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Calibrating the Global Star Formation Rate Indicator at Rest-frame 48 GHz Free-free Emission in z $\sim$ 2 Star-forming Galaxies

The accurate and efficient estimator of the star formation rate (SFR) is a powerful tool to study galaxy formation and evolution. However, such an estimator has proven challenging to derive for high-redshift star-forming galaxies because of the observing limitations: the interstellar dust attenuation in dusty star-forming galaxies at ultraviolet and optical makes it hard to obtain accurate SFRs by using the SFR indicators at these conventional wavelengths, their faintness due to great distances makes it hard to detect them without best-in-class telescopes, and there are often significant contaminating radiation from the jets of active galactic nuclei (AGN; if present) in addition to massive young stars that traces SFR if low-frequency (below rest-frame 30 GHz) is used as an SFR indicator. To avoid these limitations, we introduce a new SFR indicator used for high-redshift star-forming galaxies –free-free emission at high-frequency radio waves beyond rest-frame 30 GHz. Free-free emission (i.e., Bremsstrahlung) is thermal radiation produced by the deceleration of free electrons when are closed to the atoms dominated by positive charges (i.e., protons). Free-free emission and the facilities used to observe it has the potential to alleviate the aforementioned limitations. In the current work, we present the catalog of 32 star-forming galaxies at z = 0.12–2.65. These galaxies were selected within 4.3σ from Ku band (12–18 GHz) observations using the Karl G. Jansky Very Large Array covering 88 square arcminutes on the sky. Moreover, the selected galaxies were matched with the galaxies in the COSMOS2015 catalog (Laigle, C., et al. 2016) providing their accurate redshifts and luminosity at other wavelengths of electromagnetic waves. For further work, the selected galaxies with multi-wavelength information from the COSMOS2015 catalog would play an important role in calibrating the star formation rate indicator at rest-frame 48 GHz.

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