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Terahertz superconducting hot electron bolometer heterodyne array receivers for NASA's GUSTO balloon observatory

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Propositions accompanying the thesis

Terahertz superconducting hot electron bolometer heterodyne array receivers for NASA's GUSTO balloon observatory

1. Array receiver technology is the most promising solution to improve the mapping efficiency of terahertz heterodyne observatories. (This Thesis)
2. When designing lens-antenna systems at high terahertz frequencies (>2 THz) it is very important to understand how fabrication accuracy affects the final optical properties of mixer arrays, and in particular the uniformity of these properties across an array. (Chapter 3)
3. Achieving high pointing accuracy at the lens-antenna level is crucial to guarantee both good performance of heterodyne mixer arrays and simplification of their integration in an instrument. (Chapter 4)
4. Lens-antenna based THz mixers are a superior alternative to feedhorn-waveguide mixers in developing multi-pixel THz heterodyne receivers. (Chapter 5)
5. The combination of a high power quantum cascade laser with a phase grating in order to obtain a multi-beam local oscillator is critical to enable multi-pixel heterodyne receivers at frequencies above 3 THz. (Chapter 6)
6. It is one order of magnitude harder to develop flight hardware than it is to prototype a concept. However, flight hardware has the potential of being a few orders of magnitude more impactful than a prototype.
7. Balloon borne missions provide a low risk and cost effective option for Astronomical studies while providing training opportunities for young scientists in their path to become the space leaders of the future.
8. No amount of planning will ever be a substitute for experience.
9. Covid-19 has accelerated humanity's transition into a more digital society. With this transition new realities such as the Metaverse, which consists of the combination of online virtual worlds, will have more impact in society and become an important tool against loneliness.

José R. G. Silva

Groningen, August 2022