

Proposed charter for the Great Observatories SAG

NASA Great Observatories have opened up the electromagnetic spectrum from space, providing sustained access to wavelengths not accessible, or greatly compromised, from the ground due to Earth's atmosphere. The first Great Observatory, *Hubble*, was launched in 1990, and three of the four (*Hubble*, *Spitzer* and *Chandra*) are still operating today. Each of these observatories have delivered huge gains in sensitivity and/or resolution. Together, they have provided the scientific community with an agile and powerful suite of telescopes with which to attack broad scientific questions, and react to a rapidly changing scientific landscape. This access has become a central feature of modern astrophysics, where objects are now routinely observed across the electromagnetic spectrum from the ground and space. Recent examples of ground-breaking studies carried out with the Great Observatories range from the highest-redshift ($z > 10$) galaxies and deep surveys of the early Universe (e.g., the Frontier Fields), to nearby terrestrial exoplanets and potentially habitable worlds around Trappist-1, to the merging neutron star EM counterpart to GW170817. As the existing Great Observatories age, or are decommissioned, community access to these wavelengths will diminish, with an accompanying loss of scientific capability. The goal of the proposed SAG would be to analyze and answer the following questions:

- (1) What gaps in wavelength coverage and scientific capabilities are anticipated over the next 10-20 years as the Great Observatories age or are decommissioned? What are the corresponding scientific impacts in terms of loss of discovery space and the ability of the community to address key questions, such as those articulated in the 2010 Decadal Survey, in particular those uniquely made possible by coordinated use of a set of space observatories with a powerful and varied suite of instruments? How do these losses affect the ability of the community to address a rapidly changing scientific landscape?
- (2) What are the options for maintaining, in the next 10-20 years, the multi-wavelength coverage from space now provided by the Great Observatories? Can the anticipated scientific goals be realized with a combination of flagship and smaller missions with broad community access, wide wavelength coverage, and temporal overlap? Should longevity be a key criteria for considering future large missions, such as those outlined in the 2013 NASA Roadmap, "Enduring Quests, Daring Visions"? What is the role of international partnerships in meeting these needs? To what degree can loss of wavelength coverage be partially mitigated through the use of NASA's existing data archives?

To address these questions in a timely manner facilitating input to the 2020 Decadal survey committee, we propose a new Great Observatories Study Analysis Group (SAG), which would include representatives from the COPAG, PhysPAG and ExoPAG, as well as the broader scientific community, with the goal to analyze the above questions and compose and publish a report, delivered to NASA HQ, by April 1st, 2019.