The KISS experiment

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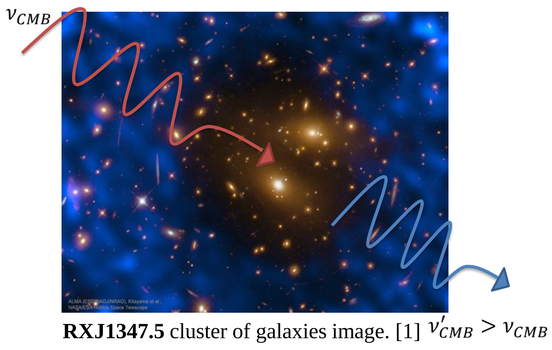
The KISS (**K**IDs-**I**nterferometer-**S**pectrum-**S**urvey) experiment is a ground-based spectrum-imager dedicated to the study of clusters of galaxies at millimeter wavelengths. The clusters will be mapped on their physical properties through the **S**unyaev **Z**el'dovic **E**ffect SZE, a spectral distortion of the Cosmic Microwave Background radiation. This study will lead the constraint of the parameters and the cataloging of the cluster of galaxies.
The instrument consists of a fast **M**artin-**P**uplett **I**nterferometer MPI with a **K**inetic **I**nductance **D**etectors KIDs, camera cooled to 150 mK.
It is installed at the 2.5 m QUIJOTE telescope in Tenerife since February 2019.

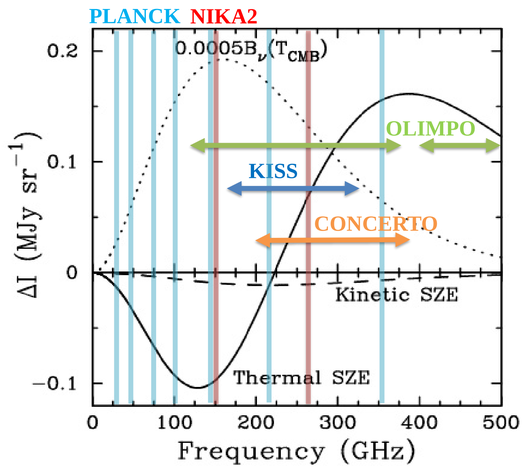
COSMOLOGICAL TARGET

Sunyaev Zel'dovic Effect

SZE due to inverse Compton scattering between CMB and ICM



RXJ1347.5 cluster of galaxies image. [1] $\nu'_{CMB} > \nu_{CMB}$



Experiments overview

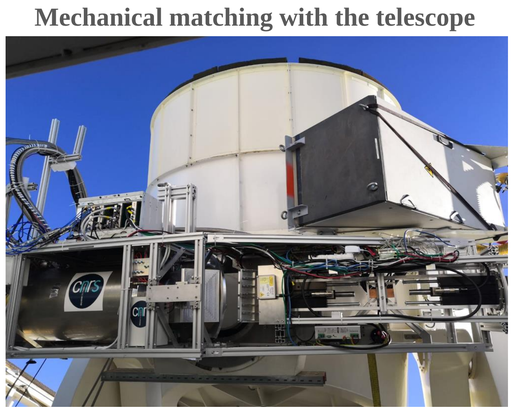
	experiment	# frequencies	type	diameter [m]	# pixels	reference
PAST	Planck	9	satellite imager	1.9	52	[2]
	NIKA2	2	ground based imager	30	3'000	[3]
PRESENT	OLIMPO	180	stratospheric balloon FTS	2.6	120	[4]
	KISS	180	ground based FTS	2.2	600	
FUTURE	*CONCERTO*	*100*	*ground based FTS*	*12*	*4'000*	[5]

Wide bands and higher angular resolution are required to components separation and cosmological parameters constraint

MEASUREMENT TECHNIQUE

The instrument and its exploitation

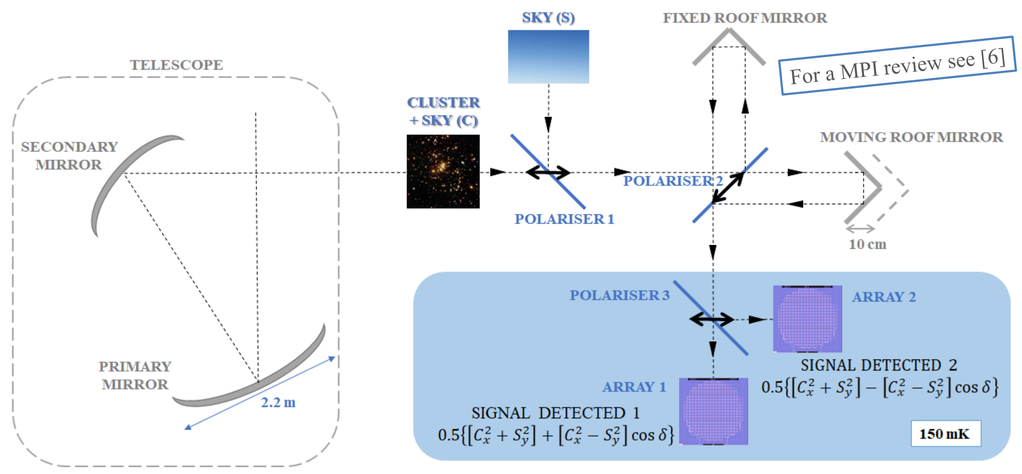
Mechanical matching with the telescope



QUIJOTE telescope in Tenerife.

FTS with two arrays sensitive to all the interested band.
Half of the signal is recovered as a calibrator (averaged SKY over the FoV or a cold reference source).

The MPI measures the difference between the powers of the two input beams.



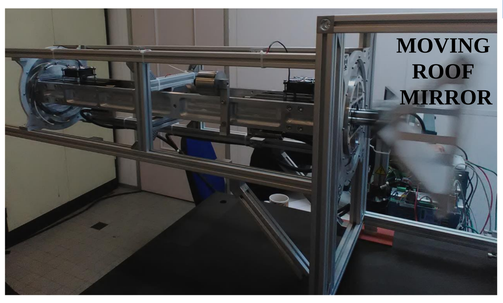
For a MPI review see [6]

Interferometric technique allows to study multifrequency on the same pixel shape.

TECHNOLOGICAL CHALLENGE

Main technological features of the instrument

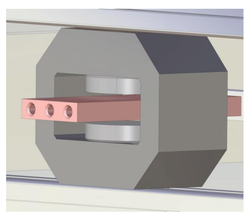
MPI: wide band and fast integration with 5 Hz oscillating mirror on 10 cm OPD



The roof mirror oscillates creating the Optical Path Difference responsible of the interferences.

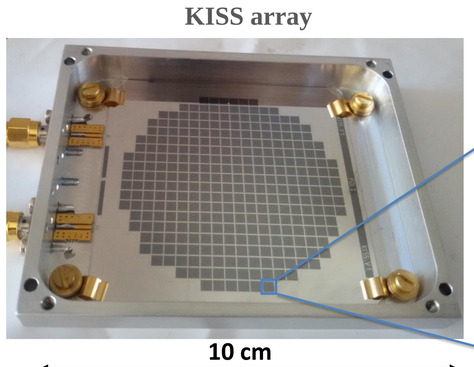
The necessity of going fast, to avoid atmospheric 1/f noise, makes the vibrations a crucial aspect.

Spiral Spring: Planck Joule-Thompson type [7], it reduces the vibration.

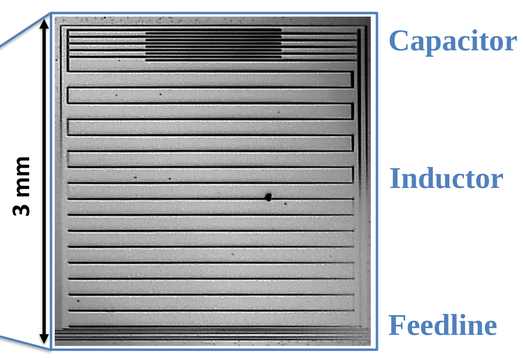


Eddy Current Brake: it dumps the residual accelerations.

KISS array



Superconducting LC circuit with high Q-factor



One of the 632 pixels within the KISS camera.

The band is down limited by the absorber material.
Al at this moment: 110 GHz.
Bi-layer Ti-Al for the future: 80 GHz.

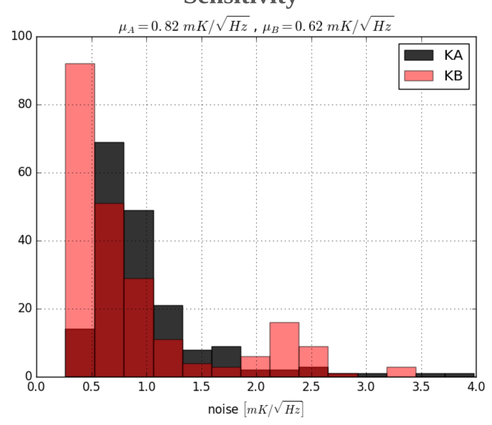
For a KIDs review see [8] and for Ti-Al technology [9]

RESULTS

Preliminary tests with on-sky observations

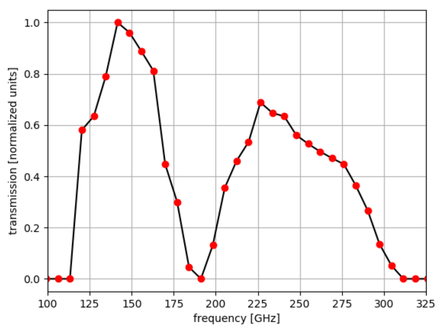
PRELIMINARY

Sensitivity



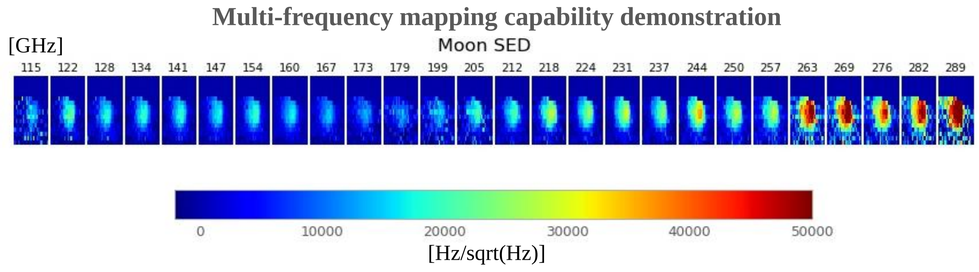
The results are compatible with the laboratory qualification.

Transmission spectrum



Features: Al cut, notch filter and LPE 10cm-1.

Multi-frequency mapping capability demonstration



PERSPECTIVES

- point source calibration
- cluster of galaxies observation
- Ti-Al integration
- software implementation on CONCERTO

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