4-Pixel Frequency Multiplied Source For High-Resolution Heterodyne Array Receivers at 1.9 THz

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There are many key tracers of the interstellar medium and the process of star formation in the submillimeter region of the spectrum. Many of these, including C+, N+, CO, and H_2O have been successfully observed with the Herschel HIFI instrument, which was a single-pixel system. The goal now is to develop and demonstrate focal plane arrays that can image extended sources in a reasonable observation time frame. This will provide a major enhancement of capability for high spectral resolution imaging of submillimeter lines with SOFIA and future suborbital and space platforms.

We report on a compact 4-pixel frequency multiplied LO source to enable high-resolution heterodyne receivers at 1.9 THz (see Fig. 1). It consists of a X3X2X3X3 multiplier configuration featuring a 2-way coax power divider to split the signal generated by a Ka-band synthesizer, two Ka-band 30-dB gain power amplifiers with 1-Watt output power. This is followed by two 2-way Ka-band waveguide splitters to divide the power into four signal branches (one per pixel), four 105-120 GHz Schottky diode based frequency triplers based on a novel on-chip power-combined topology providing around 20-25 % efficiency. The final two stages consist of a 225-GHz 4-pixel doubler module with a ~25 % efficiency. Final stage consists of four x9 multiplier blocks consisting of a biasable 650 GHz tripler chip plus a biasless 1.9 THz tripler. Initial test of the LO subsystem showed an output power greater than 5 µW from each pixel when operated at room temperature.

This work will directly benefit the development of future instruments for NASA's.

Stratospheric Observatory for Infrared Astronomy (SOFIA) and sub-orbital platforms, such as the Stratospheric Terahertz Observatory (STO-2).

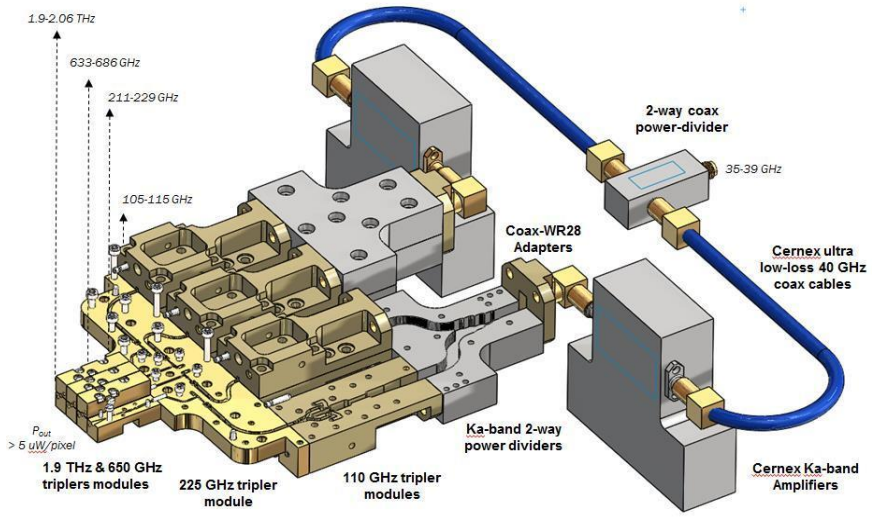

Fig. 1. General CAD scheme of the compact 4-pixel 1.9 THz source.

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