

# Photonic local oscillators for terahertz radio astronomy

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## Abstract

We report on recent improvements of photomixing technology and the realization of a photonic local oscillator (LO) at 1.05 THz for the Atacama Pathfinder Experiment (APEX) radiotelescope in the Atacama desert, Chile. Experiments with state-of-the-art photomixers operated in a cryogenic environment demonstrate pumping of an astronomical heterodyne receiver at 1050 GHz with a superconductor-insulator-superconductor (SIS) mixer. The system noise temperature of the heterodyne receiver was compared with that of the same system using a conventional solid-state LO, revealing similar noise temperatures. A self-made optical comb generator served as a relative frequency reference to which one laser was phase-locked. Under the phase lock condition, the 3 dB linewidth of the THz signal was below 3 KHz and could be continuously tuned within a range of 500 MHz -the overall tunability of the system was determined by the photomixer antenna resonance bandwidth, which was roughly 200 GHz. We installed the laser system in the telescope pedestal, whose output, the frequency-stabilized laser signal, was fed into the photomixer through a 20 meters long single-mode fiber optic.

In addition, preliminary results achieved with photomixers at 2.5 THz will be reported. The work on these devices is aimed for the implementation of a photonic LO in the GREAT instrument onboard of the Stratospheric Observatory for Infrared Astronomy (SOFIA).