SUMMARY TALK

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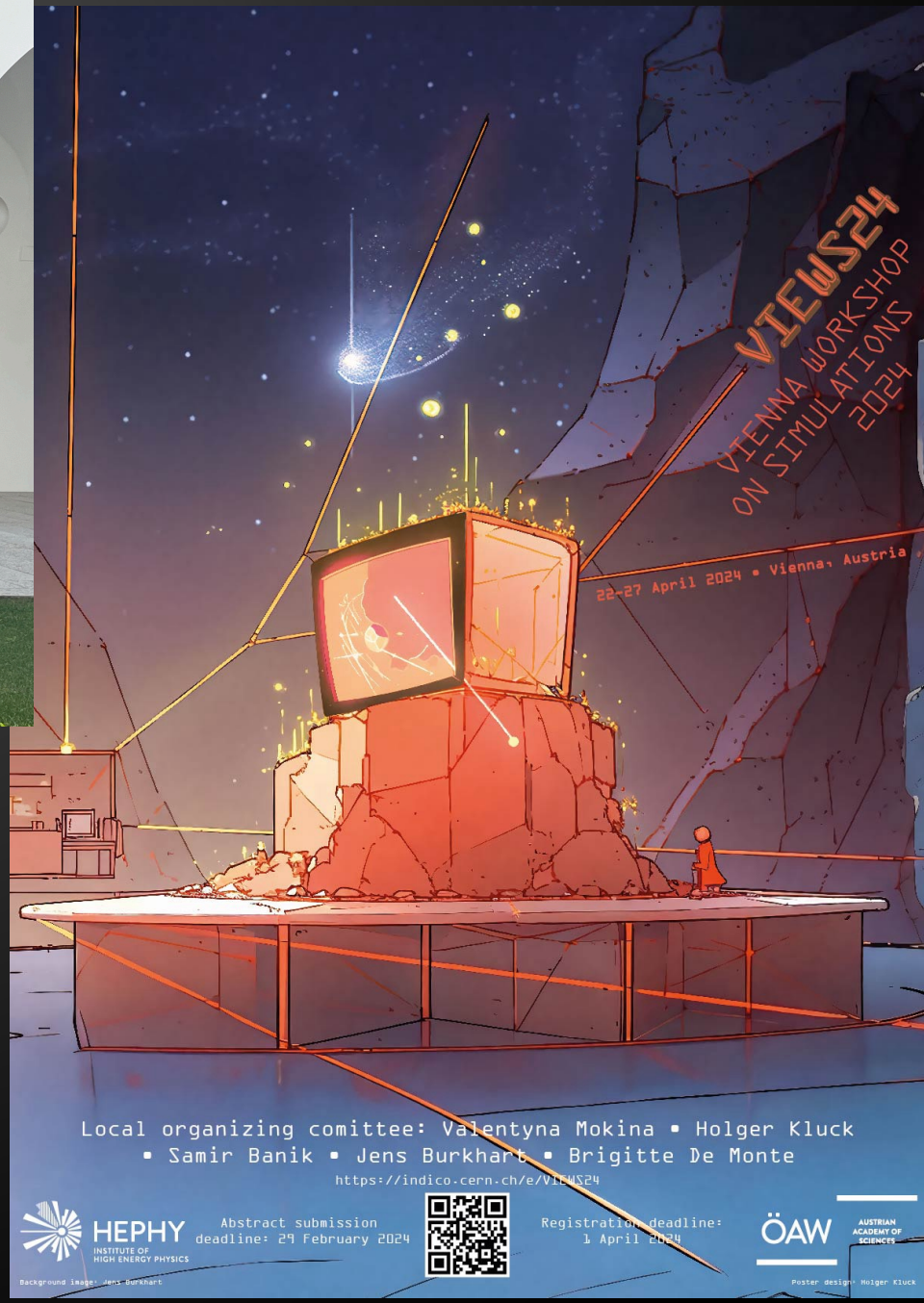

Thank you very much to the organizing committee!

Thank you for bringing us together to discuss simulations!

39 talks in 2 full days (15 minutes/talk)

A total of 585 minutes

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What was the most used word in this workshop?

GEANT4 + G4:

40 + 129 + 197 = 366

5 + 140 + 92 = 237

Most used in a talk: 41 times (51 times for G4)

Once every ~1.6 minutes (GEANT, GEANT4)

Background(s):

132 + 108 + 126 = 366

Most used in a single talk: 39 times

Once every ~1.6 minute

Simulation(s):

130 + 313 + 204 = 647

Most used in a single talk: 59 times

Every 54 seconds!

GEANT4 simulation of backgrounds

The three main things to consider when doing rare event searches

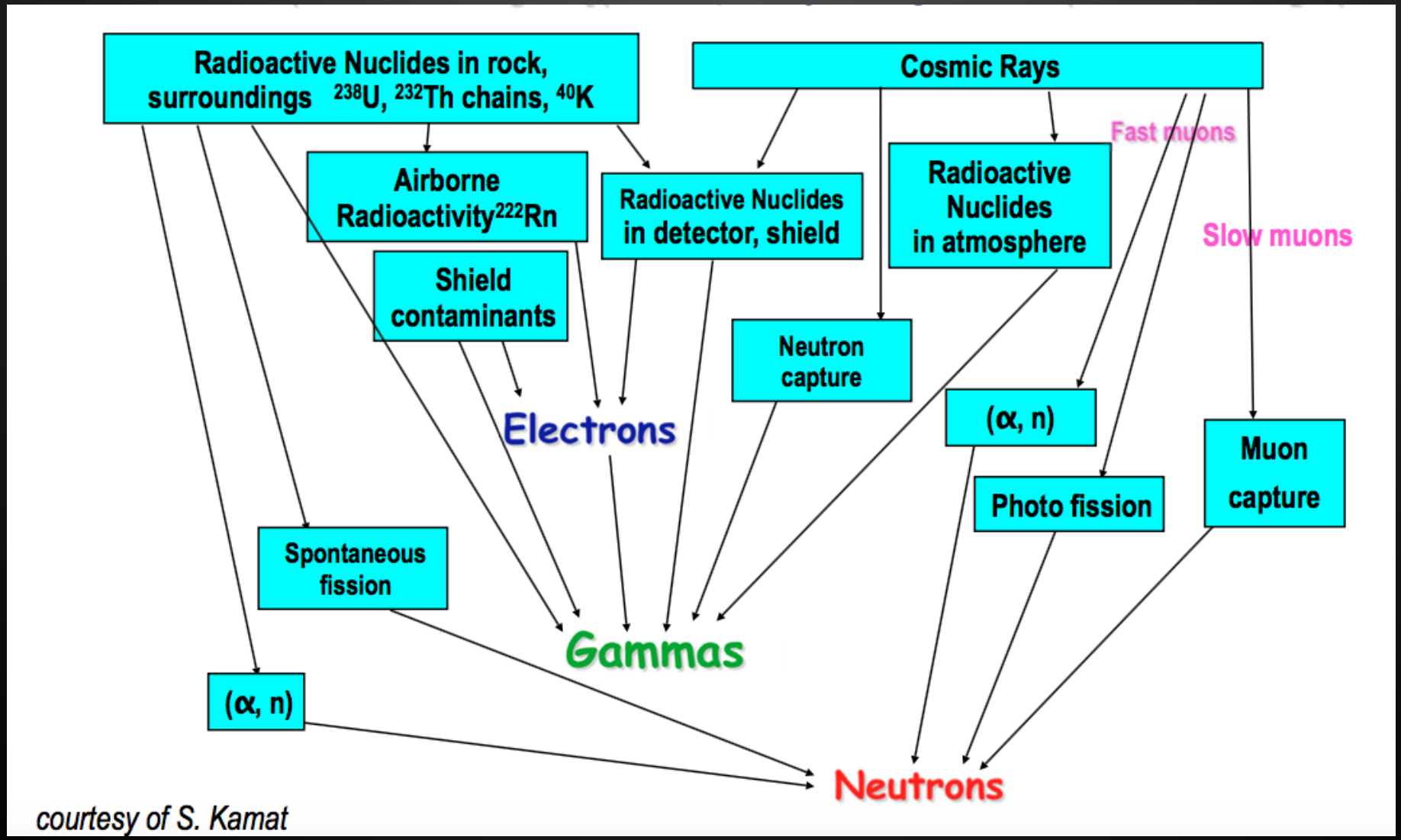
Backgrounds, backgrounds, and backgrounds

Why?

Why?

- We haven't seen dark matter
- We don't know if neutrinoless double beta decay really exists
- Only one experiment has measured CEvNS

Cosmic rays and natural radioactivity



In this workshop we had ROI's at the MeV, keV, and eV scales

- Low-mass DM, CEvNS: sub-keV
- Double beta decay: few MeV
- WIMP DM: a few keV
- Others: low energy anti-protons,…

In this workshop: lots of experience with GEANT4 and simulations, many challenges, many solutions

- In general, ensamble of base GEANT4 physics lists, tuned:
  - Custom physics lists: low-energy EM, hadronic HP,…
  - Modular physics list: shielding

Either in pure form or with frameworks using them (many available to the community): GEMC, SAGE, RAT, SNIPER, REST, G4DS, Geant4.jl

Even tools for importing/exporting CAD, GDML

But with input from different, many areas: software and data-driven

Encompassing nuclear, atomic, solid-state physics, and more

Cosmic rays: muons, neutrons,…, muon-induced,..

- In-situ measurement, but not all particles in the cascades (surface or underground)
- External generators: CRY, MUSUN, MUTE, PARMA, custom

- Systematical uncertainties play a significant role:

cross-sections, material composition,…

Gammas, electrons, neutrons, and others: radioactive decays, captures, fission, (α,n), (γ,n)

- Gammas: RadioactiveDecay, Decay0, DICEBOX, Marina, FIFRELIN, FIFRADINA, Grabmayr,…
- Neutrons: SOURCES, NEuCBOT, SaG4n,…

- Systematical uncertainties also play a significant role

Optics

- To GEANT or not to GEANT

Chroma, MaGe, others

Not only scarce data, but available data not included/incorrect/incomplete in GEANT4 or hidden/disabled

should this be the baseline effort?

In addition, material intrinsic properties also lacking experimental data or there are discrepancies

NR and ER response: ionization efficiencies, quenching factors…

Calibrations

Once these two are “understood”

Unidentified backgrounds, excess showing up in many rare event searches

They will probably continue to pop-up as thresholds and backgrounds lower even more

Alternative codes?

MCNPX, FLUKA, TOUCANS

Do they cover all the experimental efforts?

Let’s keep the momentum!

Let’s keep the momentum!

Whitepaper and central database

Let’s keep the momentum!

Whitepaper and central database

More VIEWS workshops!