LISA technology development at JPL

Dr. Charles C. Harb

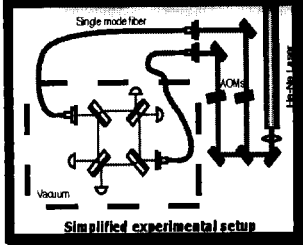
Jet Propulsion Laboratory, California Institute of Technology

LISA Rigid Interferometer Test Bed

Dr. Daniel Shaddock

Position of optical components stable to 10 pm/√Hz (1 mHz-1 Hz)

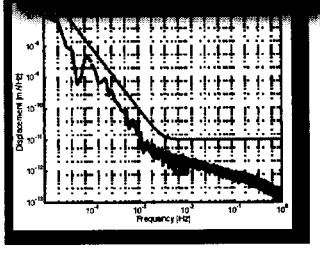
Insensitive to isotropic thermal expansion, laser noise, oscillator frequency noise, input optical path fluctuations



Simplified experimental setup

Optically contacted ULE interferometer

Optical contacting meets the LISA requirements for dimensional stability at all frequencies



Picometer Phasemeter

Dr. K. Gromov, Dr. M. Marcin, F. Chowdhury

Baseline interferometer shot-noise limit:

$10 pm/\sqrt{Hz} \Rightarrow 10^{-5} cycle/\sqrt{Hz}$ at 1-1000 mHz

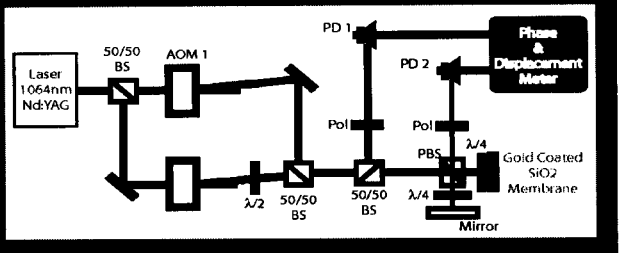
Doppler component 0-15 MHz

Development Efforts

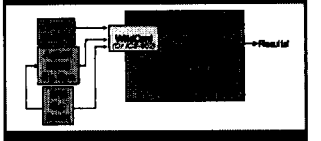
- Digital PLL/DSP technique (GPS-like) on FPGA
- Commercial digital tuner (ICS-652)

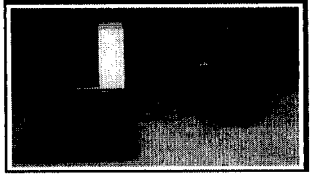
Ground Test for the DRS

To make direct ground-based measurements of back-reaction force exerted on the LISA proof mass

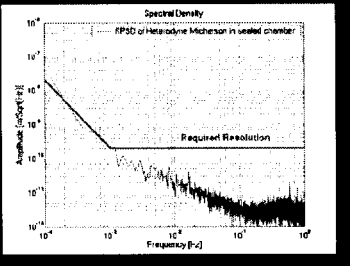


Experiment





Present Performance In Air



Membranes

Future Work

- *Bond Membranes
- *Package Membrane
- *Place Unit In Vacuum

Space Craft Pointing Sensor

Dr. Carl C. Liebe

Photon noise limited Receiving: ~60 pW

Pointing Noise: ~1 nrad/sqrt(Hz)

Δø Implies L ±ΔL

Incoming wavefront

Phase-meter

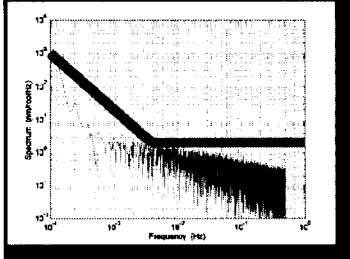
Quad Cell

Optical Displacement Sensor

Dr. Meng P. Chiao

Backup for capacitive sensors for GRS, 2 nm/√Hz above 3 mHz

Present Performance



Future Work

TRL 6
Model Simulation
Space Qualify Detector