

# GSMT

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## ABSTRACT

The Giant Segmented Mirror Telescope is intended to complement the James Webb Space Telescope (JWST) by offering diffraction limited resolution beyond 1 micron. The recent merger of the CELT and AURA design and development programs offers a real hope that the vital scientific synergy of simultaneous operation of a 30 meter GSMT and the JWST will be realized.

**Keywords:** adaptive optics, spectroscopy

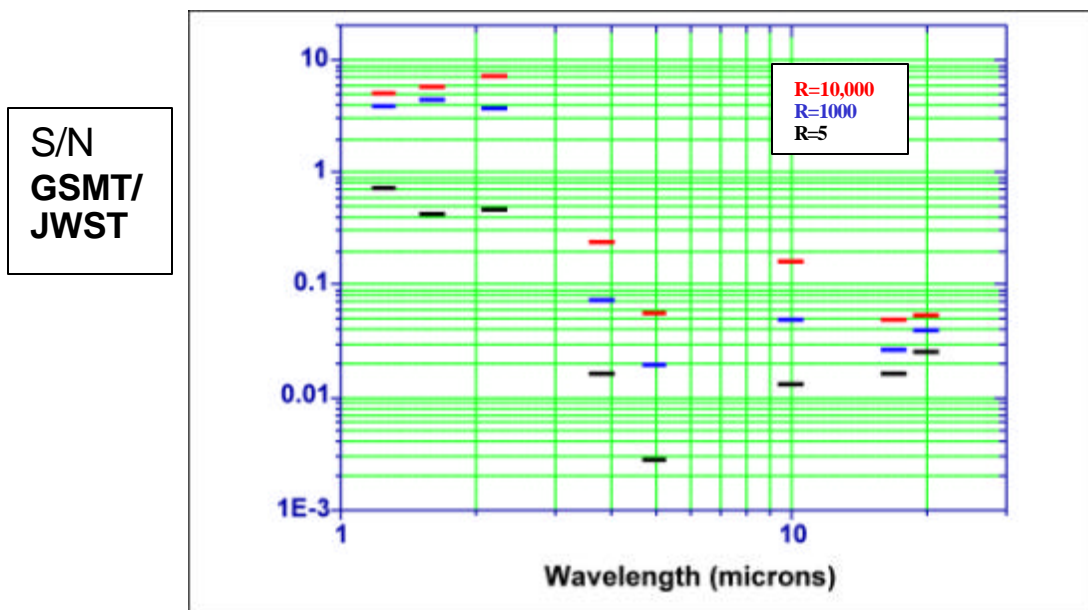
### 1. GSMT as a complement to JWST

The Astronomy & Astrophysics Survey Committee provided a vision for The Giant Segmented Mirror Telescope (GSMT), by making its top ground-based recommendation a “30-m-class ground-based telescope that will be a powerful complement to NGST in tracing the evolution of galaxies and the formation of stars and planets.”

Three examples of its synergies with JWST are

- GSMT imaging followup at 10 mas of JWST’s 50 mas resolution at  $1.6\mu$ : this reverses the HST / Ground relationship. It also puts Adaptive Optics in the drivers seat.
- GSMT kinematics of JWST protogalaxies: one sees the redshift 3-6 galaxies with JWST, but physical understanding of the formation process comes from spectroscopy with GSMT.
- GSMT offers km/sec kinematics of forming planetary systems at  $5\mu$ . JWST’s mid-infrared instrument MIRI will define the spectral energy distributions, and ALMA will measure the kinematics of cooler regions.

Figure 1 (courtesy of Matt Mountain) compares the signal to noise ratio of a 30m GSMT in unit time with that of a 6.5m JWST. The colored bars are coded by spectral resolution, R.

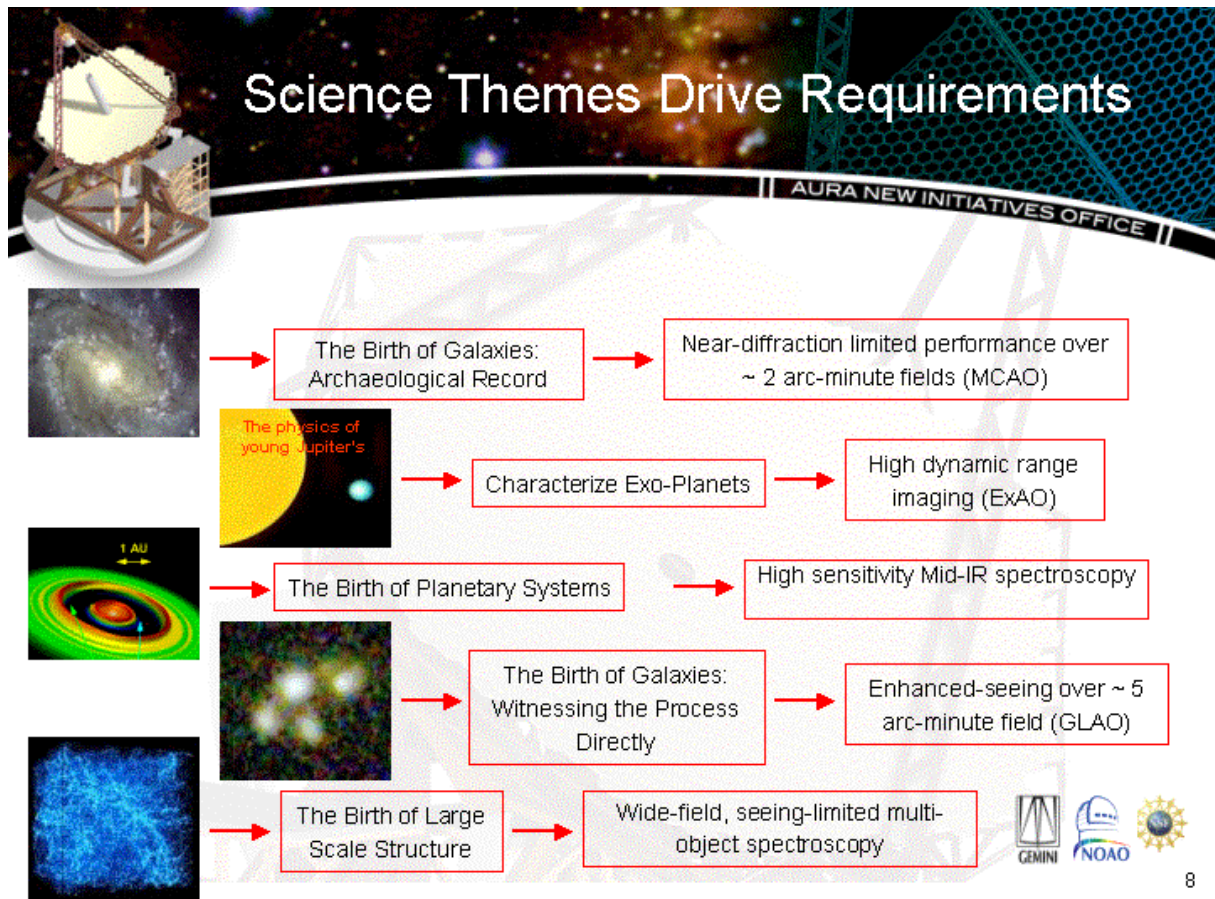


If we are to enjoy these synergies and the usual scientific modus operandi of testing ideas on with one instrument and then on the other, and iterating, it essential to get on with GSMT.

## 2. The GSMT Science Working Group

In its first year of operation the Science Working Group (SWG) for GSMT has rendered a great service by publishing ([http://www.nsf-gsmt-swg.noao.edu/SWG\\_Report/SWG\\_Report\\_7.2.03.pdf](http://www.nsf-gsmt-swg.noao.edu/SWG_Report/SWG_Report_7.2.03.pdf)) a compelling science case for the telescope at a level of detail beyond the decadal survey. In addition, the SWG has advised that “investment now in a major technology development program targeted at key areas can serve multiple design programs and ensure a strong public voice at all stages in developing next generation telescopes.”

Figure 2: Science themes from the GSMT SWG’s initial study. These drive the design of the telescope as indicated in the boxes on the right. MCAO is multi-conjugate adaptive optics. ExAO is Extreme adaptive optics, and GLAO is Ground layer adaptive optics.



There is an important ongoing role for the GSMT SWG to

- Seek further feedback from the community on the science cases identified, the key observations, and how to make them.
- Broaden input to TMT Science Advisory Committee.
- Review scientific instrument concepts.
- Monitor the progress of key technology development.
- Provide scientific feedback to groups involved in GSMT design efforts.
- Establish working relationships with international groups in Europe and Asia to serve as a forum for mutually beneficial collaborations.
- Work closely with the JWST Science Working group to prepare for an optimized complementary scientific use of GSMT and JWST.
- Provide reports to the NSF astronomy division, and U.S. national committees: NAAAC, and CAA.
- Evolve its membership to ensure input from a broad cross-section of the research community.

### **3. The Thirty Meter Telescope project**

The merger of three ELT programs into the Thirty Meter Telescope project

- AURA
- ACURA (Canadian universities)
- University of California
- Caltech

is a major consolidation and a great step forward in realizing GSMT. This is particularly the case if it is a defining feature of GSMT that it reach first light soon after the launch of JWST. Other projects will achieve other goals on other timescales.

We have been asked about the further extension of the partnership. If all four partners are funded, no more are sought for the Design and Development Phase. This phase ends in the Preliminary Design Review. At PDR additional partners would be attractive, because the capital needed is estimated at \$650M, and the operations cost will exceed the total NOAO annual budget. International partners need to be well synchronized with the project timeline.