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Fiber-based laser designs offer a number of advantages for LISA, including low noise, ease of alignment, low susceptibility to contamination, and convenient mounting of redundant components. We have investigated a fiber ring laser and a commercial external cavity diode laser, and built and tested a fiber amplifier. We have evaluated the frequency and intensity noise of all these systems, and are planning to study the issues involved in their space qualification.

LISA laser requirements

- Single frequency/longitudinal mode
- Low frequency noise (narrow linewidth)
- Continuous-wave output, ninear polarization
- No mode-hops, polarization change
- Tuning capabilities
- Low amplitude noise
- High power stability (at ~2W)
- Wavelength ~1064nm



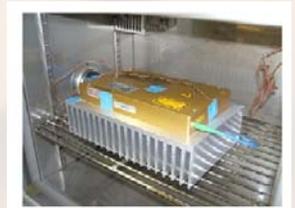
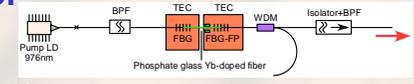
Fiber DBR laser

Features

- Built by NP Photonics
- Highly-doped phosphate glass fiber
- Short cavity length
- Low reliability of splice
- Patented

Status

- Qualification tests by Fibertek
- "Space version" passed thermal cycling
- Noise evaluations



Advantages of fiber laser

Traditional: NPRO laser	New: Fiber laser
Difficult alignment	No alignment needed
Glue/solder needed	No glue needed
Need to couple back into fiber	Laser light within fiber
Strong magnet needed	No strong magnet
Contamination sensitive (sealed package)	No contamination
Distorted Gaussian beam	Mode & polarization cleaned by fiber

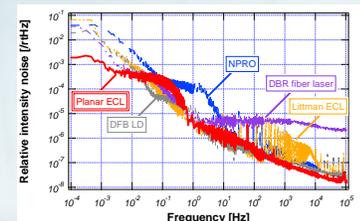
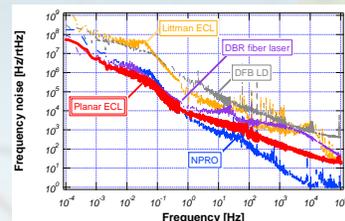
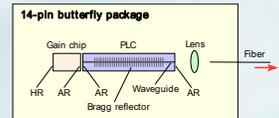
External cavity diode laser

Features

- Built by Redfern Integrated Optics
- Compact & simple
- Low cost
- Low noise at LISA band
- Unconditionally single-mode
- Low power (~15mW)
- Telecom C-band only

Status

- Frequency stabilization done @ 1542nm
- Phase locking experiment
- 1064-nm version, high-freq. noise investigation



GSFC fiber ring laser

Features

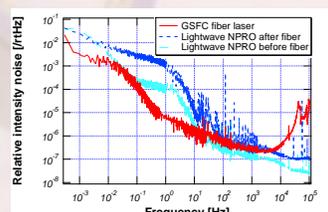
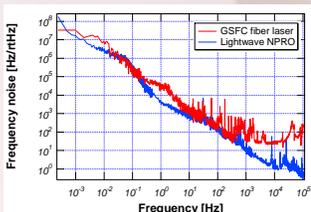
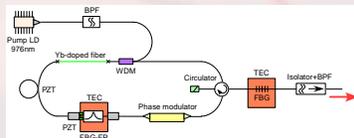
- Design & built in house
- Commercial components only
- No special gain fiber
- No patent issues
- Two FBGs for single-mode operation
- Fast frequency tuning by waveguide EOM
- Low power (~2mW)

Status

- Design fixed
- Iodine stabilization
- Digital system design

Noise performance

- Low frequency: comparable to (better than) NPRO
- High frequency: increased noise due to relaxation oscillation



Fiber amplifier

Features

- Built by Lucent Government Solutions (LGS)
- Clad pump, LMA fiber, ~4W maximum
- Focused on reliability
- Detailed risk analysis
- Passed thermal cycling tests

Status

- Noise measurements at GSFC
- Stabilization experiments

