Telescope Dimensional Stability Study for a Space-based GW Mission

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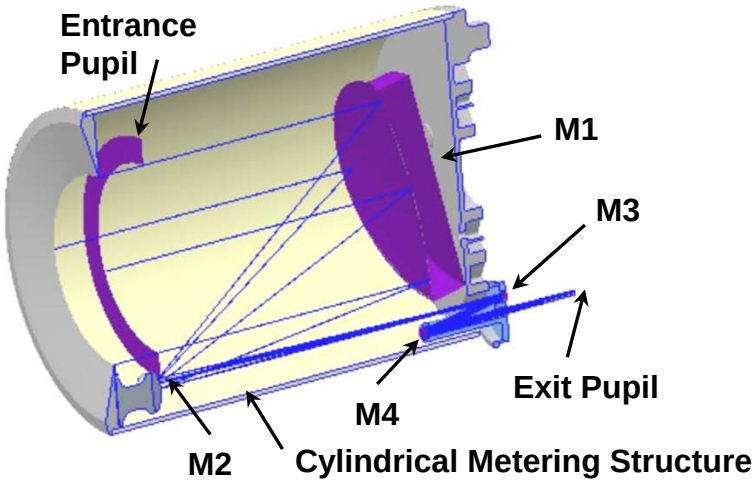
Objectives and Key Challenges:

- Design, fabricate, and test a lightweight eLISA telescope design in a flight-like environment and demonstrate the ability to satisfy mission requrements for a low scattered light and high dimensional stability in time for selection for the eLISA L3 Mission Opportunity
- Key Challenge 1: dimensional stability
- Key Challenge 2: stray light performance

Significance of Work:

- First demonstration of a validated scattered light model combined with a previous demonstration of dimensional stability will provide a firm basis for a realistic engineering model design for a flight-qualifiable telescope.
- Potential technology contribution to L3

Modified Off-axis Design



Approach:

- Use requirements developed for existing telescope
- Modify based on experience (e.g. exit pupil tilt)
- Merge a high thermal conductivity material in a simple symmetric mechanical configuration with a low-scatter optical design
- Fabricate and test for compliance with specifications

Key Collaborators:

- Code 551/Optics: Joe Howard/Garrett West/Peter Blake/Len Seals/Ron Shiri/ and Vincent Bly/553
- Code 543/Mechanical: John Crow/Justin Ward
- UF; Prof Guido Mueller

Currently Funded Period of Performance:

- Oct 2015 – Sept 2017

Recent Accomplishments:

- Nov 2015: Preliminary optical model
- Nov 2015: Preliminary stray light model
- Nov 2015: Preliminary mechanical model

Key Milestones:

- Nov 13, 2015: design preparation/initiate purchase
- Feb 19, 2016: Award contract
- Jan 24, 2017: Telescope delivery
- Jul 20, 2017: demonstrate low scatter performance
- Sep 30, 2017: demonstrate optical pathlength stability

Application:

- Flagship gravitational wave missions (eLISA)
- Laser ranging and/or communications
- precision metrology applications

$TRL_{In} = 3+ \; TRL_{PI\text{-}Asserted} = 3+ \; TRL_{Target} = 4$