COMMITTE ON SPACE RESEARCH (COSPAR)

Expanding the knowledge frontier of space for the benefit of humankind

COSPAR Working Group: Future of Space Astronomy

A Global Road Map for the Next Decades

EXECUTIVE SUMMARY

COSPAR Secretariat
c/o CNES • 2 place Maurice Quentin • 75039 Paris Cedex 01, France
Tel. +39 1 44767510 (outside France), 01 44767510 (inside France)
Fax +39 1 44767437 (outside France), 01 44767437 (inside France)
cospar-at-cosparhq.cnes.fr - http://cosparhq.cnes.fr

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Recommended Space Astronomy Road Map

A select group of future space astronomy missions has been identified in major studies by national scientific committees to be of the highest priority. Critical technologies and instrumentation for these missions have been brought to a high level of technical readiness. Though these missions do not provide complete coverage of the electromagnetic spectrum, the WG considers these missions to be the most feasible core of the near-term major space astronomy missions, and recommends this list as a Road Map for the next few decades.

JWST. JWST is a collaborative mission of NASA, ESA and the Canadian Space Agency (CSA). It is the only future large space astronomy mission already approved for development, with a planned launch in 2018. It was the highest priority programme recommended in the US National Academy of Sciences decadal survey in 2000 ("Astronomy and Astrophysics for the New Millenium"), and its central importance to astronomy was reiterated in the 2010 survey ("New Worlds, New Horizons"). With a combination of near- and mid-infrared imagers and spectrometers, JWST will provide unprecedented capability to study systems from the first galaxies that formed in the early Universe, to newly forming stars and planetary systems, and to bodies in our solar system.
The WG recommends completion and launch of this major observatory as soon as possible. JWST is recognised to be the only new large space astronomy Observatory to be possibly operational in the next 10-20 years. It is an essential asset for space science investigations complementing "ground based".

Euclid/WFIRST. Both ESA and NASA are currently evaluating missions to study dark energy: Euclid (ESA; dark energy and dark matter) and Wide-Field Infrared Survey Telescope (NASA; dark energy, exoplanets and near-infrared sky survey). The scientific goals of these missions have been recommended as being of the highest importance by the worldwide astronomical community. Euclid has been selected as an ESA M-Class mission; NASA is conducting a definition study for WFIRST. Possible collaboration has been discussed by the national agencies, but the situation is unclear at the time of this study.
The WG believes it would best serve the interests of science and the community to have a single optimised mission or programme, combining the resources and technical capabilities of NASA and ESA. Canada, India, China, Russia and others could be added as partners.

International X-ray Observatory (IXO). IXO has been extensively studied and reviewed as a collaborative NASA/ESA/Japan mission, now re-scoped by ESA as an L-Class candidate for the 2020-2025 time-frame, Athena, without NASA collaboration. The proposed IXO/Athena satellite, or a similar large high energy observatory, would be able to exploit a broad scientific scenario, possibly including investigation of the 'first stars' via a high-z γ-rays burst detection capability.
The WG recommends development of a large X-ray space observatory, operative in the next decade.

Large Interferometer Space Antenna (LISA). LISA is a pioneering gravitational wave mission, designed to open a new window on the cosmos. LISA has been extensively studied as a collaborative NASA/ESA mission, but, though highly ranked in the 2010 US Decadal Survey, programmatic constraints are preventing NASA from proceeding. The LISA Pathfinder mission is in development in Europe. ESA has re-scoped LISA as NGO, an L-Class mission candidate.

The WG recommends that the agencies involved support, exploit and finalise the R&D programmes necessary to have in operation a gravitational wave mission [illegible] Even though the previous collaborative mission concepts for [illegible] and LISA are not feasible in the current ESA or NASA plans, the Working Group recommends that some multinational aspect of the missions be preserved to prevent significant loss of scientific capability.

Space Infrared Observatory for Cosmology and Astrophysics (SPICA). SPICA is large aperture, cryogenically cooled far-infrared observatory studied as a collaborative JAXA/ESA/Canada mission. Contribution of an additional instrument was recommended by the US 2010 Decadal Survey, but may not be possible due to US programmatic constraints.

The WG believes that a large aperture, cryogenically cooled far-infrared observatory is essential to bring about the major advance in sensitivity needed to continue investigation of the cold and dust obscured Universe.

In the longer term, it is to be expected that detailed characterisation of Earth-like exoplanets, a major scientific priority, will require the stability and sensitivity afforded by a large space [illegible] Numerous UV/optical and infrared mission concepts have been proposed and studied.

The WG recommends further technical development to bring the most promising approaches to readiness.

The WG also recommends that space-faring nations pursue robust cooperative programmes devoted to solving specific burning scientific questions via the implementation of multilateral medium and small size dedicated missions.

In addition to the specific high priority near-term missions listed above, the WG compiled a list of additional missions of interest around the globe, some of which might be accomplished by 2030. Such missions are listed, by approximate size class, in section 3 of the Ubertini at al., ASR paper in press (2012).