

CO₂ footprint of Astronomical Instrumentation and the Astronomical community worldwide

Level: MSc.
Start of project: Open
Project form: Desk study
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Background

In the light of the climate crisis, the worldwide Astronomical community is investigating the CO₂ footprint of the discipline. As scientists, and even more as scientists very aware of the uniqueness of planet Earth, they want to reduce their footprint. Several studies have been done to investigate the CO₂ footprint of astronomy, i.e. on the level of countries (e.g. Australia, Netherlands), institutes (e.g. the Max-Planck Institute for Astronomy) and organisations (e.g. the European Southern Observatory, European Space Agency) [1,1,1,1]. However, in none of these studies the CO₂ footprint of Astronomical instrumentation and observatories, including space missions, was not taken into account. A preliminary international study to estimate the impact of instrumentation and observatories was recently performed, but it concluded that in most cases the data was not available for a meaningful quantification [1].

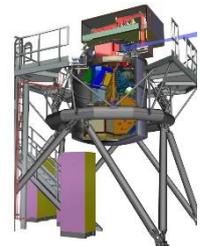
Project aims

In a collaboration between Radboud environmental science and astrophysics, we have a number of MSc-projects available:

1. Quantifying the CO₂ footprint of the METIS instrument
2. Quantifying the CO₂ footprint of the LISA mission
3. Identifying strategies for reducing the CO₂ footprint from astronomy worldwide

CO₂ impact of the METIS instrument

The METIS instrument is a ~100M€ instrument for studies of exoplanets, planet formation and galaxies throughout the universe for the European Extremely Large Telescope that is currently under construction in Chile. The Netherlands is the PI of METIS and coordinates the international consortium that is building the instrument. The instrument is currently in the building phase and is expected to be ready by 2027. Because of the central role of the Netherlands, a detailed investigation of the CO₂ footprint of the project is likely feasible.



CO₂ impact of the LISA mission

The LISA mission is an project from the European Space Agency ESA in collaboration with NASA. The total mission budget is estimated around 2B€. The Netherlands are partner in the international LISA consortium that will provide part of the hardware of the mission and will organise the scientific exploitation of the mission. The scale of this project makes it necessary to do a more global analysis of the CO₂ footprint. Alternatively, the CO₂ footprint study could be limited to the LISA consortium activities.



Strategies for reducing CO₂ impact from astronomy worldwide

Although in principle it is good that all agents in astronomy know their own CO₂ footprint and take measures to reduce it, there is a lot to say for a global approach in which reducing the global CO₂ footprint of the whole discipline is the goal. Here a global analysis of the worldwide CO₂ footprint, based on the earlier studies, will be performed to identify most effective strategies to reduce the CO₂ footprint of astronomy worldwide.

References

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4. <https://www.eso.org/public/announcements/ann21016/>
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6. Knödlseeder et al. 2022, <https://arxiv.org/abs/2201.08748>