Katharsis of Ultimate Theory Standards

Meeting 15 @ Karlsruhe Institute of Technology

23 – 25 March 2026

https://indico.global/event/16546/

PH

ITP Institute for Theoretical Physics

KIT Karlsruhe Institute of Technology

Organized by:

S. Heinemeyer, P. Slavich

Local organizers:

C. Borschensky, M. Mühlleitner

Katharsis of Ultimate Theory Standards

Precision SUSY Higgs Mass Calculation Initiative

As is well known, the experimental accuracy of the mass measurement of the observed signal is already below the GeV-level, whereas in the (N)MSSM the theory uncertainty is still at the level of several GeV. Therefore, a dedicated effort for reducing the theory uncertainty to the level of the experimental accuracy would be appropriate.

We therefore plan to start a coordinated initiative in this direction, which is meant to get the people working in this field together to contribute to a highly focused and ongoing working group.

Goals:

The main idea is to provide a platform where the relevant experts of the field can communicate with each other, exchange ideas and discuss in detail the open questions. We will (for now) concentrate *only* on (N)MSSM Higgs *mass* calculations. We do not want (at least for the moment) to dilute the effort by including other observables etc.

In particular the following issues should be addressed:

- Identification and listing of existing corrections, and how the are included in public codes.
- Identification and estimate of remaining uncertainties, taking into account the dependence of the theoretical uncertainty on the considered region of parameter space.
- Development of tools to make existing results that are complicated and numerically slow accessible for general analyses, i.e. development of "fast" codes.
- Identification of the most important future improvements.
- Seek to identify teams who tackle those improvements.

General structure:

- This will be an ongoing effort.
- We will try to meet twice a year.
- The emphasis of the meetings will be on free discussions, rather than on talks.
- We will have *very informal* and possibly web-based write-ups, so that, e.g., the "identification and listing" is not lost, but kept for further discussion.

Meetings:

- twice a year
- meeting structure:

* one afternoon (arrival in the morning)

* one full day

* one morning (departure in the afternoon)

- ample room for free discussion (Santander style)

Main organizers:

- Marcela Carena (Fermilab)
- Howard Haber (St. Cruz)
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https://sites.google.com/site/kutsmh/

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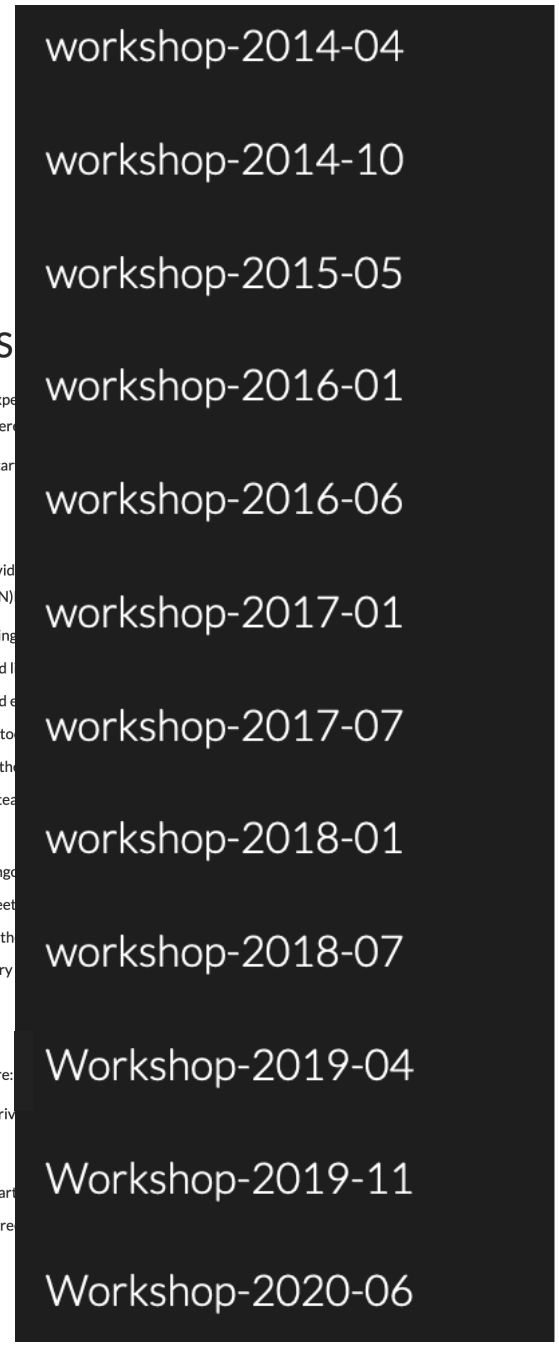

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The KUTS report: 2012.15629

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THE EUROPEAN PHYSICAL JOURNAL C

Review

Higgs-mass predictions in the MSSM and beyond

P. Slavich[1,a], S. Heinemeyer[2,3,4], E. Bagnaschi[5], H. Bahl[6], M. Goodsell[1], H. E. Haber[7], T. Hahn[8], R. Harlander[9], W. Hollik[8], G. Lee[10,11,12], M. Mühlleitner[13], S. Paßehr[9], H. Rzehak[14], D. Stöckinger[15], A. Voigt[16], C. E. M. Wagner[17,18,19], G. Weiglein[6], B. C. Allanach[20], T. Biekötter[6], S. Borowka[21], J. Braathen[6], M. Carena[18,19,22], T. N. Dao[23], G. Degrassi[24], F. Domingo[25], P. Drechsel[6], U. Ellwanger[26], M. Gabelmann[13], R. Gröber[27], J. Klappert[9], T. Kwasnitza[15], D. Meuser[6], L. Mihaila[28], N. Murphy[29], K. Nickel[25], W. Porod[30], E. A. Reyes Rojas[31], I. Sobolev[6], F. Staub[13]

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Received: 15 March 2021 / Accepted: 27 April 2021

Abstract Predictions for the Higgs masses are a distinctive feature of supersymmetric extensions of the Standard Model, where they play a crucial role in constraining the parameter space. The discovery of a Higgs boson and the remarkably precise measurement of its mass at the LHC have spurred new efforts aimed at improving the accuracy of the theoretical predictions for the Higgs masses in supersymmetric models. The "*Precision SUSY Higgs Mass Calculation Initiative*" (KUTS) was launched in 2014 to provide a forum for discussions between the different groups involved in these efforts. This report aims to present a comprehensive overview of the current status of Higgs-mass calculations in supersymmetric models, to document the many advances that were achieved in recent years and were discussed during the KUTS meet-

Editors: P. Slavich and S. Heinemeyer.

S. Borowka, P. Drechsel, L. Mihaila, N. Murphy, K. Nickel, F. Staub: Former academic affiliation.

[a] e-mail: slavich@lpthe.jussieu.fr (corresponding author)

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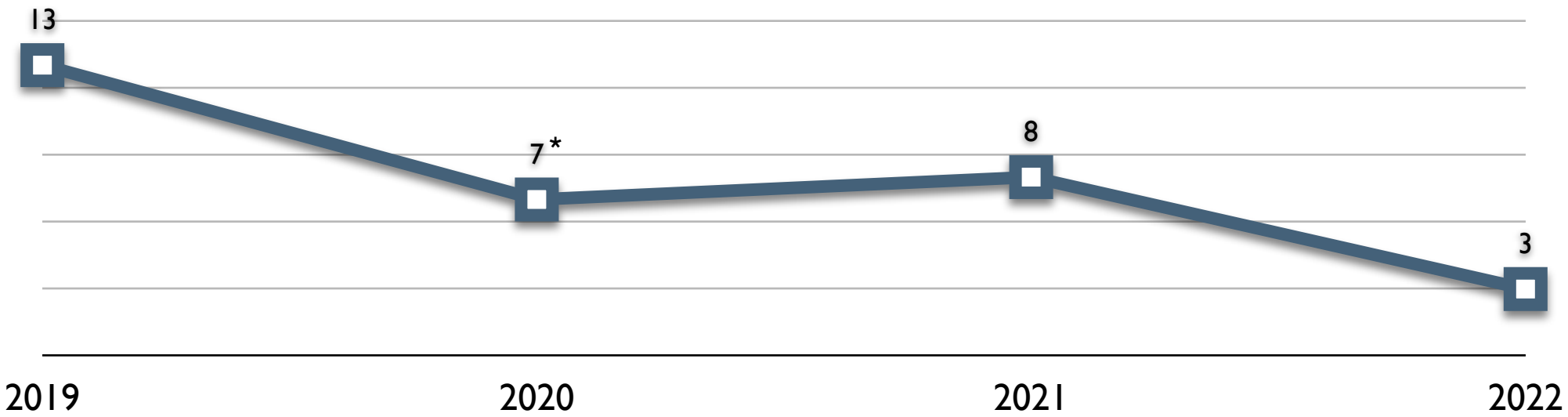
KUTS-related papers, 2019-2022



* including KUTS report

KUTS 2: time to widen our focus

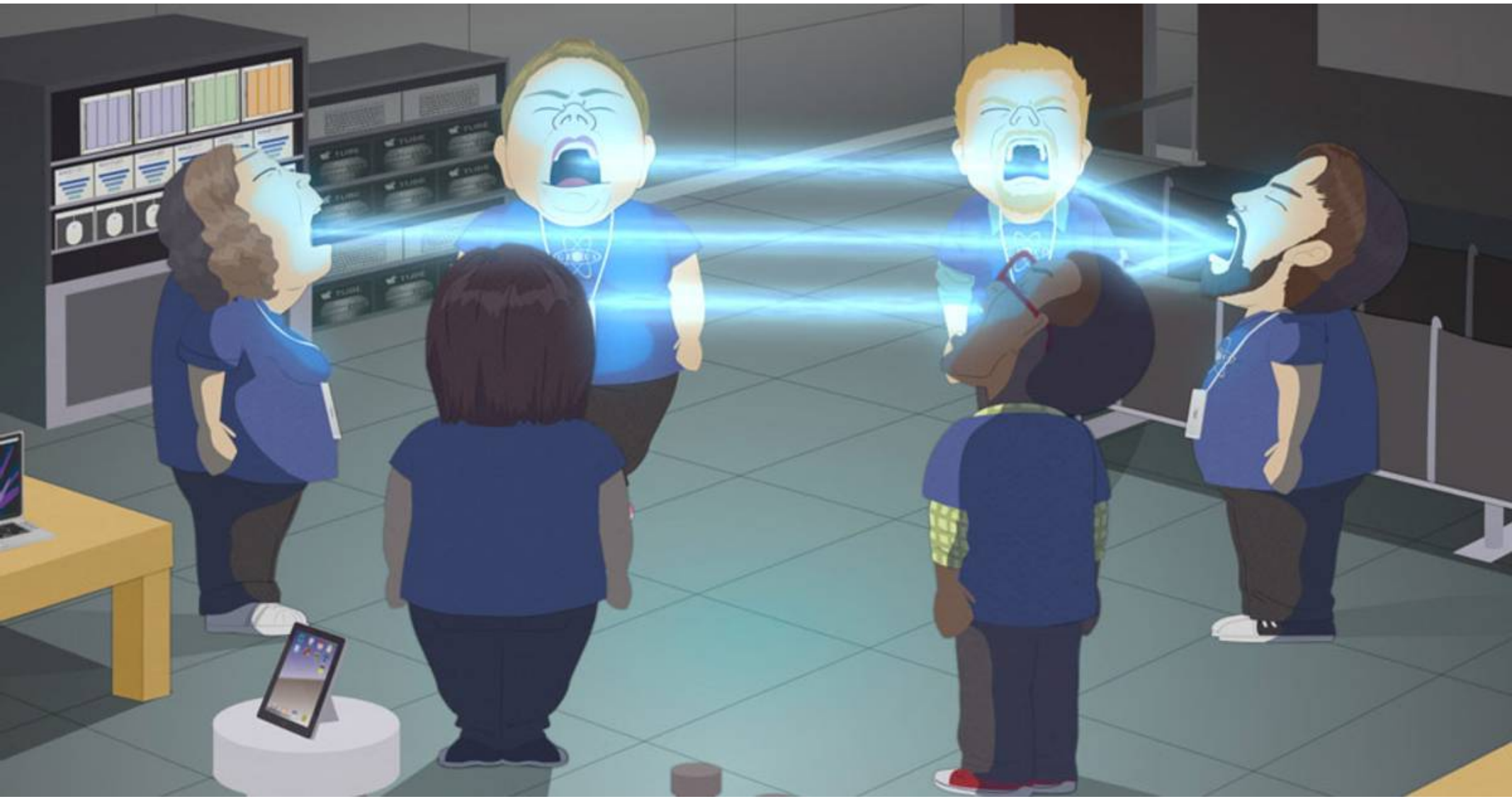
- From *"Higgs-mass calculations in SUSY"* to *"Precision calculations in BSM"* (including non-SUSY models, other Higgs properties, non-Higgs observables…)

- No phenomenology, lest we become "Higgs Days without experimentalists"

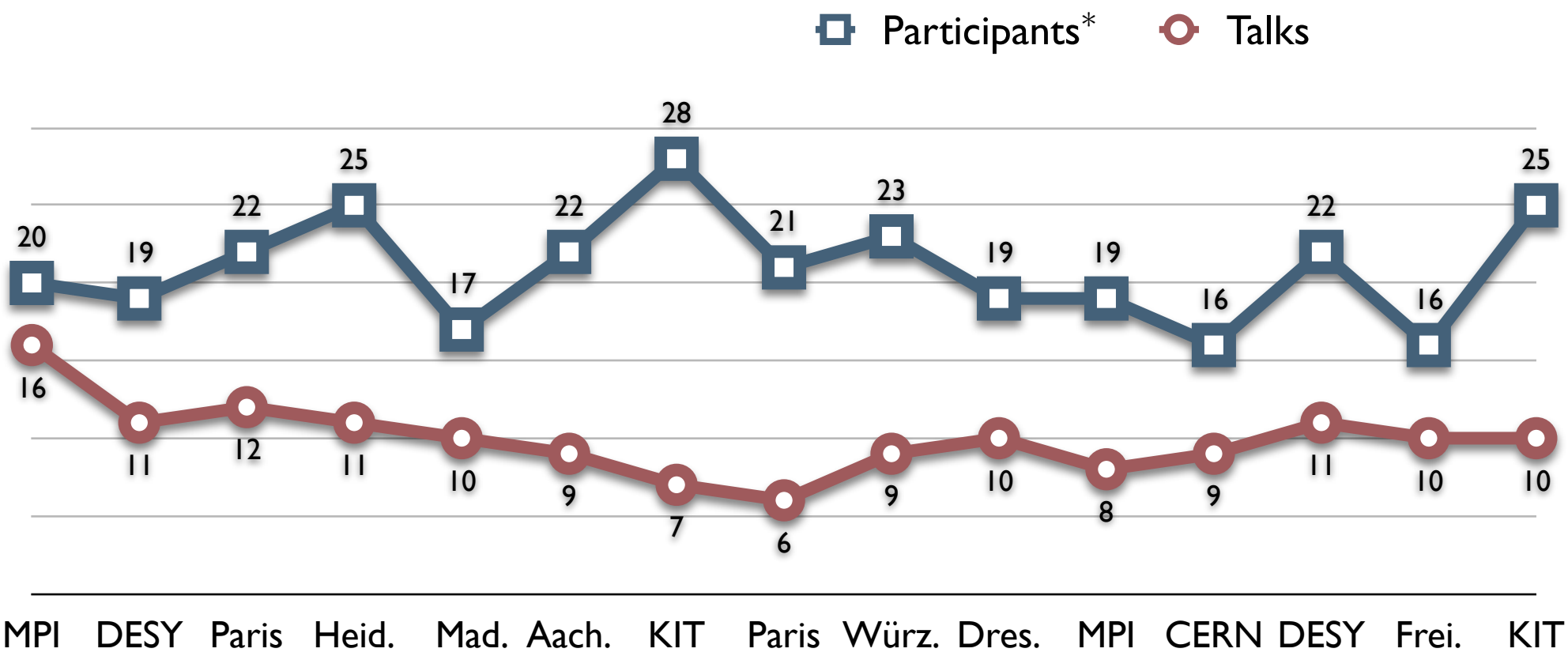
- Which future directions for KUTS? Please contribute to the discussion!

The poster was AI-generated by Emanuele, back when doing this was still cool and original…

It always reminded me of this…

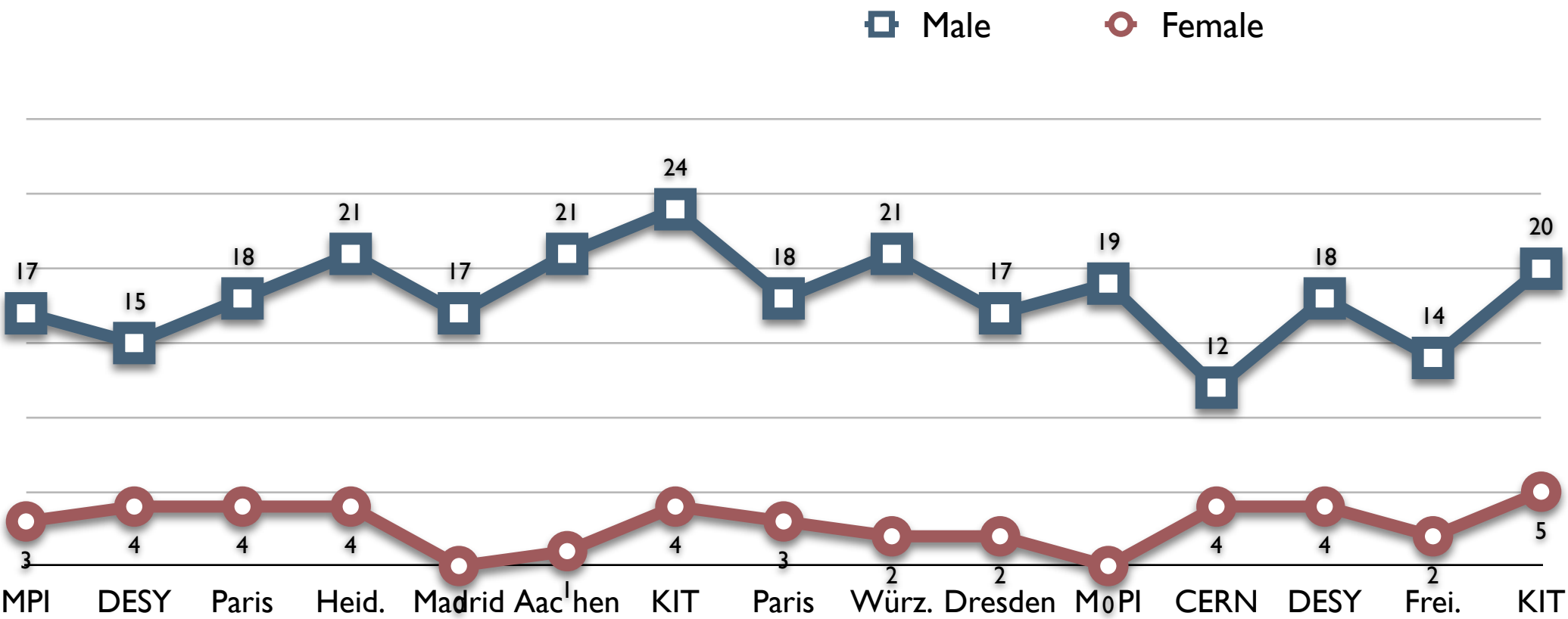


Participants & Talks



(*) including remote and part-timers

KUTS participants by gender



The Program

Monday Afternoon:

- F. Egle: *THDM at two loops*
- J.A. Hernandez Cuevas: *Precision predictions of* Γ_i *in the general THDM*
- P. Slavich: *Revisiting the Higgs-mass calculation in the SI-THDM*

Tuesday Morning:

- M. Gabelmann: *Status of MH calculation in* `NMSSMCALC`
- K. Moehling: *On-shell renormalisation of Vector-like lepton Models*
- K. Radchenko: *Sensitivity to New Physics in Higgs observables*

Tuesday Afternoon:

- M. Weisswange: *Ren. of XGTs with non-anticom.* γ_5 *in the BMHV scheme*
- W. Kotlarski: *Infrared divergences and the choice of regularization*
- J. Wünsche: *NLO Calculation of h -> ff in the decoupling renorm. scheme*

Wednesday Morning:

- G. Weiglein: *Precise BSM predictions for the W mass*
- All Participants: *The future of KUTS*

Let the KUTS-15 begin!!!

Let the KUTS2-4 begin!!!

English

catharsis | kə'THärsəs |

noun (plural **catharses** | -sēz |)

1 the process of releasing, and thereby providing relief from, strong or repressed emotions.

2 *Medicine, rare* purgation.

ORIGIN

early 19th century (in catharsis (sense 2)): from Greek ***katharsis***, from ***kathairein*** ‘cleanse’, from ***katharos*** ‘pure’. The notion of ‘release’ through drama (catharsis (sense 1)) derives from Aristotle's *Poetics*.