# Particle Physics Day 2020

## Welcome!

Mikko Voutilainen,
University of Helsinki and
Helsinki Institute of Physics

# Something new

- We've all by necessity become familiar with Zoom meetings, for good and bad
  - ▷ Good: enable video recordings, invite expat Finns and remote speakers, no 6 am wakeup call
  - ▷ Bad: no free lunch (though you can eat while listening to the talks), no personal discussions
- Changed PPD format this year to **short all-plenary talks on high-lighted topics**
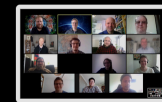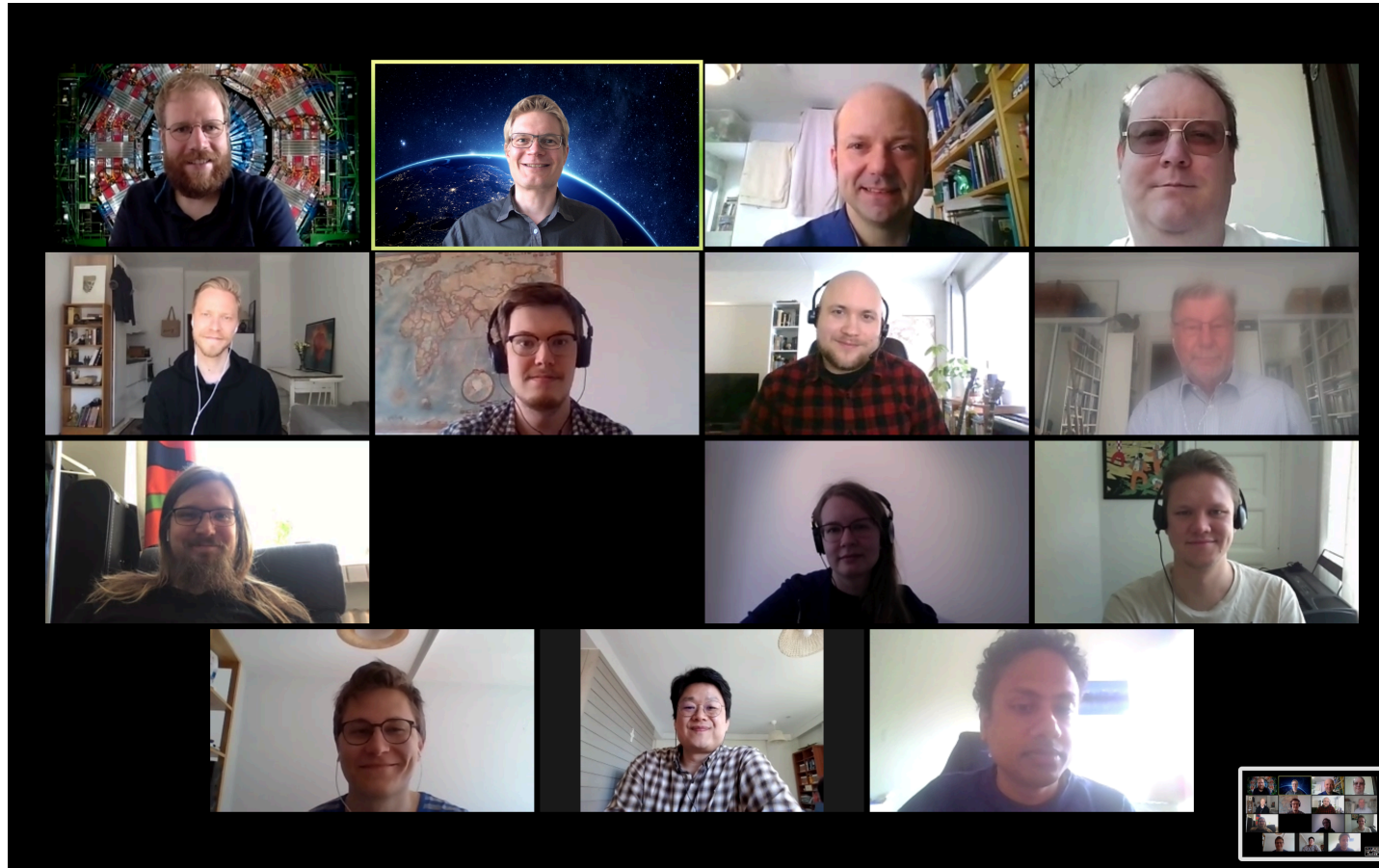
- We're at crossroads:
  - ▷ Pandemic vs travel
  - ▷ Trump vs science
  - ▷ Japan vs ILC

- European Strategy Update
  - ▷ **(HL-)LHC operation  Kim, Kim, Forthomme**

*The successful completion of the high-luminosity upgrade of the machine and detectors should remain the focal point of European particle physics, together with continued innovation in experimental techniques. The full physics potential of the LHC and the HL-LHC, including the study of flavour physics and the quark-gluon plasma, should be exploited.*

  - ▷ **Neutrino experiments**

*Europe, and CERN through the Neutrino Platform, should continue to support long baseline experiments in Japan and the United States. In particular, they should continue to collaborate with the United States and other international partners towards the successful implementation of the Long-Baseline Neutrino Facility (LBNF) and the Deep Underground Neutrino Experiment (DUNE).*

https://physicsworld.com

- European Strategy Update
  - ▷ **Higgs factory (FCC-ee?)**

*Europe, together with its international partners, should investigate the technical and financial feasibility of a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage. Such a feasibility study of the colliders and related infrastructure should be established as a global endeavour and be completed on the timescale of the next Strategy update.*

  - ▷ **Higgs factory (or ILC?)**

*The timely realisation of the electron-positron International Linear Collider (ILC) in Japan would be compatible with this strategy and, in that case, the European particle physics community would wish to collaborate.*

  - ▷ **Higgs factory (or wakefield!?)**

The technologies under consideration include high-field magnets, high-temperature superconductors, plasma wakefield acceleration and other high-gradient accelerating structures, bright muon beams, energy recovery linacs.

Nigel Lockyer @Nigel_Lockyer · Nov 2
Science at such large scale will need many years of R&D to prepare. The world will want to explore inner space and outer space. Let's get started.

> **DESY** @desynews · Nov 2
> Does @CERN need another supercollider?! @desynews's Beate Heinemann discusses alongside @Nigel_Lockyer, Ursula Bassler of @IN2P3_CNRS and @JeremyFarrar today at 4pm at @Falling_Walls falling-walls.com/event/circle-t...

Geneva
PS
SPS
LHC
27 km
Future Circular Collider
100 km
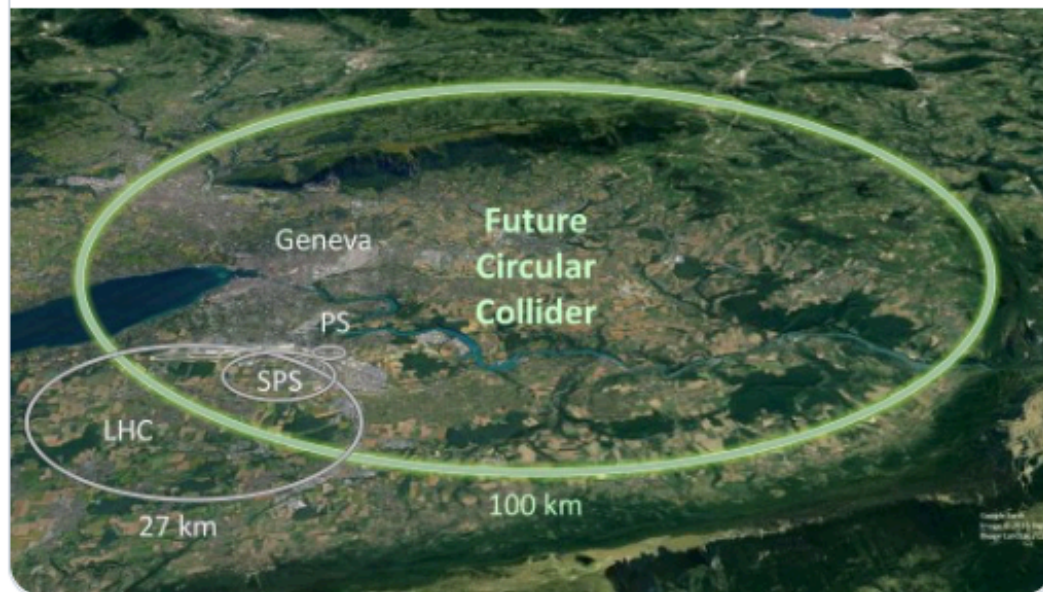
💬 58    ⇄ 154    ♡ 3.2K    ⬆

Elon Musk @elonmusk · Nov 2
I could not be more excited about the new supercollider! That said, while it is considerably larger, I don't think it necessarily requires all that much incremental engineering.

💬 327    ⇄ 171    ♡ 6.3K    ⬆

- European Strategy Update

  **Helenius Kurkela**

  ▷ **Theory (QGP, quark matter)**

  Theoretical physics is an essential driver of particle physics that opens new, daring lines of research, motivates experimental searches and provides the tools needed to fully exploit experimental results. It also plays an important role in capturing the imagination of the public and inspiring young researchers. The success of the field depends on dedicated theoretical work and intense collaboration between the theoretical and experimental communities.

  ▷ **Gravitational waves (50 now!)**

  Astroparticle physics, coordinated by APPEC in Europe, also addresses questions about the fundamental physics of particles and their interactions. The ground-breaking discovery of gravitational waves has occurred since the last Strategy update, and this has contributed to burgeoning multi-messenger observations of the universe.
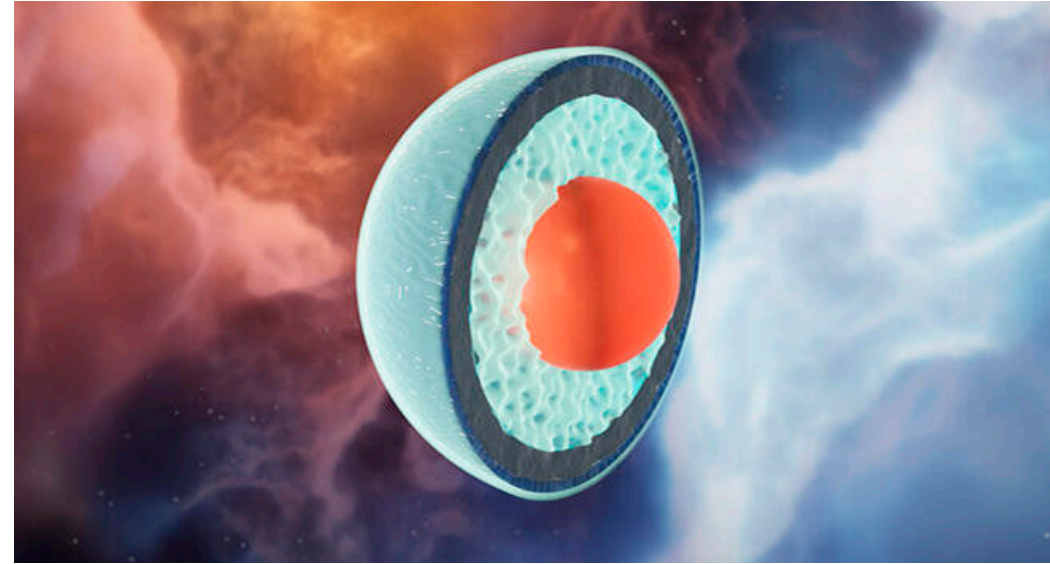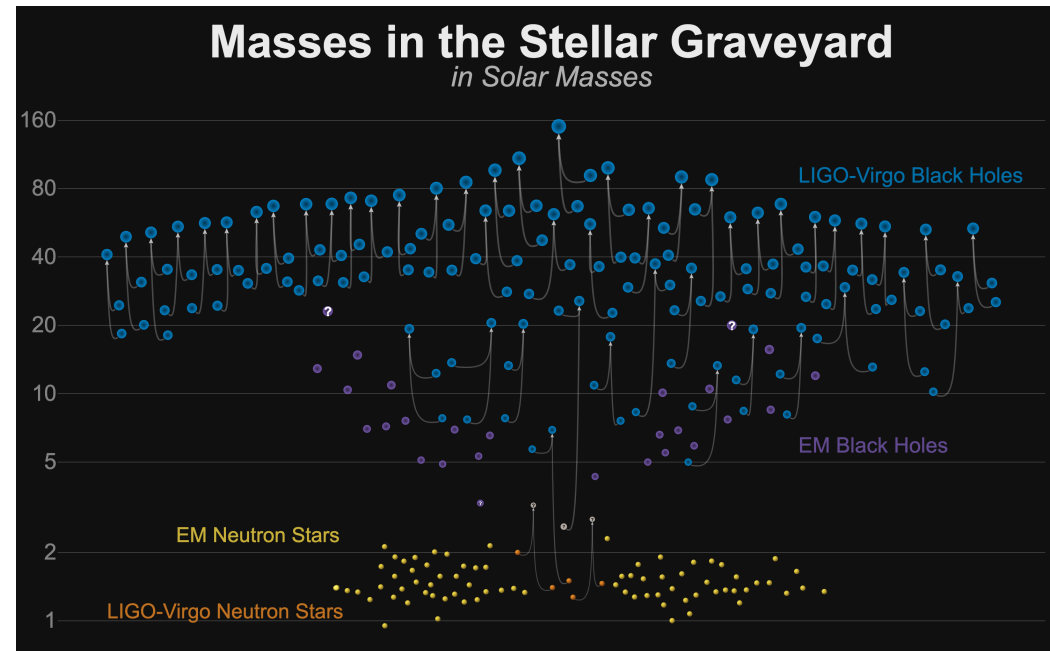
  **Rummukainen**



PHOTO: JYRKI HOKKANEN, CSC - IT CENTER FOR SCIENCE



**Masses in the Stellar Graveyard**
*in Solar Masses*

LIGO-Virgo Black Holes

EM Black Holes

EM Neutron Stars

LIGO-Virgo Neutron Stars

LIGO-Virgo / Frank Elavsky, Aaron Geller / Northwestern