Sustainability in Astroparticle Physics

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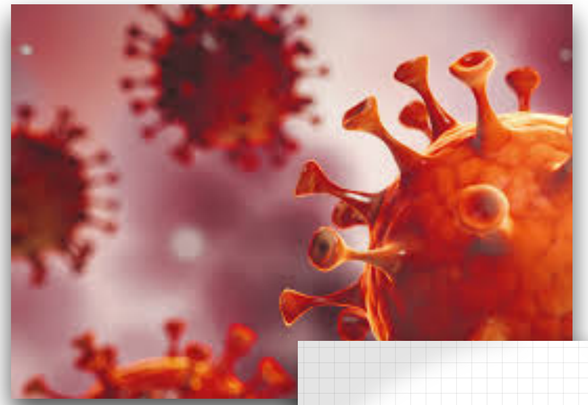
Markus Roth (KIT)

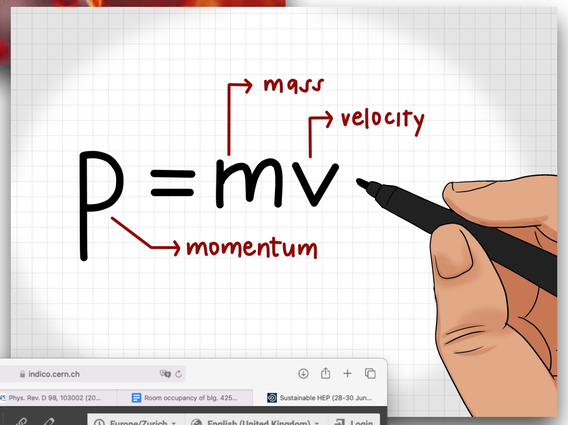
Motivation

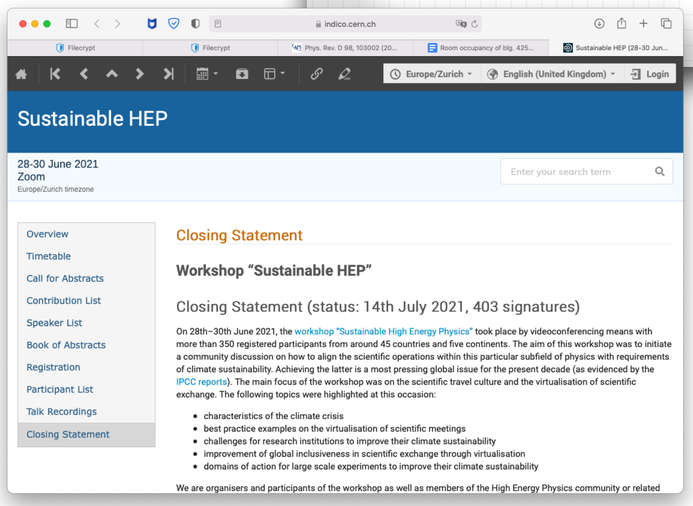
- COVID19 has triggered many new developments unimaginable prior to pandemic

- The momentum for change and rethinking is strong at the very moment
(hopefully reaching critical mass in our community today:)

- Several other science communities have started initiatives on sustainability already
(e.g. recent HEP workshop on *Sustainable HEP*)







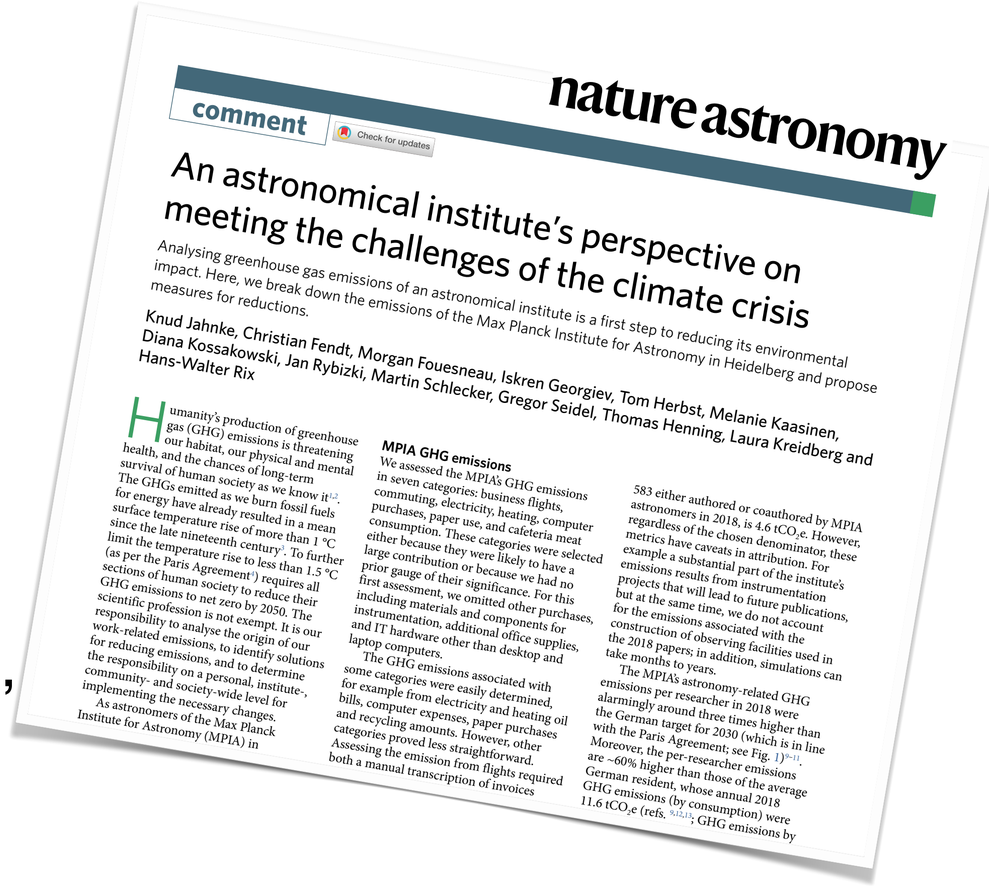
Agenda of today

- Knud Jahnke: Sustainability in Astroparticle Physics (Introduction)
- Victoria Grinberg: Sustainable Conferences/travel in astroparticle Physics
- Volker Lindenstruth: Green computing
- Christos Markou: Green experiments

- Course of the meeting
  - 12 minute talks + 3 minutes for questions
  - General discussion afterwards

Knud Jahnke
Introduction

- Studies of physics+astronomy, Uni Hamburg, incl. 1 year at Uni Uppsala, Sweden
- PhD Astronomy, Uni Hamburg, 2002
- Postdoc Leibniz Institute for Astrophysics, AIP, Potsdam, 2002-2005
- Postdoc Max Planck Institute for Astronomy (MPIA), Heidelberg, 2005-2007
- Emmy-Noether Group Lead MPIA, 2007-2012
- Staff astronomer and Euclid Mission group lead at MPIA, since 2011
- Within Euclid (=ESA cosmology space mission, launch 2022) context: instrument scientist for near-infrared photometry



nature astronomy

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Check for updates

An astronomical institute's perspective on meeting the challenges of the climate crisis

Analysing greenhouse gas emissions of an astronomical institute is a first step to reducing its environmental impact. Here, we break down the emissions of the Max Planck Institute for Astronomy in Heidelberg and propose measures for reductions.

Knud Jahnke, Christian Fendt, Morgan Fouesneau, Iskren Georgiev, Tom Herbst, Melanie Kaasinen, Diana Kossakowski, Jan Rybizki, Martin Schlecker, Gregor Seidel, Thomas Henning, Laura Kreidberg and Hans-Walter Rix

Humanity's production of greenhouse gas (GHG) emissions is threatening our habitat, our physical and mental health, and the chances of long-term survival of human society as we know it[1,2]. The GHGs emitted as we burn fossil fuels for energy have already resulted in a mean surface temperature rise of more than 1 °C since the late nineteenth century[3]. To further limit the temperature rise to less than 1.5 °C (as per the Paris Agreement[4]) requires all sections of human society to reduce their GHG emissions to net zero by 2050. The scientific profession is not exempt. It is our responsibility to analyse the origin of our work-related emissions, to identify solutions for reducing emissions, and to determine the responsibility on a personal, institute-, community- and society-wide level for implementing the necessary changes.

As astronomers of the Max Planck Institute for Astronomy (MPIA) in

MPIA GHG emissions

We assessed the MPIA's GHG emissions in seven categories: business flights, commuting, electricity, heating, computer purchases, paper use, and cafeteria meat consumption. These categories were selected either because they were likely to have a large contribution or because we had no prior gauge of their significance. For this first assessment, we omitted other purchases, including materials and components for instrumentation, additional office supplies, and IT hardware other than desktop and laptop computers.

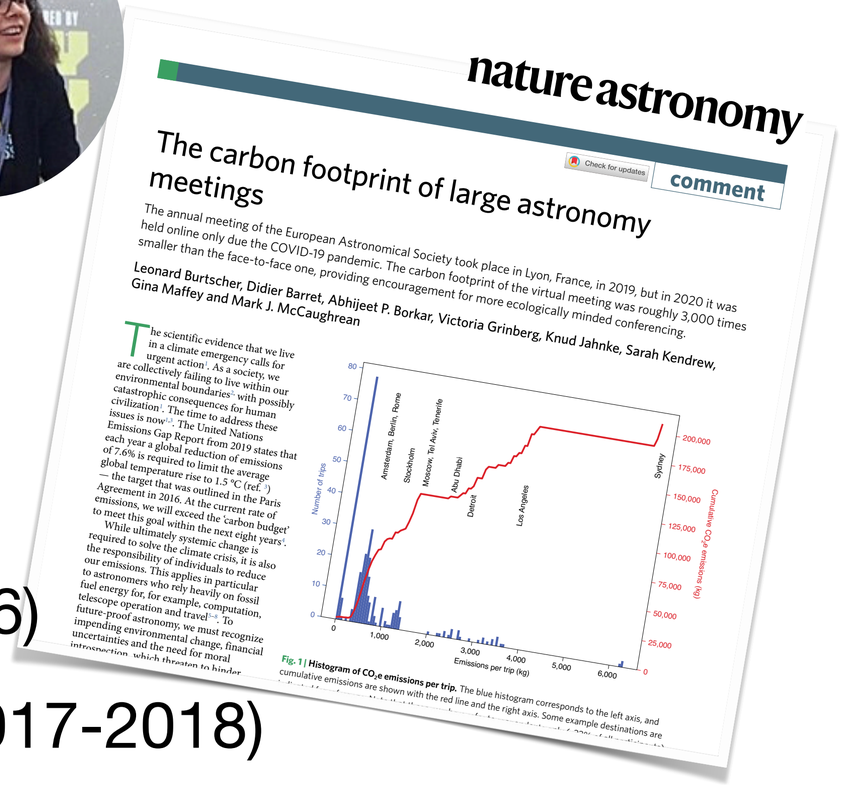
The GHG emissions associated with some categories were easily determined, for example from electricity and heating oil bills, computer expenses, paper purchases and recycling amounts. However, other categories proved less straightforward. Assessing the emission from flights required both a manual transcription of invoices

583 either authored or coauthored by MPIA astronomers in 2018, is 4.6 tCO_2e. However, regardless of the chosen denominator, these metrics have caveats in attribution. For example a substantial part of the institute's emissions results from instrumentation projects that will lead to future publications, but at the same time, we do not account for the emissions associated with the construction of observing facilities used in the 2018 papers; in addition, simulations can take months to years.

The MPIA's astronomy-related GHG emissions per researcher in 2018 were alarmingly around three times higher than the German target for 2030 (which is in line with the Paris Agreement; see Fig. 1)[9–11]. Moreover, the per-researcher emissions are ~60% higher than those of the average German resident, whose annual 2018 GHG emissions (by consumption) were 11.6 tCO_2e (refs. [9,12,13]; GHG emissions by

Victoria Grinberg

Sustainable Conferences/travel



nature astronomy

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The carbon footprint of large astronomy meetings

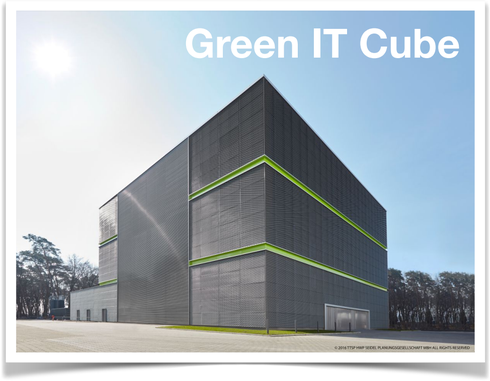
The annual meeting of the European Astronomical Society took place in Lyon, France, in 2019, but in 2020 it was held online only due the COVID-19 pandemic. The carbon footprint of the virtual meeting was roughly 3,000 times smaller than the face-to-face one, providing encouragement for more ecologically minded conferencing.

Leonard Burtscher, Didier Barret, Abhijeet P. Borkar, Victoria Grinberg, Knud Jahnke, Sarah Kendrew, Gina Maffey and Mark J. McCaughrean

- Studies of physics+astronomy, Ludwig Maximilians University in Munich, Germany
- PhD at the Remeis Observatory, Bamberg and Erlangen Centre for Astroparticle Physics (ECAP)
- Postdoc at MIT Cambridge/Boston USA (2014-2016)
- Postdoctoral research fellowship at ESA/ESTEC (2017-2018)
- Junior research group leader at the University of Tübingen, Germany
- Scientist with the Science Division at the European Space Agency (ESA) based at ESA's European Space Research and Technology Centre (ESTEC) in the Netherlands

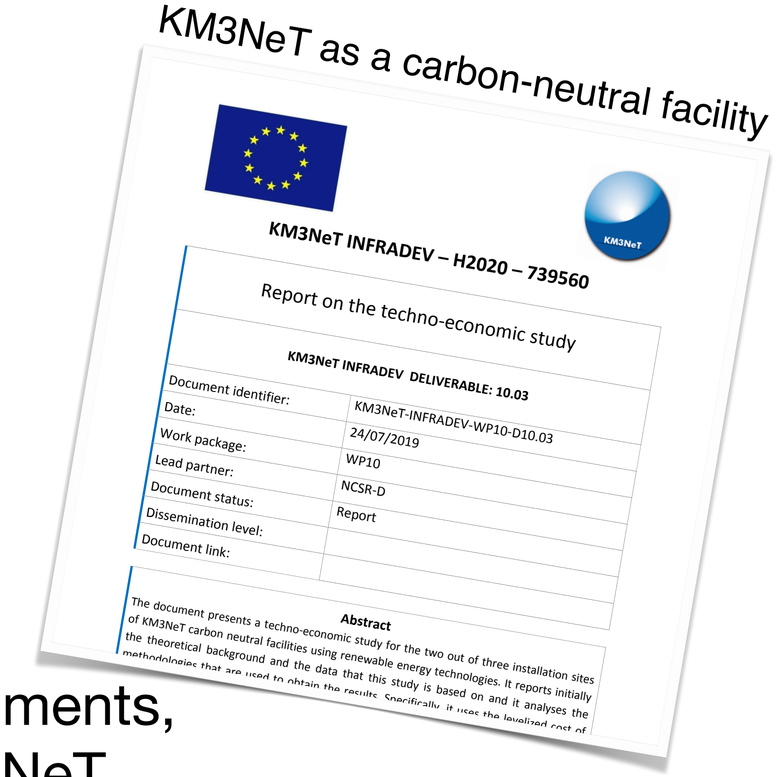
Volker Lindenstruth
Green computing

- Studied Physics at TU Darmstadt (Diploma in1989)
- Phd at Goethe University Frankfurt (1993)
- Feyodor v. Lynen Fellow at LBNL Berkley (1993-1995)
- Scientific Staff at UC Space Science Laboratory, USA (1995-1997)
- Chair of Computer Engineering at U. of Heidelberg and Director for the Kirchhoff Institute (1998-2009)
- Since 2010 on the board of FIAS, (chaired in 2012-2018)
- In charge of scientific IT at the GSI Helmholtz centre since 2010.



Christos Markou

Green experiments



- Studied at Imperial College, University of London, UK, obtaining his B.Sc. (1985)
- PhD at Imperial College, University of London, UK (1989)
- Participated in several high energy particle physics experiments, at CERN, Geneva and DESY, Hamburg, and lately at KM3NeT
- Researcher at NCSR DEMOKRITOS Institute of Nuclear and Particle Physics (1995-today)
- Chairman of the Institution Board of KM3NeT (2016-2019)
- Director of the Institute of Nuclear and Particle Physics of NCSR DEMOKRITOS (2019-today)