**Compact Submillimeter-wave Multi-Pixel Local Oscillator Sources**

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Many key tracers of the interstellar medium and the process of star formation in the submillimeter region, such as C+, N+, CO, and $H_2O$ have been successfully observed with the Herschel HIFI instrument. HIFI also confirmed the dusty and filamentary nature of the universe with many unanswered questions regarding star formation. While HIFI 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 compact 4-pixel frequency multiplied LO source to enable high-resolution heterodyne receivers at 1.4 and 1.9 THz. The 1.4 THz chain consists of WR-10 amplifier followed by a x2x3x3 configuration. The laboratory version of the chain is shown in Figure 1. The final stage tripler has been fabricated with a bias-able device. The bias can be used to further optimize output power (see Figure 2) but more importantly can be used to adjust the output power to optimized HEB pumping. The output from the 4-pixels as measured at room temperature is shown in Figure 3.

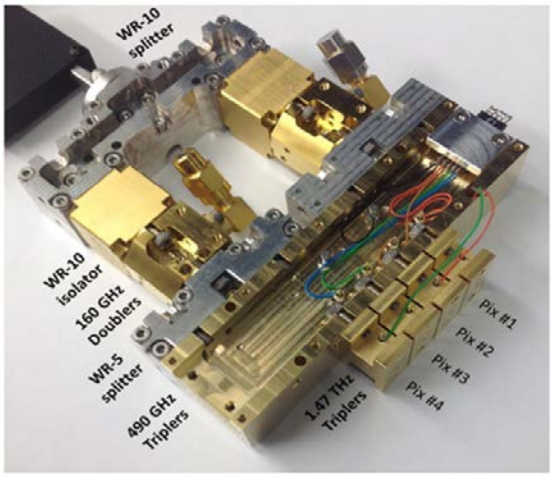


Figure 1: A 4-pixel LO chain to 1.47 THz has been demonstrated.

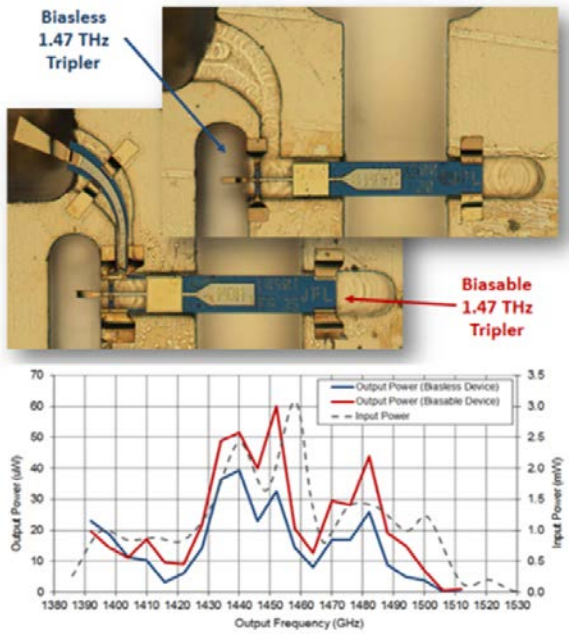


Figure 2: A Bias-able last stage multiplier allows for optimization and dynamic control.

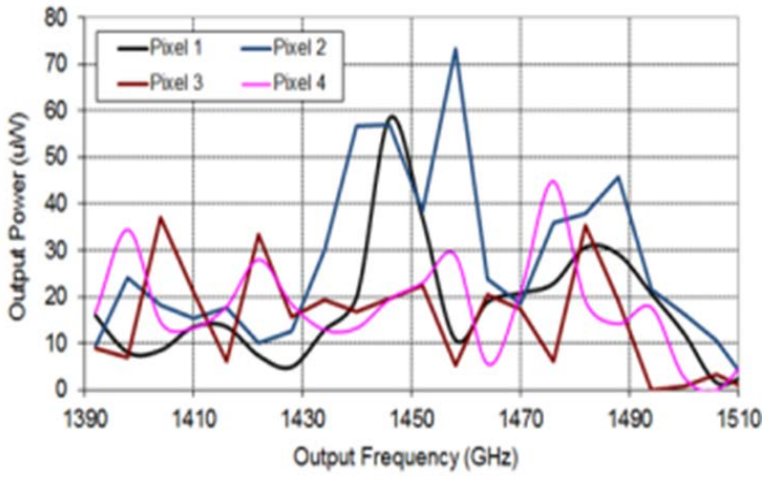


Figure 3: All 4-pixels provide sufficient power to pump hot electron mixers.

The 1.9 THz consists of Ka-band (30-40 GHz) synthesizer and power amplifiers followed by a X3X2X3X3 multiplier configuration. The block diagram is shown in Figure 4. It features a 2-way coax power divider to split the signal generated by the 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. Room temperature results measured from this chain are shown in Figure 5 and it has been successfully used to pump HEB based mixers.

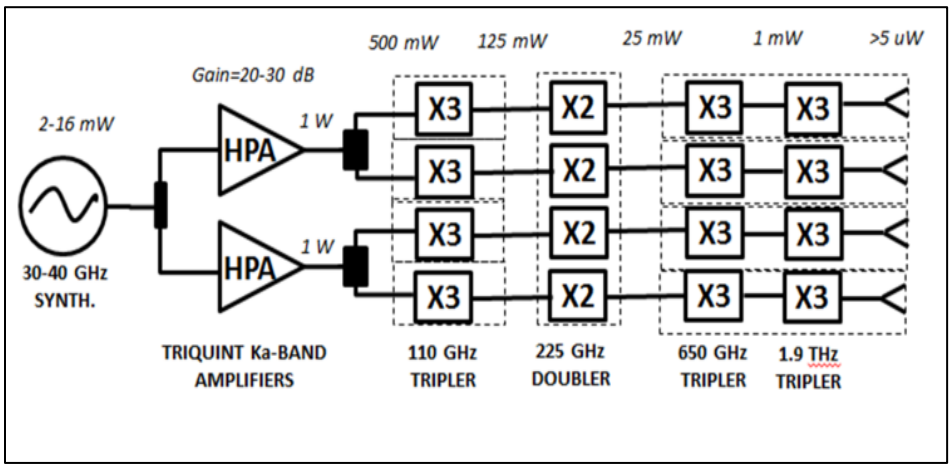


Figure 4: Block diagram of the 4-pixel 1.9 THz LO chain.

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).

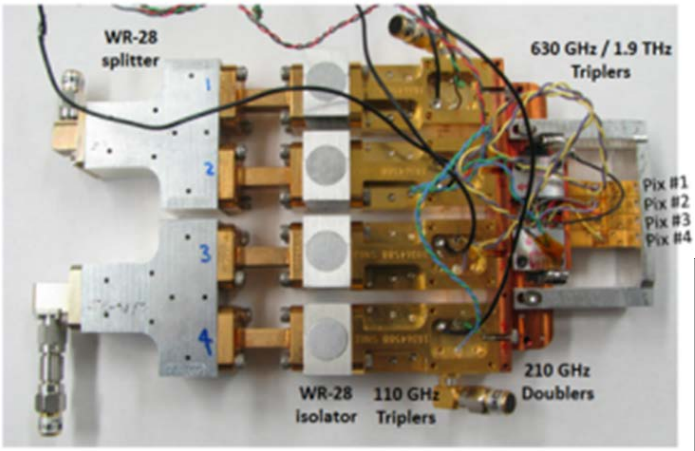


Figure 5: Laboratory model of the 4-pixel 1.9 THz LO chain.

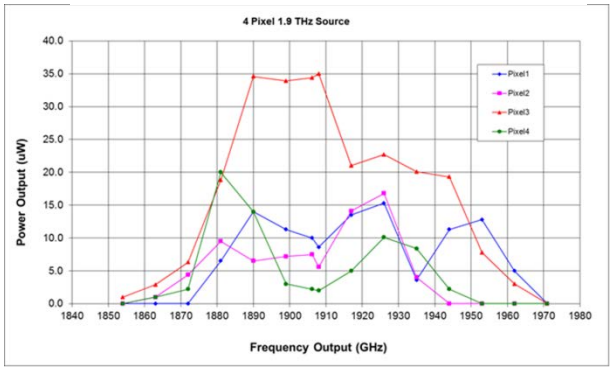


Figure 6: Measured room temperature performance of the 1.9 THz 4-pixel chain.

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