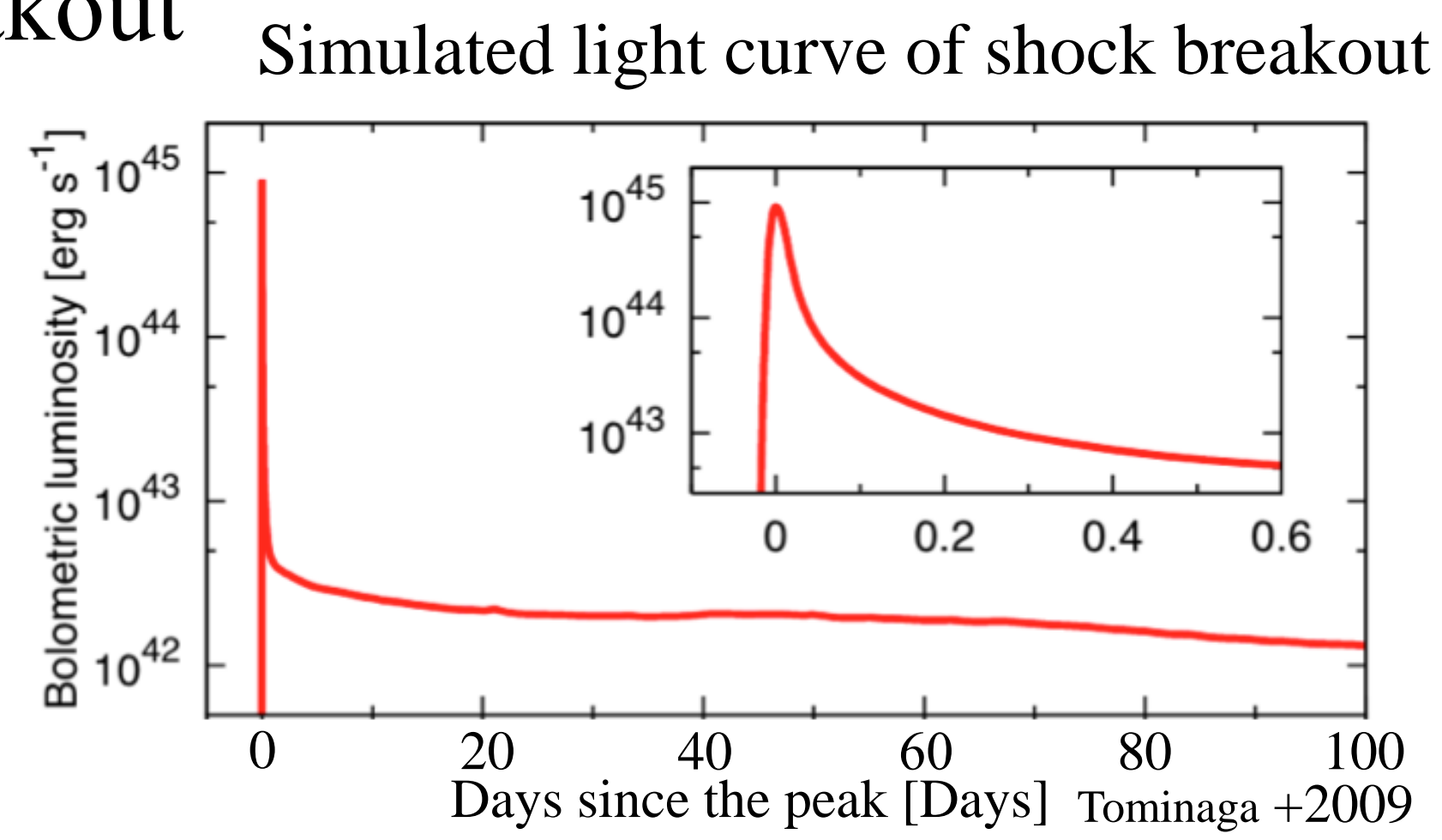
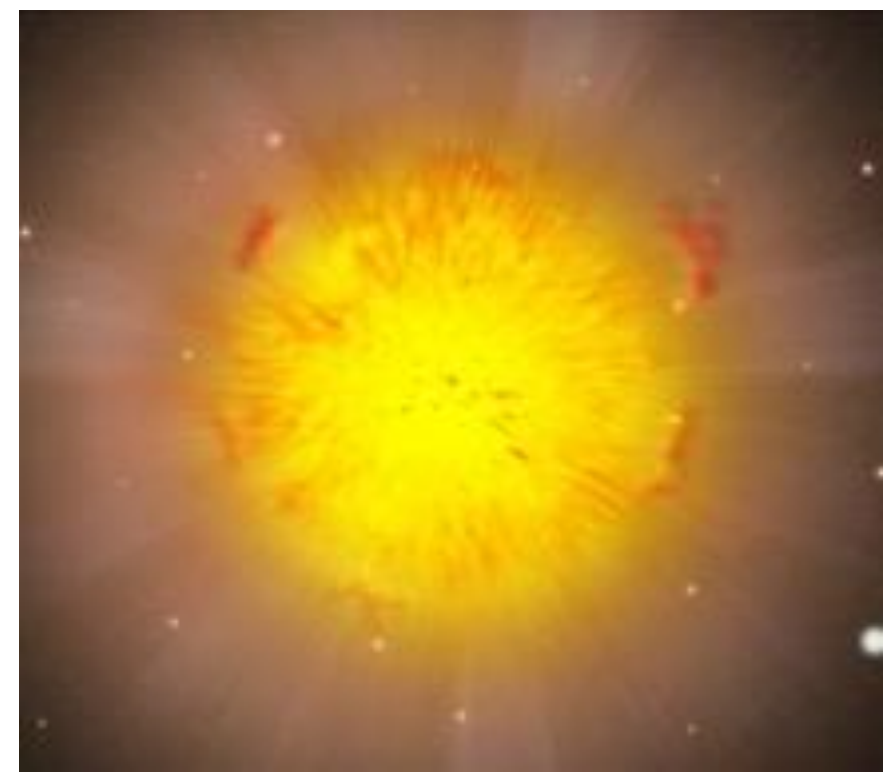


Development of Wide Field UV Space Observatory “PETREL”

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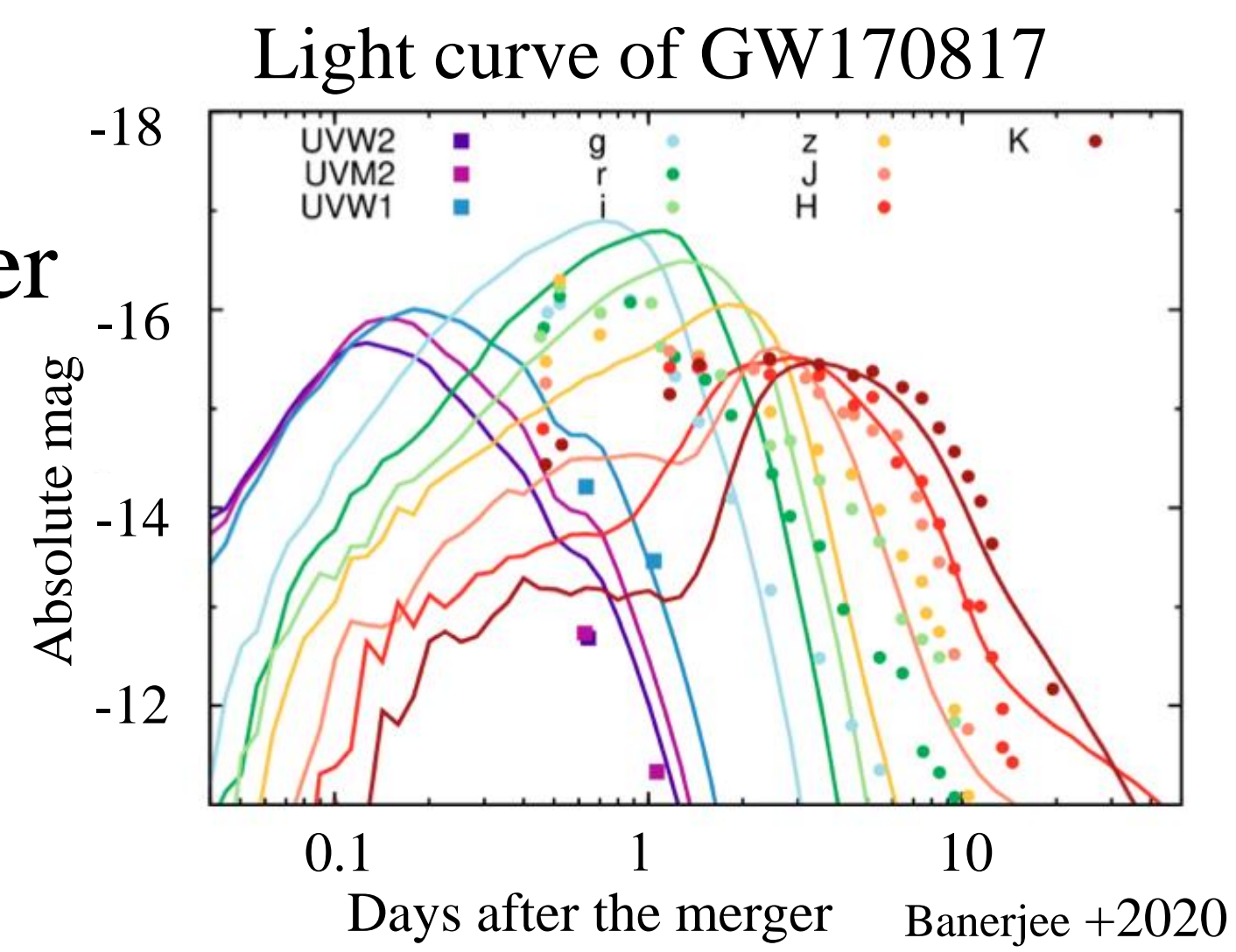
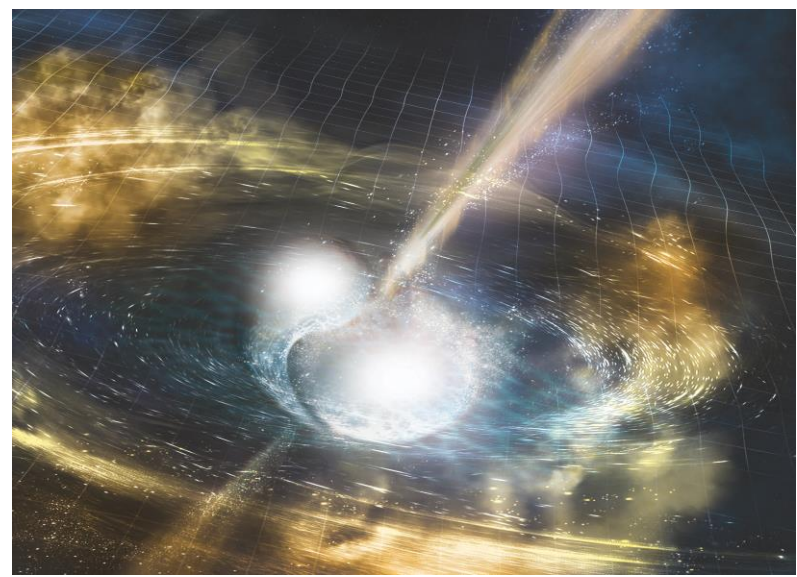
1. Observation target

■ Supernova shock breakout



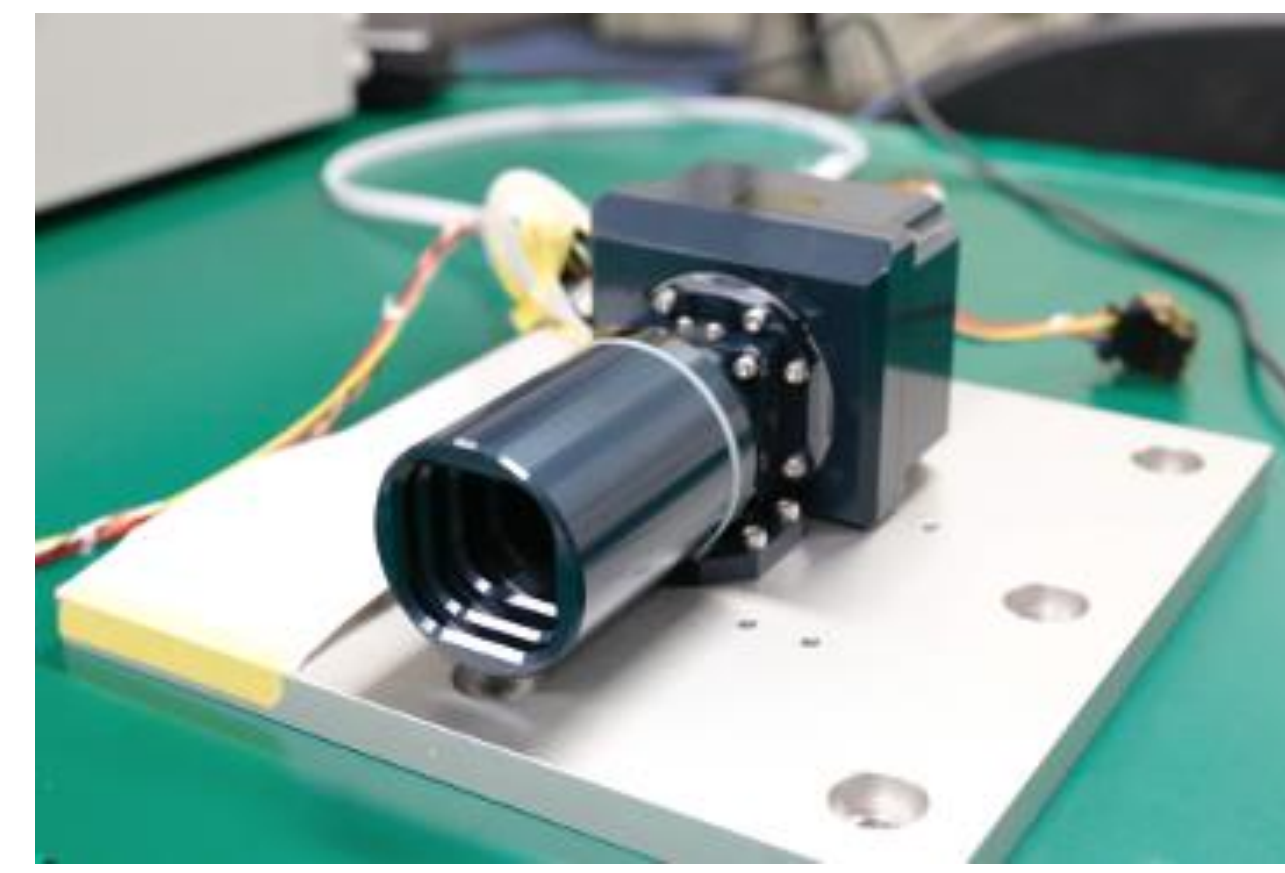
When a shock wave generated by a supernova is reached to the surface of the star, an ultraviolet (UV) light is emitted. A decay timescale of the light curve is from 0.1 to 1 day.

■ Binary neutron star merger



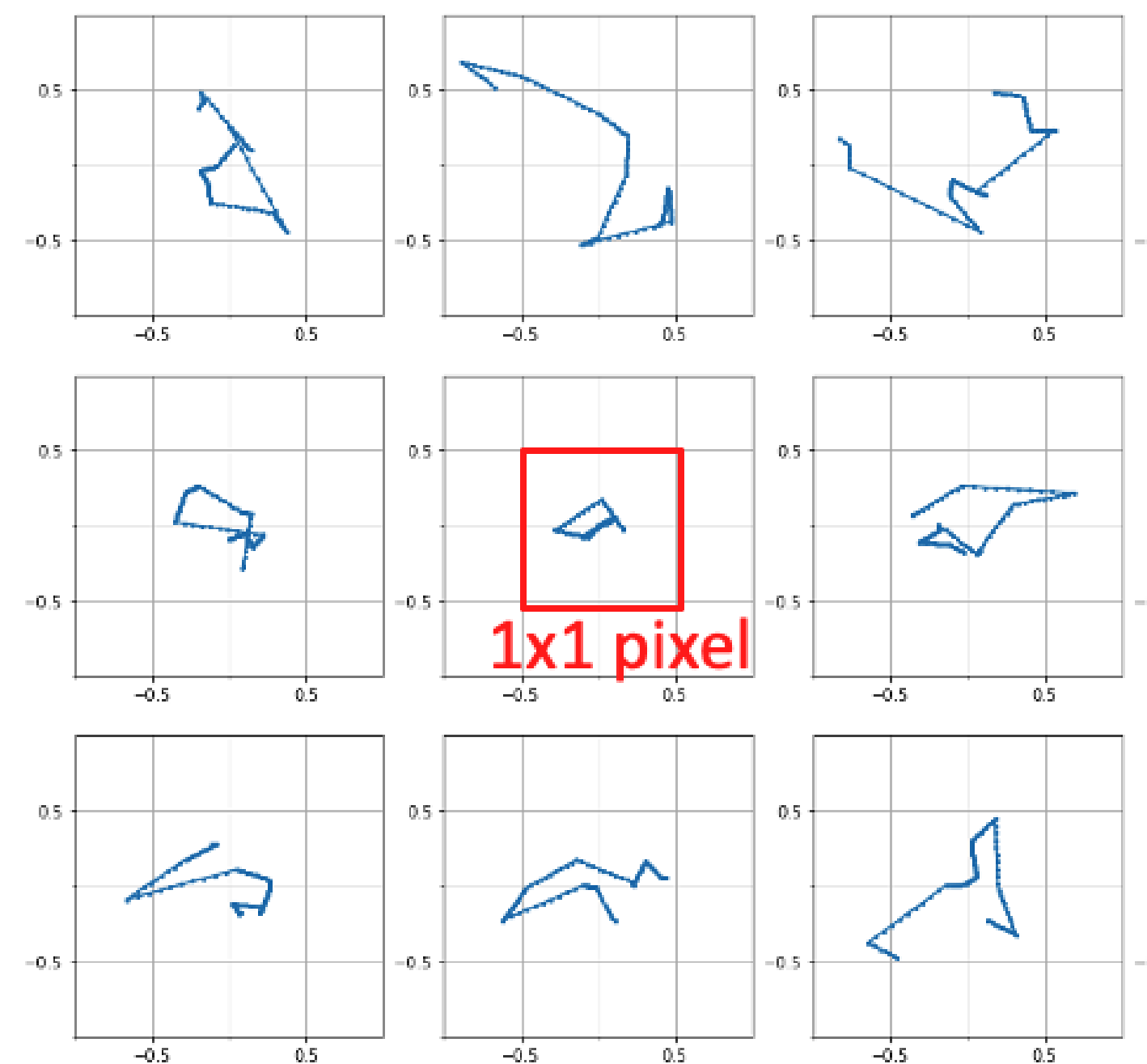
Gravitational waves are emitted at a merger of a binary neutron stars system. After this, “kilonova” is caused by radioactive decay of heavy elements and relativistic jet occurs. To confirm jet formation, observing UV emission immediately after the merger is required.

3. Attitude stability



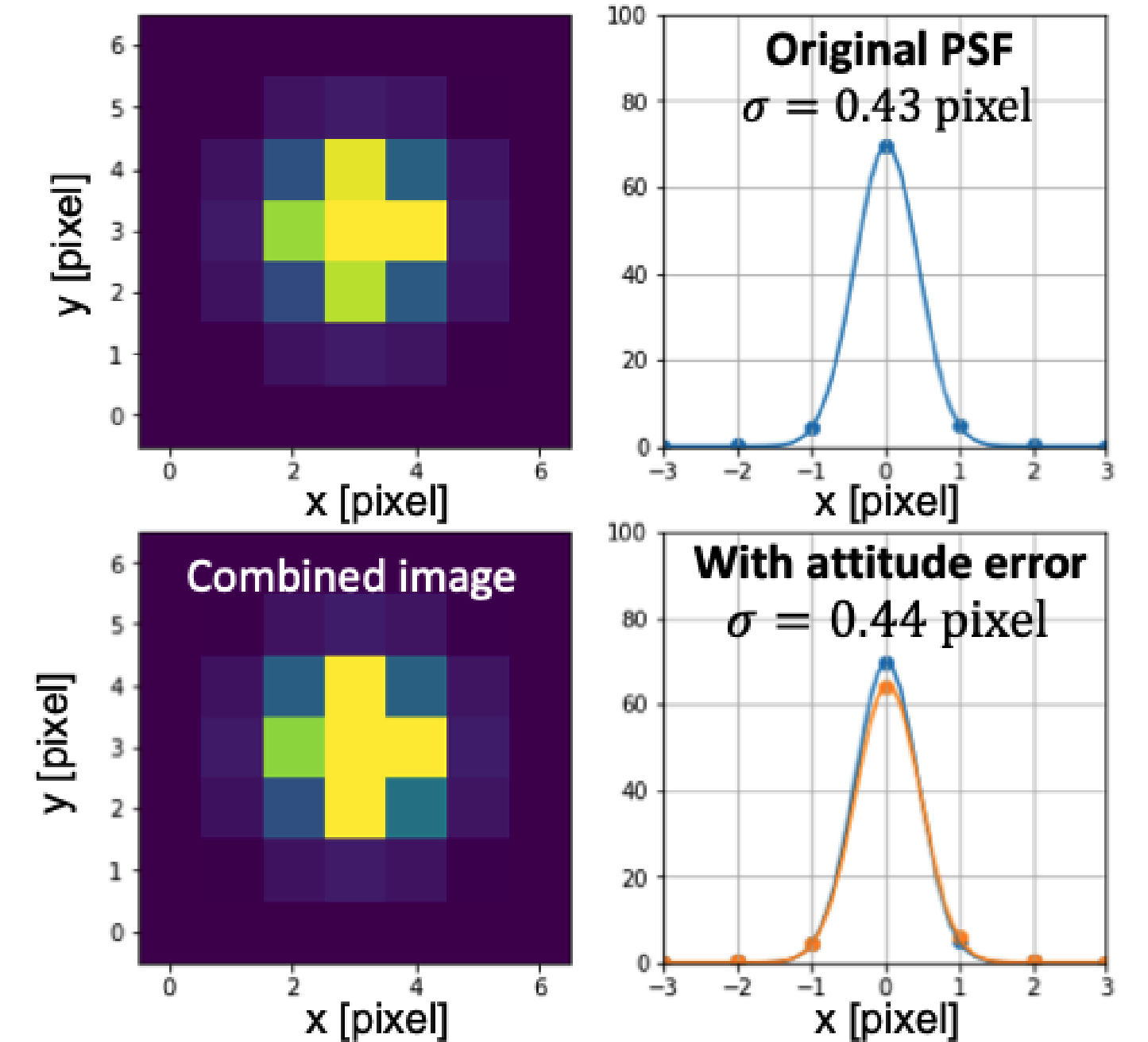
- PETREL control the attitude using a high-performance star tracker with an attitude determination accuracy of ± 2 arcsec (RMS).

Star tracker



Attitude simulation by HiLS

- Simulation results have demonstrated that stable attitude control is possible.



Combine 10 images whose exposure time is 10s

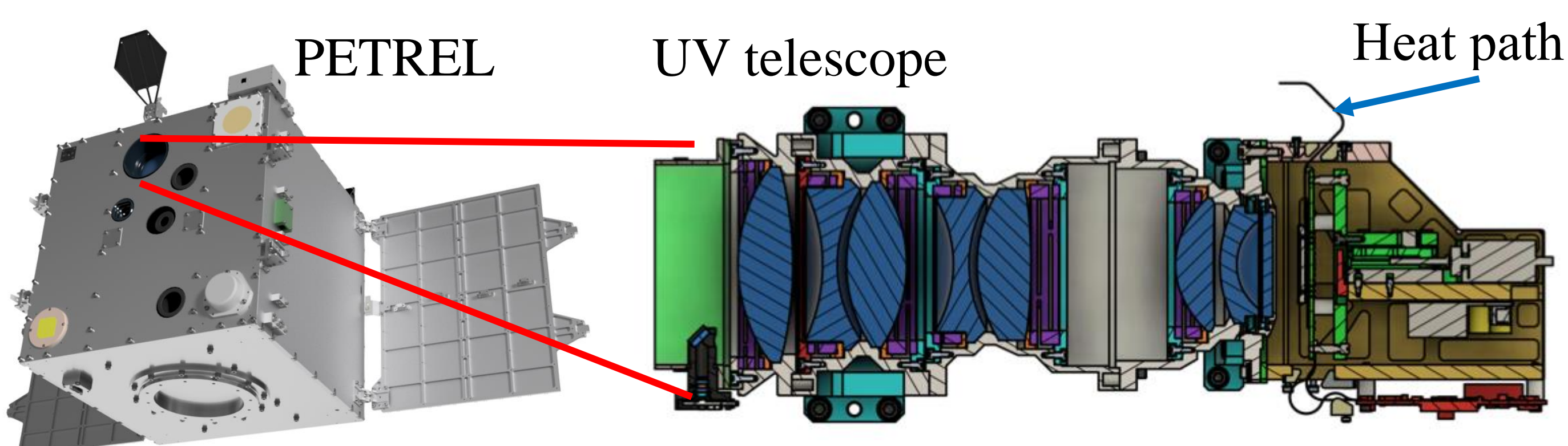
- Taking into account attitude errors, it has little effect on the spread of the PSF.

2. PETREL and UV telescope

In order to observe above phenomena, the UV telescope with a 50 square degree field of view is installed on the 50kg-class micro-satellite Platform for Extra & Terrestrial Remote Examination with LCTF (PETREL). This will be **launched in July 2025**. Using this, we will conduct the **first wide-field UV observation aimed at detecting transient objects**.

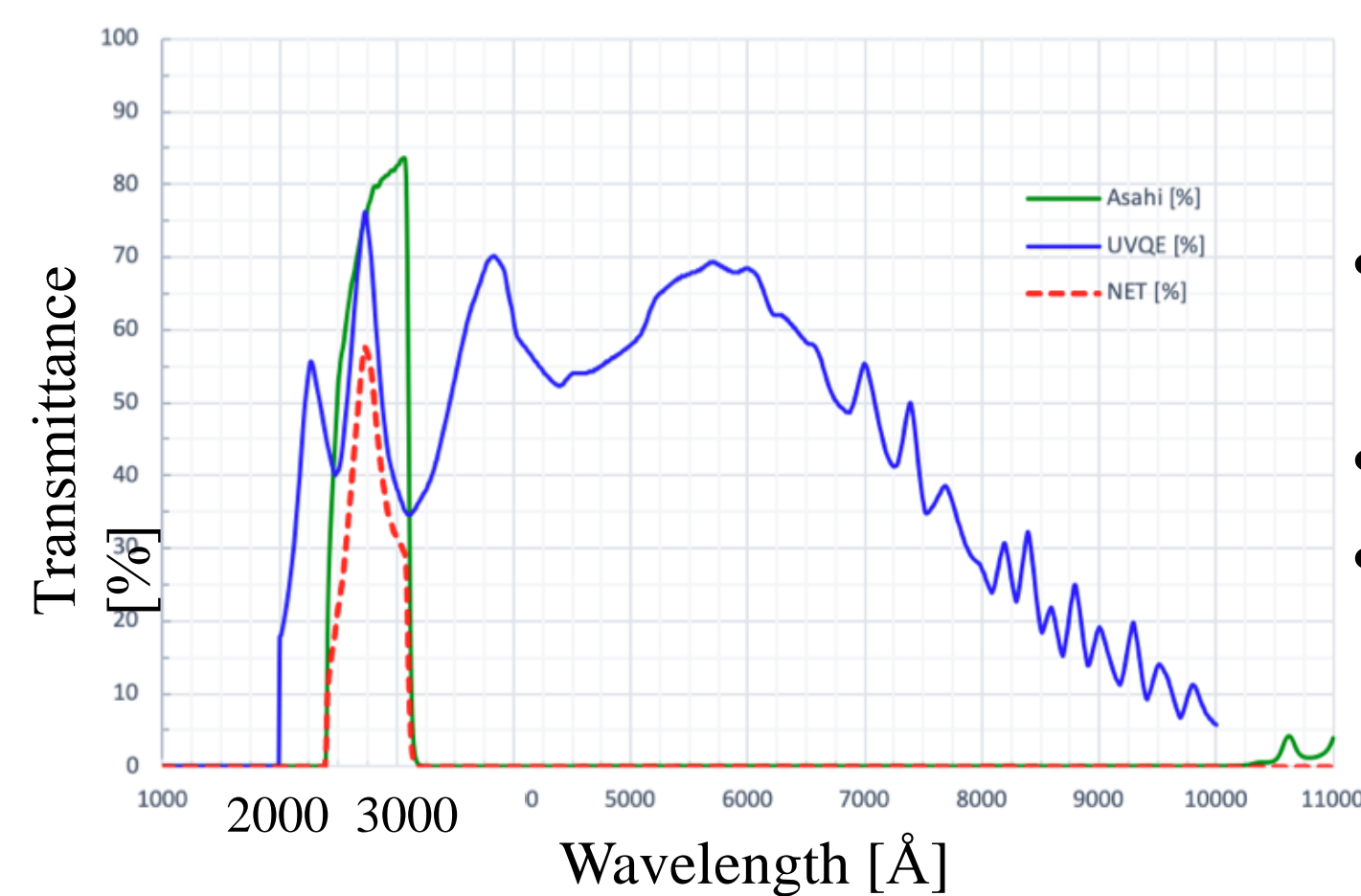
Mission requirements

parameter	requirements
Wavelength	200 – 300 nm (NUV)
Survey region	200 deg ²
Upper limit (AB)	19 / orbit
Alert delay	30 min after detection

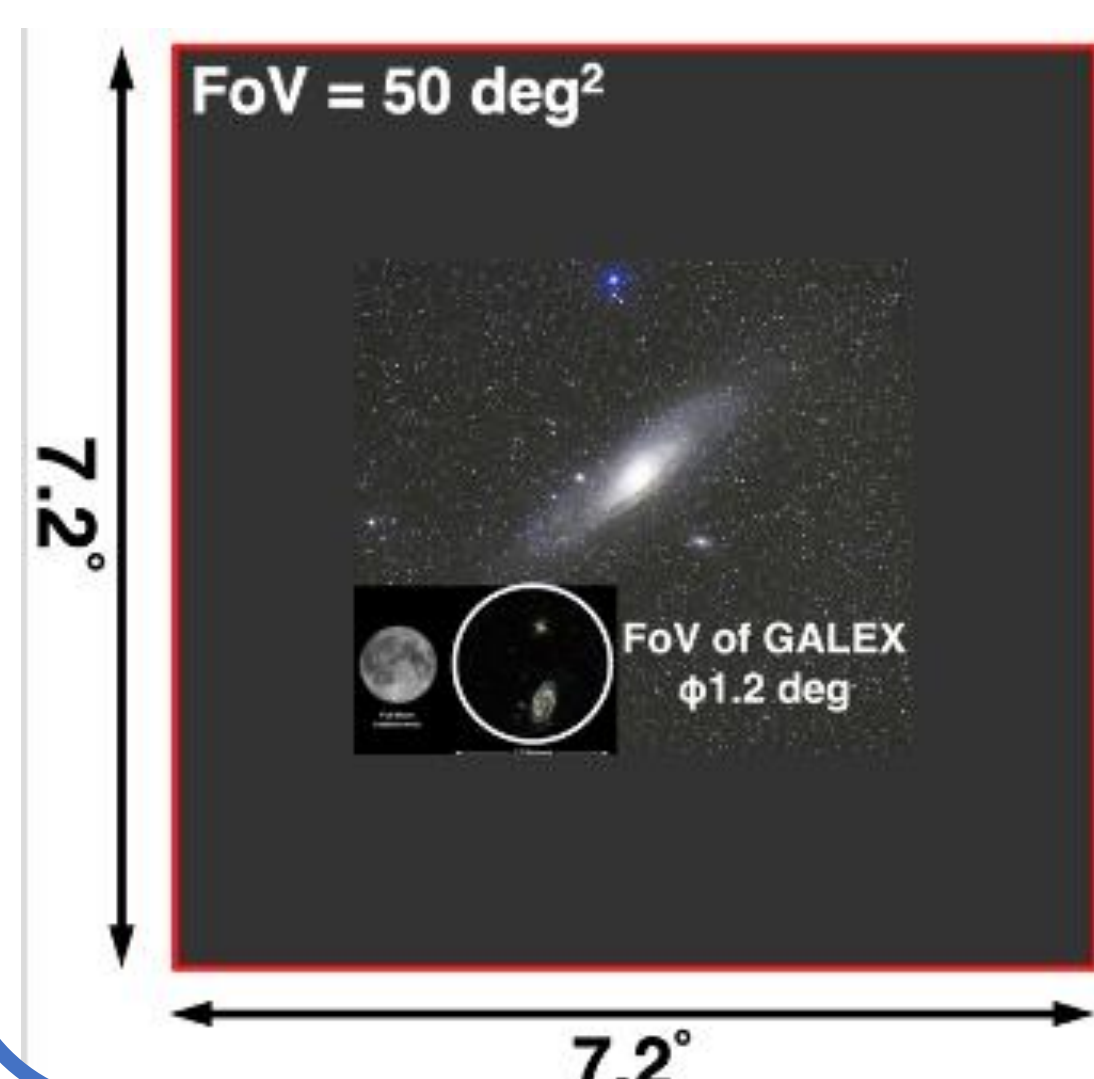


Diameter: 80mm,
Focal length: 180mm (F: 2.25)

- Equipped with a back-illuminated CMOS sensor that is sensitive to UV light
- The pixel scale is 12.6 arcsec/pixel
- The observation wavelength is approximately 2500~3000 Å due to the optical light cut filter



- The CMOS sensor is **cooled below -20°C** to decrease dark current
- Heat is dissipated through the heat path
- Magnitude of **19 (AB)** is achieved with **600 seconds integration**



- The field of view combining the optical system and CMOS sensor is **50 deg²**
- Cover wide error area of the gravitational wave telescope

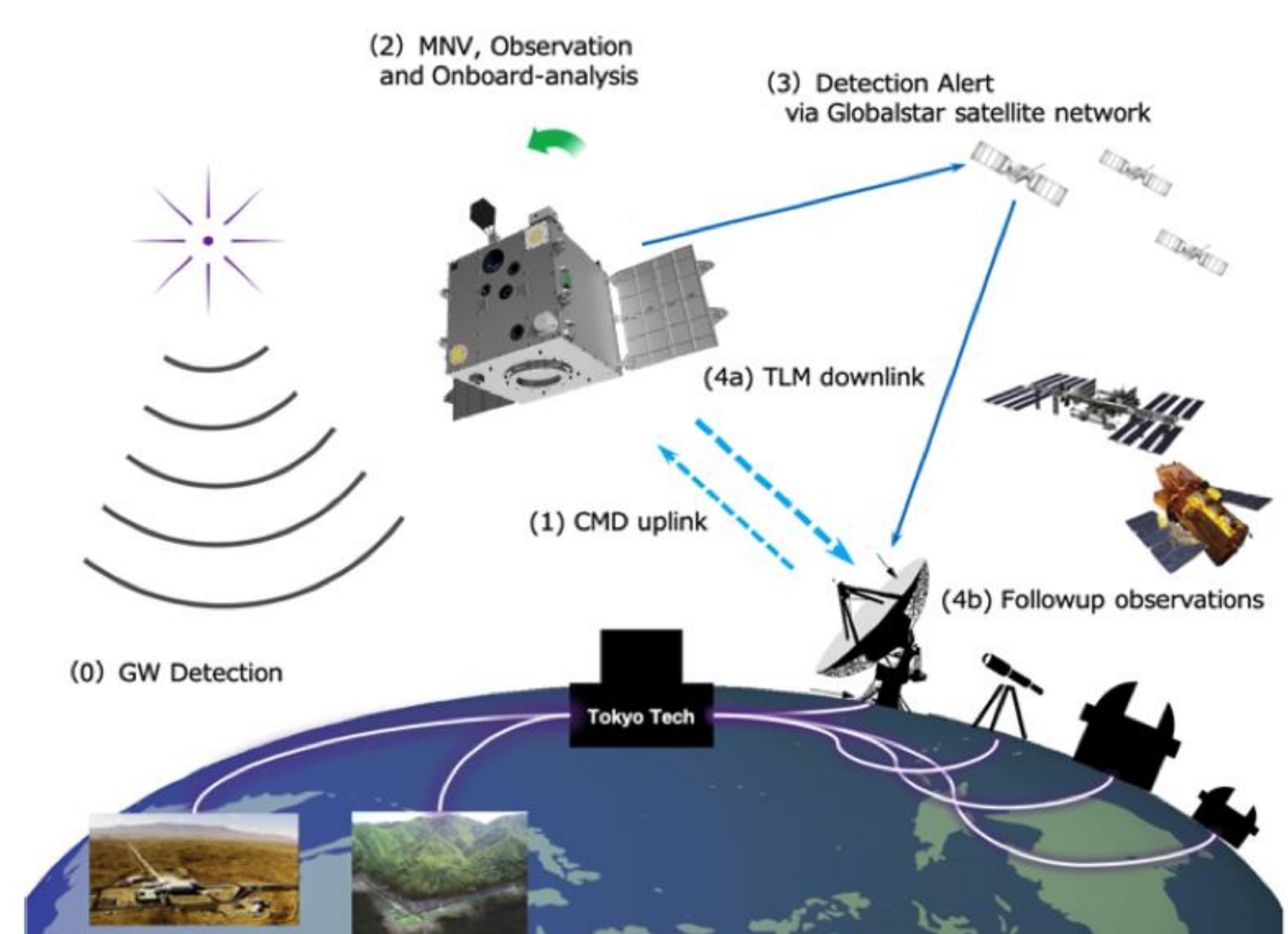
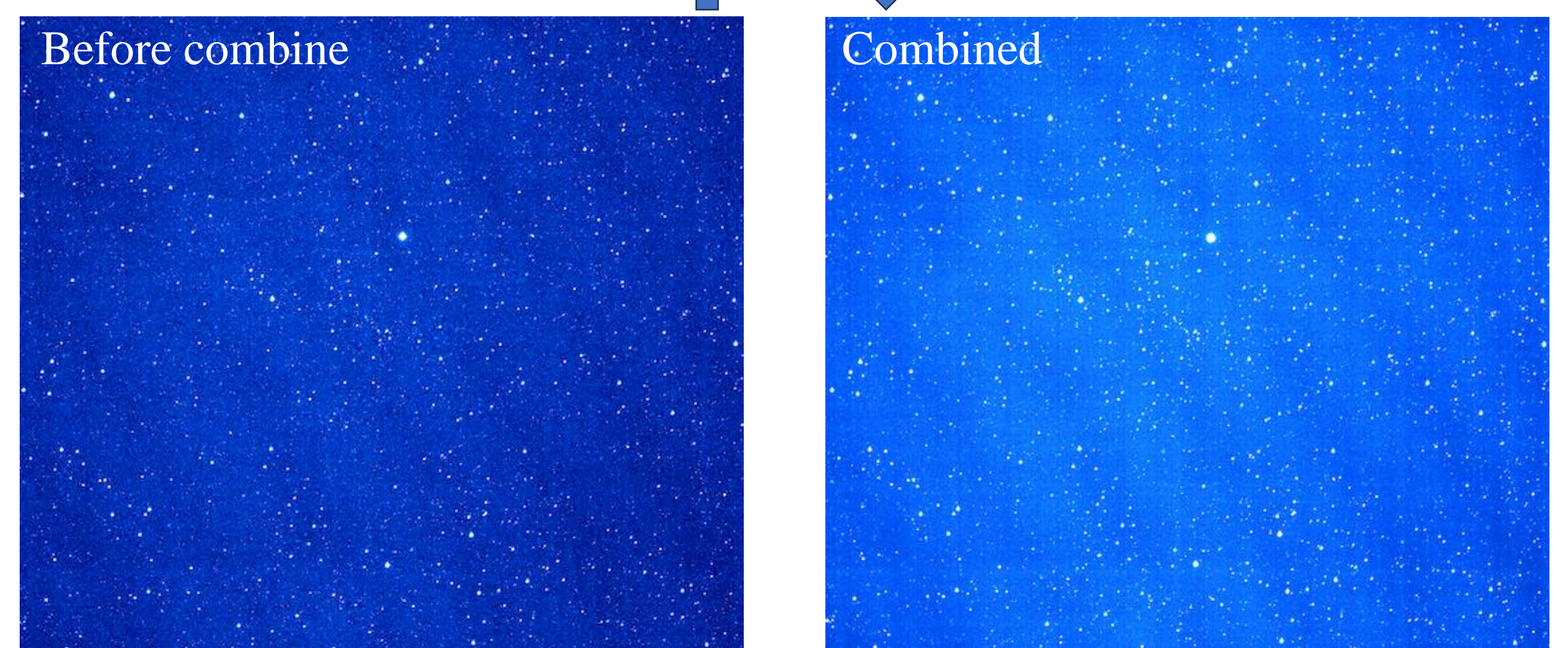
4. Detection of transients and follow-up of gravitational wave events

In order to achieve rapid alert transmission, PETREL perform **on-board computer detection of transients** and issue a preliminary report **within 30 minutes via Globalstar satellites**. Information includes the time of detection, coordinates of the object, and signal-to-noise ratio. The type of objects are determined by follow-up spectroscopic observations using optical telescopes on the Earth.

Image processing flow on-board

- Images are combined
- Photometry
- Transient detection

Improve signal-to-noise ratio



Follow-up of gravitational wave events

- Send commands and observe specified area
- Send a preliminary report to the ground via Globalstar satellites