A3 (GEP=4)

Measure CMB with BS antenna

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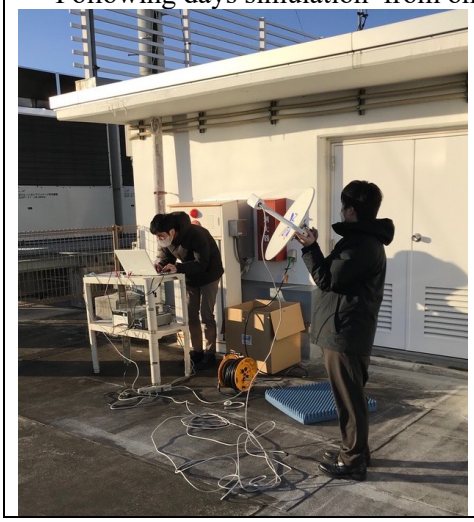
GPPU Experimental Point (GEP): 4

Goal of Study

1. Try to measure CMB temperature at microwave (11GHz) and measure 21 cm emission line from neutral hydrogen in Galactic disk with spectroscopic measurement in 1-2 GHz.
2. Become able to use one of following simulation methods to treat electromagnetic wave transportation. 2-1. CST: Obtain the beam pattern and other optical features of the system which has the comparable size of the wavelength of the EM wave based on Physical Optics. 2-2. GRASP: Obtain the beam pattern of the optical system for which the size of the system is much larger than the wavelength of the EM wave based on Quasi Optics. 2-3. Sonnet: high frequency electromagnetic wave transportation simulation code for 2 dimensional system.

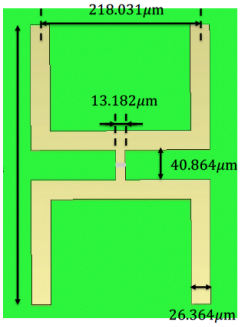
At the first and second day, thema 1 measurement is performed.
Following days simulation from one of thema listed in thema 2 is performed.



Contents

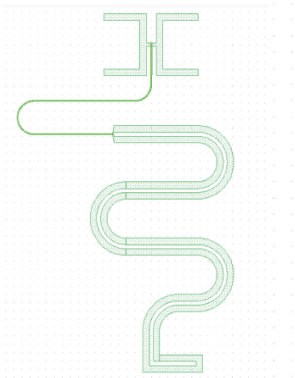
Measure the sky temperature at 11GHz with BS antenna and possibly measure the CMB temperature.

Become able to use one of following simulation methods to treat electromagnetic wave transportation.



2-1. CST: this is powerful tool to simulate the performance of the detector chip antenna. This tool is used to optimize the antenna attached to the detector in microwave region.

2-2. GRASP: This tool is used to obtain the beam pattern of the optical system for which the size of the system is much larger than the wavelength of the EM wave based on Quasi Optics.



2-3. Sonnet: This tool is used to simulate resonance frequency of the designed resonator circuit. Example is kind of superconducting microwave detector MKID.

Textbook and References

[1] In preparation.

Progress Schedule

- Day 1
  Measure the sky temperature with BS antenna on the roof.
- Day 2
  Study how to manipulate one the simulation tools and solve example.
- Day 3
  Apply the code to the advanced problem.
- Day 4
  Apply the code to the advanced problem.

Other Details

Course Period	2023
Place	H26 Physics research building 217 and roof.
Number of Students	1 -2
Evaluation method	Quality of the report and availability of the experiment.

In Addition

CMB measurement system is still in under brushing up stage. Any feedback is welcome.