Preparing for the FGOs

- X-ray FGO:
  - Optics: mature at <1” demonstrating feasibility, retiring risk and reducing cost requirements
  - Precursor Science: improve knowledge related to primary science objectives to better constrain technology and mission requirements
  - Operations: designed to operate similarly to Chandra, well-demonstrated for >22 years.
- Precursor Science:
  - Done or in process:
    - CSM Call proposals: Mass loss in cc SN, BH occupation fraction for Dwarf Galaxies, mass loss in low-mass red giants
    - Approved Chandra proposals: e.g. Seek AGN in JWST first galaxies lensed by cluster
  - Required to drive design:
    - Black Holes at Cosmic Dawn: predictions currently cover a broad range, need new observations (e.g. above) to probe population, and improved modeling to constrain predictions. Drives <1’’ imaging.
    - Hot (>10^6K) Phase of Circumgalactic Medium: deep X-ray sight-lines through local galaxies, improve galaxy formation modeling, and refine X-ray constraints. Drives spectral mapping (~0.3eV) & spectroscopy (R>5000) requirements.

- Preparatory Science:
  - JWST/WFIRST ultra-deep (mag~28.5-29.5) surveys: >1 sq deg, several sight-lines, to detect light-seed hosts and estimate phot-z.
  - CGM: cooler-phase observations, e.g. UV absorption lines w/HST/COS and ground-based t/ps, SZ detections of individual galactic halos with upcoming CMB missions.
- Follow-up:
  - Black Holes at Cosmic Dawn: LISA observations to directly track mergers and so unveil complete picture of SMBH assembly.
  - CGM: LUVOIR sight-lines through UV ($<10^6$K) CGM to constrain lower-temperature halo, and facilitate comparison with pre-dominant (>50%) hot phase for full understanding of halos.
- Other: Recommendations (based on NASA Round Table Discussion, Aug 2022):
  - Engage experience and expertise of science centers for all FGOs to:
    - Aggressively work on retiring technology risks and foster community support
    - Apply systems engineering methods to assess and plan final designs and avoid later need for operational fixes
    - Work with NASA-appointed science working groups to ensure consistent advocacy and messaging, foster international collaborations and engage worldwide community