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Title:First in-field application of a full photonic local oscillator to terahertz astronomy

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Abstract:This letter reports on our recent improvements in photomixing technology for the realization of a photonic local oscillator (LO) at 1.05 THz for the Atacama Pathfinder Experiment (APEX) radio telescope. Experiments with state-of-the-art photomixers, operated at room temperature and in cryogenic environment demonstrate successful operation of an astronomical heterodyne receiver at 1050 GHz with a superconductor-insulator-superconductor (SIS) mixer. The system noise temperature of the heterodyne receiver pumped by the photonic LO was at least as low as that using a conventional solid-state LO in the same receiver system. An optical comb generator served as a relative frequency reference to which both lasers were 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, from there, the frequency-stabilized laser signal, was fed into the photomixer, installed in the Nasmyth cabin of the telescope, through a 20 meters long single-mode fiber optic. © 2012 IEEE.

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Main heading:Laser mode locking

Controlled terms:Astronomy - Monolithic microwave integrated circuits - Optical telescopes - Radio receivers - Single mode fibers

Uncontrolled terms: Antenna resonance - Atacama pathfinder experiments - Cryogenic environment - Heterodyne receivers - In-field - Laser signals - Laser systems - Phase lock -Photomixers - Photomixing - Photonic local oscillator - Receiver system - Relative frequencies -Room temperature - Single-mode fiber optics - Superconductor-insulator-superconductor mixers -System noise - Tera Hertz - Terahertz photomixing - Terahertz sources - THz signal - Tunabilities

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