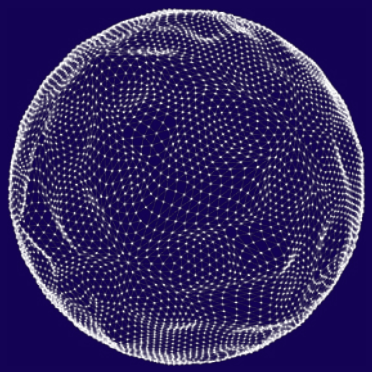


h-cube

Micromechanical Bolometers arrays for THz hyperspectral imaging

PUBLIC SUMMARY

The h-cube project addresses the emerging need for low-cost, portable solutions for hyperspectral imaging in the terahertz (THz) region of the electromagnetic spectrum. THz waves sensing has important applications across a diverse range of fields such as health, security, construction, agriculture, drug development, monitoring of transport and civil infrastructure, inspection and quality control in production lines, and astronomy.

Unfortunately, the THz wave region has been for centuries one of the most challenging across the entire electromagnetic spectrum to exploit for practical applications, since it seats at the upper end of the frequency range accessible by electronic devices and at the lower end of those measurable by photonic devices. Factors such as the cost of THz cameras (often > 50k€) and the lack of multifrequency sensing ("color imaging") capabilities still prevent wide deployment of THz sensing. h-cube aims at tackling these challenges and producing a game-changing, affordable (<2k€) solution that can be manufactured at scale.

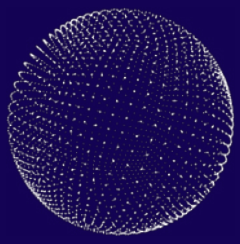
Some projects funded by Phase 1 of the ATTRACT program already investigated important aspects of THz technology: detectors development, hyperspectral imaging and application to quality control in production lines. Some of the scientists involved in those Phase 1 projects have joined forces as partners in h-cube and agreed a common strategy to address the abovementioned challenges in THz cameras.

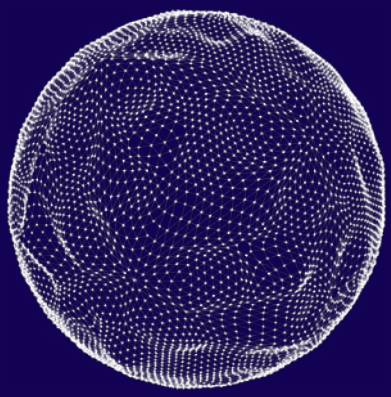
Building on the synergies and results of three ATTRACT Phase 1 projects (GRANT, ROTOR and TACTICS) h-cube will demonstrate a THz sensor for hyperspectral imaging with unprecedented sensitivity, broad THz response and a design optimized for low-cost production.

The sensor prototype will consist of a 360x240 pixel array of micromechanical oscillators whose resonance frequency (ReF) will provide a THz irradiation sensitivity equivalent to the best performances available today, but at a cost more than a factor 10 cheaper. Adjacent pixels will be engineered to respond to different portions of the THz spectrum, thanks to the tuning, focusing and filtering action of plasmonic nanostructures, thus creating the equivalent of an RGB codification for color imaging in the THz region.

The array readout will be performed by separated RFCMOS electronics to decouple the thermal and noise contribution of readout and sensing. This step is crucial to our cost reduction objective. The very low energy requirements of our approach, its simple architecture and room temperature operation will make our solution extremely light, portable and compatible with airborne operation.

H-cube will therefore extend the use THz imaging from costly, extremely low-volume applications such as large body scanners in airports, expensive inline machines for production quality control and sophisticated research tools, to larger-volume, every-day applications such as crop monitoring, building control and weapon identification in crowded environments.





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