Introduction

- How was our universe born? -

The theory of Cosmic inflation: which determines the model of how our universe was born.

B-mode: Gravitational waves generated by the cosmic inflation. It is hidden in the cosmic microwave background.

- Find the B-mode in the sky! -

The theory of Cosmic inflation, which determines the model of how our universe was born.

B-mode: Gravitational waves generated by the cosmic inflation. It is hidden in the cosmic microwave background.

Key Instrument

- Polarization modulator unit (PMU) -

- Encoder -

- Rotor -

- Superconducting magnet chassis

Half Wave Plate

The half wave plate will be made of sapphire.

The rotating HWP modulates the CMB polarization signal.

The incoming signal to the HWP is upconverted in frequency far above the low frequency detector noise (1/f noise).

Material List

<table>
<thead>
<tr>
<th>Assembly name</th>
<th>Material</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top rotor part</td>
<td>Permanent magnet</td>
<td>For rotation</td>
</tr>
<tr>
<td>Encoder</td>
<td>G10</td>
<td>Grippers</td>
</tr>
<tr>
<td>Grippers</td>
<td>Aluminium 6061</td>
<td>For levitation</td>
</tr>
<tr>
<td>Grippers</td>
<td>Aluminium 6061, SUS304</td>
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</table>

Issues & Questions

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Issues

Even though the SMB is a contactless bearing without any heat dissipation from mechanical frictions, there are still two potential losses:

- Magnetic field inhomogeneous & Eddy current

Questions

#1 How much heat is accumulated on the rotor when the rotor is rotating?

#2 How much heat is allowable to keep the HWP temperature below 20 K? (Thermal design requirement)

- Experimental procedure to obtain gripper noise -

- Rotating HWP is modulating signal -

- How to answer the questions? -

- Estimated Heat Dissipation to Equilibrium Temperature of HWP

- Conclusion

Using a thermal model along with the experimental data,

- The heat dissipation on the current rotor is estimated to be about 10 mW.
- The heat dissipation must be reduced to be 1 mW.

Measures to reduce the heat dissipation:

- To suppress the fluctuation in magnetic field on the rotor.
- To use a non-metallic material as much as possible.