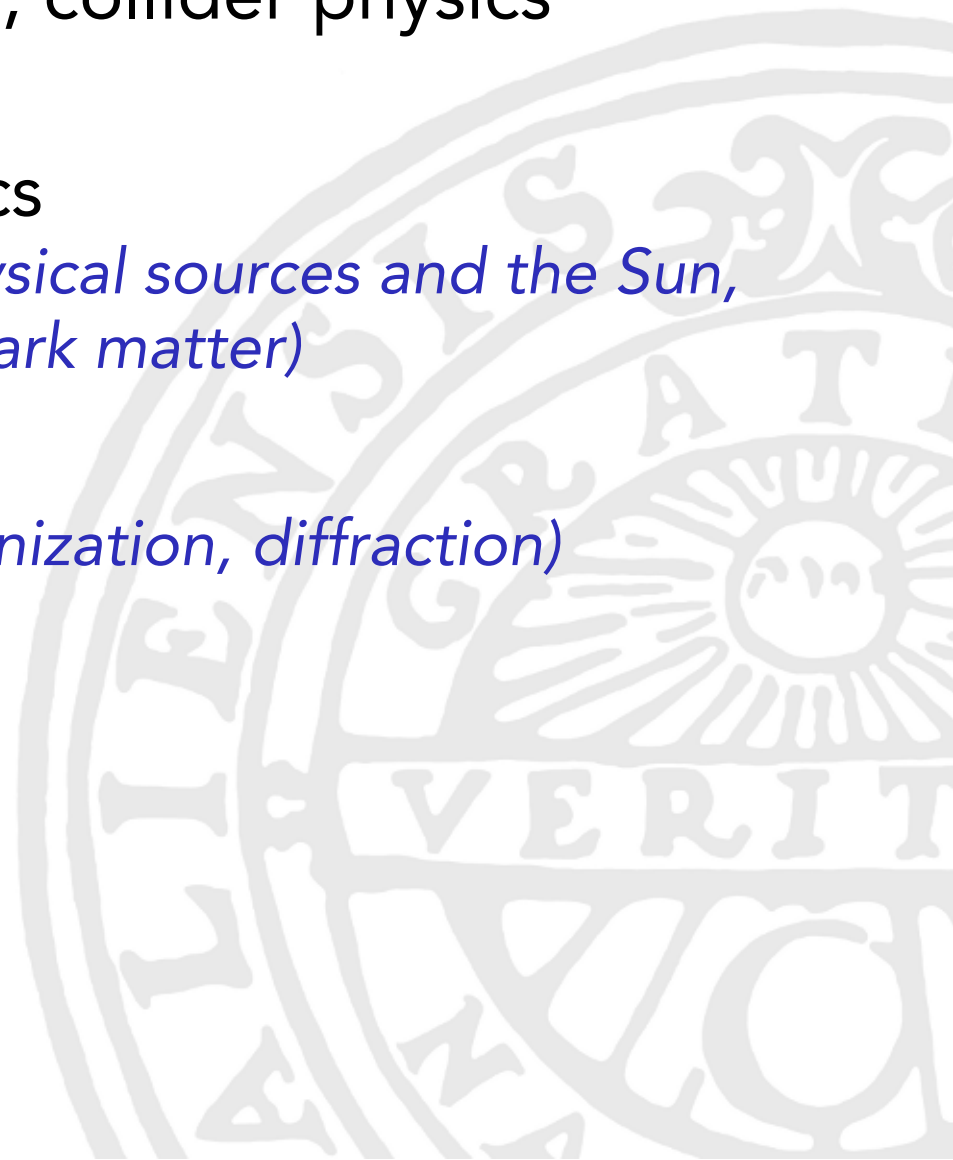
PhD students:

- Andreas Ekstedt, Johan Löfgren, Dominik Werder

Recently left: William Klemm, Shoaib Munir (postdocs), Glenn Wouda (PhD student)

Uppsala group activities

- Higgs phenomenology, BSM, collider physics
(rest of talk)
- Neutrino/astroparticle physics
(HE neutrino fluxes from astrophysical sources and the Sun, prompt atmospheric neutrinos, dark matter)
- QCD
(soft QCD, small-x physics, hadronization, diffraction)
- Monte Carlo development
(not at present)



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Some examples of Higgs-related recent projects, mostly Higgs phenomenology in 2HDMs and NMSSM:

(RE, G. Wouda, S. Munir; collaborations w/ S. Moretti, R. Pasechnik, J. Rathsman, O. Stål et al)

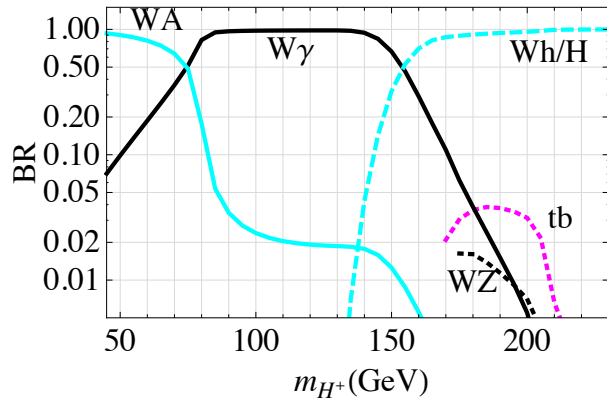
- Dark matter in NMSSM: constraints from Higgs and prospects for IceCube
(RE, S. Munir, C. de los Heros, D. Werder, arXiv:1506.05714)
- $H^+ \rightarrow W^+ H_{125}$ decay channel at LHC
(with S. Moretti, arXiv:1412.5814)
- A light NMSSM pseudoscalar Higgs boson at the LHC redux
N.-E. Bomark, S. Moretti, S. Munir, L. Roszkowski, arXiv:1409.8393
- SO(10) Grand Unification in light of recent LHC searches and colored scalars at the TeV-scale
U. Aydemir, arXiv:1512.00568

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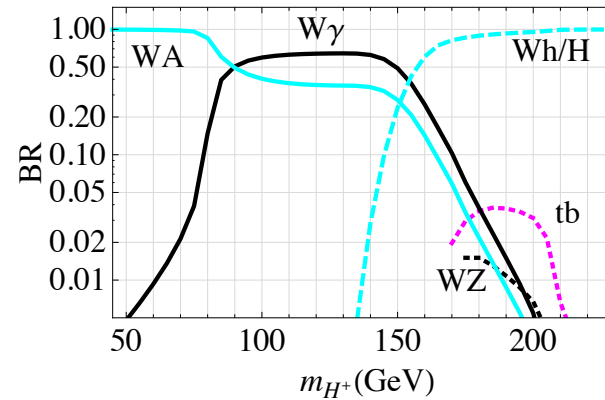
Examples of ongoing projects:

- Left-right models, $SO(10)$, $U(1)_R$ etc at LHC
→ MadGraph implementation
- Constraints on 2HDMs from LHC and electroweak phase transition
→ using 2HDMC, HiggsSignals/HiggsBounds;
code for 1-loop V_{eff} plus thermal corrections written
(RE, G. Wouda, O. Stål, J. Löfgren)
- Electroweak pair production of Higgses in 2HDM
(RE, Klemm, Moretti, Munir)

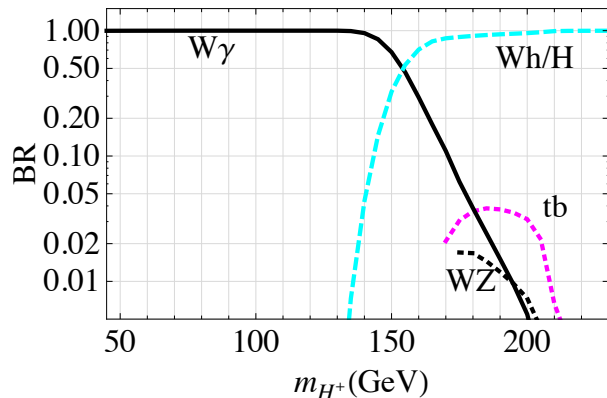
Example: unusual H^+ decays



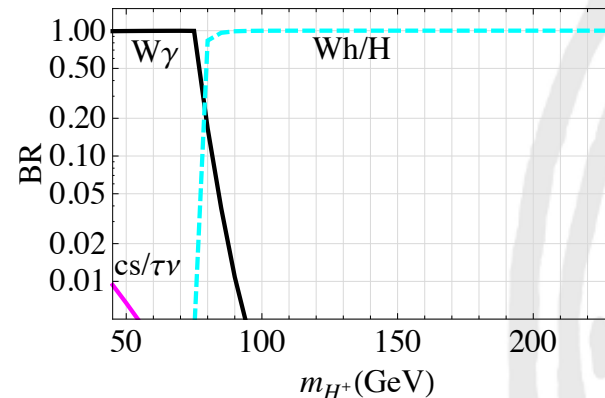
(a) $m_A = m_{H^\pm} - 10$ GeV, $m_h = 125$ GeV, $m_H = 300$ GeV, $\sin \alpha = 0.9$.



(b) $m_A = m_{H^\pm} - 20$ GeV, $m_h = 125$ GeV, $m_H = 300$ GeV, $\sin \alpha = 0.9$.



(c) $m_A = m_{H^\pm}$, $m_h = 125$ GeV, $m_H = 300$ GeV, $\sin \alpha = 0.9$.



(d) $m_A = m_{H^\pm}$, $m_h = 75$ GeV, $m_H = 125$ GeV, $\sin \alpha = 0.1$.

2HDM where the 2nd doublet is fermio-phobic

In particular $H^+ \rightarrow W\gamma$ at one loop

(R. Enberg, J. Rathsman, G. Wouda, arXiv:1311.4367)

Lund is associated to Uppsala

Lund faculty (most close to NonMinimalHiggs):

- Johan Rathsman
- Roman Pasechnik
- (Other theorists: Hans Bijnens, Gösta Gustafson, Leif Lönnblad, Malin Sjödahl, Torbjörn Sjöstrand)

Postdocs:

- Eliel Camargo-Molina, António Morais (also Aveiro U)

Students:

- Jonas Wessén, Astrid Ordell, Joel Oredsson

Lund ongoing/recent research (1)

Johan Rathsman:

- In general, Higgs phenomenology & model building, e.g. 2HDM, NMSSM, ...
- 2HDMC code: 2-Higgs Doublet Model Calculator ([Eriksson, Rathsman, Stål](#))
- Interim recommendations for the evaluation of Higgs production cross sections and branching ratios at the LHC in the Two-Higgs-Doublet Model ([Harlander, Mühlleitner, Rathsman, Spira, Stål, arXiv:1312.5571](#))
- RG running of Yukawas in 2HDMs
- ...

Lund ongoing/recent research (2)



LUND
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Higgs sectors in Left-Right symmetric models

Ongoing research on:

- Vacuum stability in LR symmetric models
- Effective multi-Higgs potentials
- Radiative symmetry breaking and RG flows
- Global flavour symmetries and emergent flavour spectra
- SUSY vs non-SUSY Trinification
- Hierarchy problem and emergent multi-scale gauge hierarchies
- E8-inspired Trinification and effective low-energy theories

R. Pasechnik

J. E. Camargo-Molina

A. Morais

M. Sampaio

J. Wessen

A. Ordell

Software

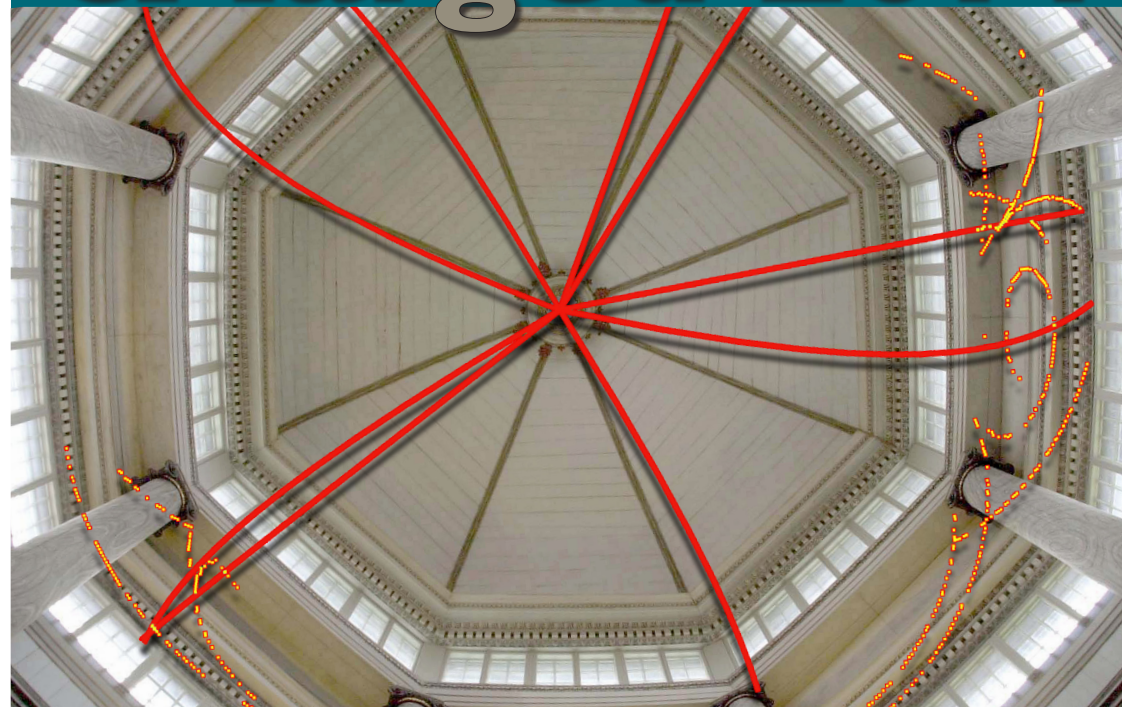
- **2HDMC — two-Higgs-doublet model calculator**
*D. Eriksson (left the field), J. Rathsman (Lund),
O. Stål (left the field)*
- **Vevacious: Tool For Finding The Global Minima Of
One-Loop Effective Potentials With Many Scalars**
*J. E. Camargo-Molina (now Lund), B. O'Leary, W. Porod,
F. Staub*

SIXTH

FIFTH INTERNATIONAL WORKSHOP

cH[±]arged 2014

2016



Prospects for Charged Higgs Discovery at Colliders

Uppsala University, Sweden, ~~16-18 September 2014~~

International Scientific Advisory Committee:

- Kétévi Assamagan (BNL, USA)
- Johann Collot (University of Grenoble, France)
- Albert de Roeck (CERN, Geneva, Switzerland)
- Eilam Gross (Weizmann Institute of Science, Israel)
- Sven Heinemeyer (University of Cantabria, Spain)
- Karl Jakobs (University of Freiburg, Germany)
- Ritva Kinnunen (Helsinki Institute of Physics, Finland)
- Michael Krämer (RWTH Aachen University, Germany)
- Maria Krawczyk (University of Warsaw, Poland)
- Chiara Mariotti (INFN Torino, Italy)
- Stefano Moretti (University of Southampton, UK)
- Per Osland (University of Bergen, Norway)
- Tilman Plehn (University of Heidelberg, Germany)
- Rui Santos (Universidade de Lisboa, Portugal)
- Trevor Vickey (University of the Witwatersrand, South Africa)



Topics

- Search results, analysis tools
 - Phenomenology and Monte Carlo tools
 - Theory
- We welcome contributed talks.

Local Organisation Committee:

- Elin Bergeås Kuutmann,
- Richard Brenner, Elias Coniavitis, Mattias Ellert, Rikard Enberg, Inger Ericson (secretary), Arnaud Ferrari (co-chair), Johan Rathsman (co-chair), Camila Rangel Smith, Oscar Stål



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3-5 or 3-6
October 2016?
(prel.)

