钱学森空间技术实验室
Qian Xuesen Laboratory of Space Technology

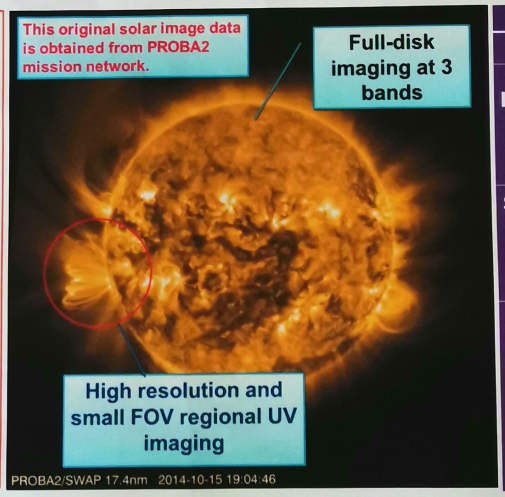
Space Science

Pathfinder for Solar flAre Monitoring Explorer (SAME-Pathfinder)

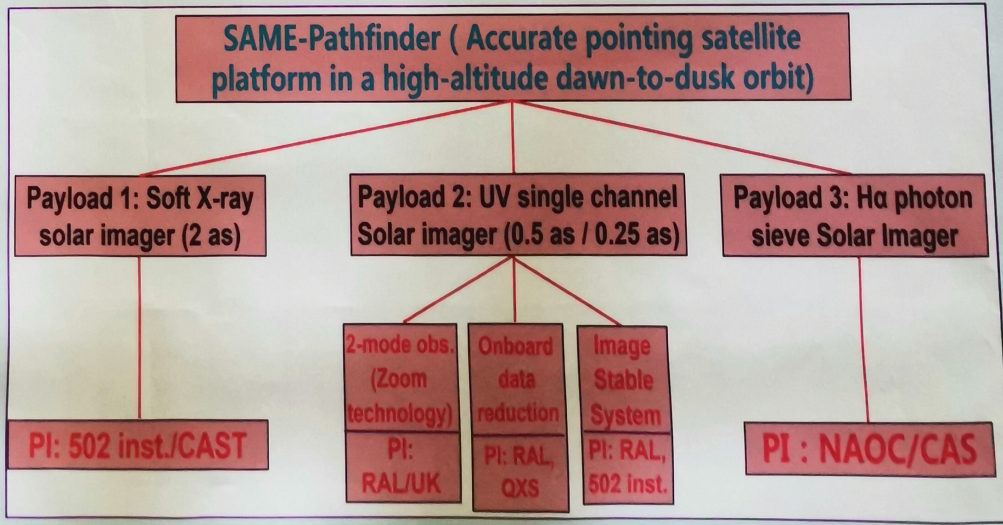
- The sun is the closest star to humans, with a diameter of 32 arcseconds. The survival and development of living things on Earth is also inseparable. All fossil energy on Earth comes from solar energy. The sun often has bursts, such as flares and CME.
- Solar flares are intense radiation bursts from the release of magnetic energy caused by magnetic reconnection, which is related to active areas such as sunspots. Solar flares release energy in many forms: electromagnetic radiation (ultraviolet rays, X-rays, and gamma rays), high-energy particles (protons and electrons), and mass flow of propellant matter.
- Three phases of a flare: 1) soft X-ray/EUV radiation; 2) Radio, EUV, hard X-ray, and γ-ray radiation; (3) gradual ↑ and ↓ of soft X-ray radiation. The duration is a few seconds to ~1 hour. Multi-wavelength (X-ray, EUV and optical bands) monitoring the solar flare could be very useful for space weather forecast and solar physics, just in time for the start of the 25th solar cycle on 2020s.
- It is proposed to develop the SAME-Pathfinder mission that monitors the solar burst in a high-altitude dawn-to-dusk orbit. The mission carries three main scientific payloads: soft X-ray imager, Hα photon sieve imager and ultraviolet imager (UI) with an automatic zoom technology. The UI could be collaborated with RAL of UK. The scientific payloads enable uninterrupted high-resolution multi-band video imaging of the Sun, monitoring its burst events, and have an crucial role in space weather forecasting and solar physics studies. Moreover, it can also verify the technologies of photon sieve imaging payloads, high pointing stability and intelligent satellite platforms. The SAME-Pathfinder mission will lay the foundation for the Solar Panoramic Stereoscopic Monitoring mission (SAME) at the 3 Lagrangian points (L3, L4, L5), between the Sun and earth. The SAME mission can be a promising international-collaboration mission between the Asia, Europe and US.

Science Goals of SAME-Pathfinder:
(1) Studies on physical process of the solar burst (flare, CME); (2) Research on the origin of solar flares and CME, particle acceleration and radiation mechanisms of solar wind; (3)Statistical studies of solar bursts on astronauts, satellites, ground facilities, and the health of the Earth.

Application Goals of SAME-Pathfinder:
(1) Creating a seires of long-term solar burst missions to provide <=15 minutes of solar burst warning for manned space missions (Accurate prediction plan of solar flares for the time schedule of astronauts' out-cabin activities), navigation and communications satellites, and human health; on physical process of the solar burst (flare and CME);



Major Science Payloads	
Major Payload	**Performance index**
H_α photon sieve Solar Imager (656.28nm)	（1）Aperture: 20 cm （2）Spatial resolution: ~ 0.9 as （3）FOV: 35-40 arcmin （4）Δλ: 0.02 nm
Soft X-ray Solar Imager (Wolter-I mirror)	（1）Aperture: 20 cm （2）Spatial resolution: ~ 2 as （3）FOV: 40 arcmin （4）Energy bands：0.5-15 keV
Two-mode UV single channel Solar imager (133.4 nm)	（1）Aperture: 20 cm （2）Spatial resolution: ≤ 0.25 as (flare) | ≤ 0.5 as (quiet) （3）FOV: 5 arcmin (flare mode) | 40 arcmin (quiet mode) （4）Δλ < 2 nm



Corresponding Author: Yuanjie Du Email : duyuanjie@qxslab.cn