Studying Near-Infrared Extragalactic Background with the Cosmic Infrared Background ExpeRiment-2 (CIBER-2)

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We present the current status of the Cosmic Infrared Background ExpeRiment-2 (CIBER-2) project, whose goal is to make a rocket-borne measurement of the Cosmic Infrared Background (CIB), under collaborate with U.S.A., South Korea, and Taiwan.

The extragalactic background is the integrated light of all extragalactic sources of emission back to the early Universe. At near-infrared wavelengths, measurement of the CIB is a promising way to detect the diffuse light from the first collapsed structures at redshift $z\sim10$, which are impossible to detect as individual sources. However, recently, the intra-halo light (IHL) model [1] is advocated as the main contribution to the CIB, and our new result of the CIB fluctuation [2] is also supporting this model. In this model, CIB is contributed by accumulated light from stars in the dark halo regions of low-redshift ($z<2$) galaxies, those were tidally stripped by the interaction of satellite dwarf galaxies. Thus, in order to understand the origin of the CIB, both the spatial fluctuation observations with multiple wavelength bands and the absolute spectroscopic observations for the CIB are highly required.

After the successful initial CIBER experiment [3], we are now developing a new instrument CIBER-2 [4], which is a sounding-rocket borne payload comprising a 28.5-cm aluminum telescope and three broad-band, wide-field imaging cameras (Fig. 1). The three wide-field (2.3×2.3 degrees) imaging cameras use the 2K×2K HgCdTe Hawaii-2RG arrays, and cover the near-infrared wavelength range of 0.5–0.9 μm, 0.9–1.4 μm and 1.4–2.0 μm, respectively. Combining a large area telescope with the high sensitivity detectors, CIBER-2 will be able to measure the spatial fluctuations in the CIB after removing foreground point-sources at a >24 AB-mag limit. Additionally, we will use a linear variable filter installed just above the detectors so that a measurement of the absolute spectrum of the CIB is also possible.

In the year of 2014, the conceptual design of the instruments and the development of new technology have been completed. The lens fabrications, the manufacture of the lens barrel, and telescope assembly will be done in the year of 2015, and the performance evaluation test at the LN_2 temperature is also scheduled. CIBER-2 plans at least two flights in the same configuration described here. The first flight is planned for 2016 with the second flight to follow six months or one year later.

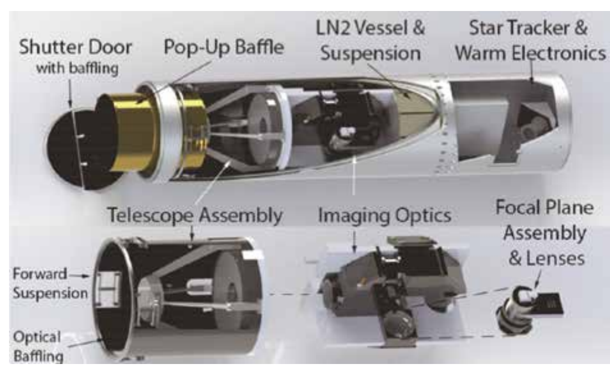

Figure 1: Model of the CIBER-2 instrument. A 28.5 cm Cassegrain telescope directs light into the imaging optics, where beam splitters divide the light into three imaging optics (Arm-S, Arm-M, Arm-L). Each optical path travels to one of three focal plane assemblies, where a broadband filter subdivided the light into two wavelength bands which are both recorded by a single detector array for a total of 6 bands. A small segment of each detector array is also covered by a linear-variable filter. The imaging optics is mounted to an optical bench that connects the Cassegrain telescope assembly to a liquid nitrogen cryostat. Radiative shielding is provided by a radiatively-cooled door and cryogenically-cooled pop-up baffle that extends during observations.

References

[1] Cooray, A., et al.: 2012, *Nature*, **490**, 514
[2] Zemcov, M., et al.: 2014, *Science*, **346**, 6210.
[3] Zemcov, M., et al.: 2013, *ApJS*, **207**, 31.
[4] Lanz, A., et al.: 2014, *Proceedings of the SPIE*, **9143**, 91433N.