Advancing local terahertz oscillators to enable cosmic observations

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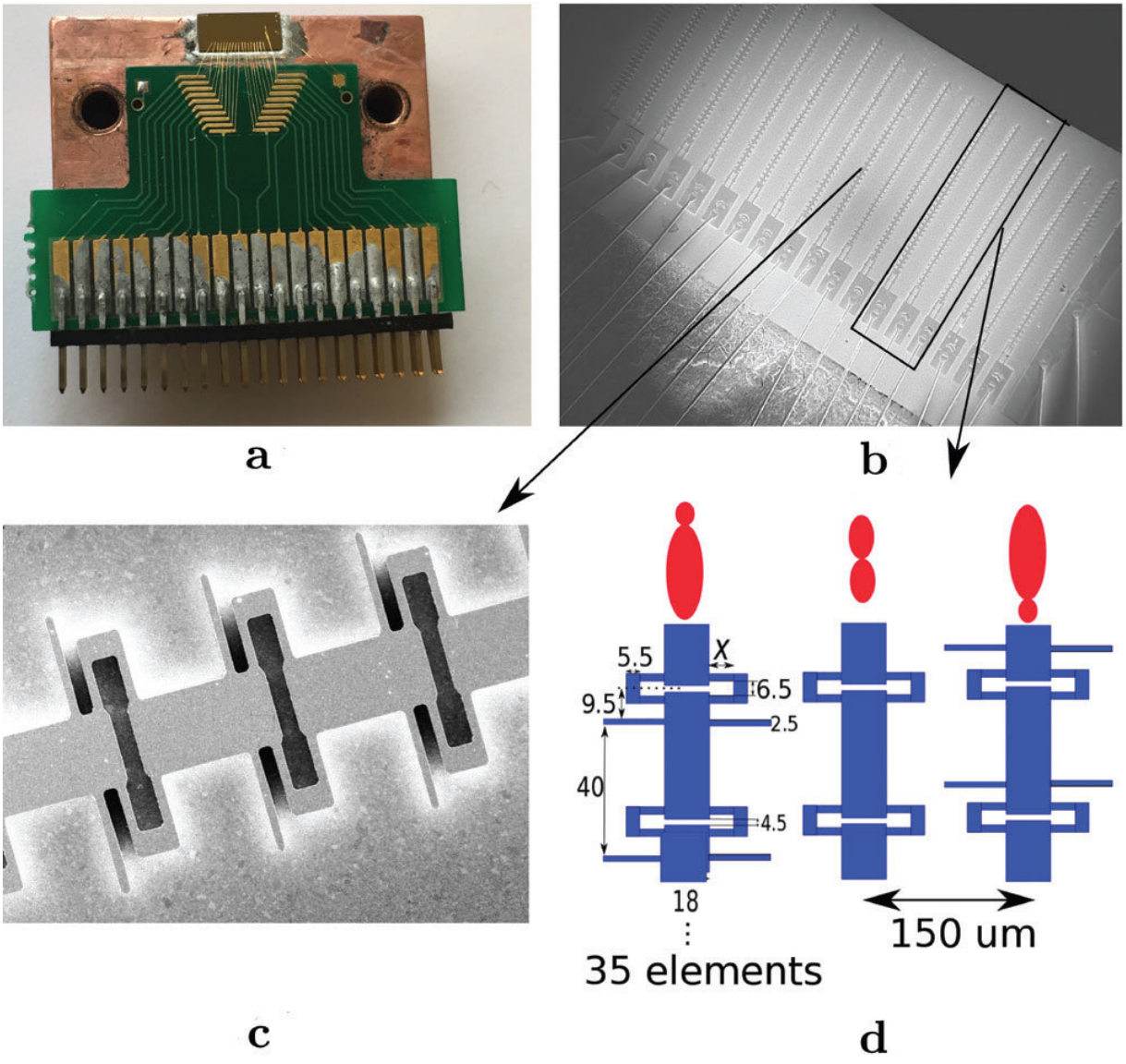

The figure above shows: (a) an array of 3rd-order DFB lasers gold wire bonded to an electronic chip, (b) a photo of a fabricated array of DFB triplets, (c) scanning electron microscope image of a DFB device showing three periods, and (d) a schematic of a triplet with the corresponding radiation profile. Credit: NASA

NASA is developing a new type of detector that will provide insight into the formation and structure of the universe. Many of the radiative and mechanical interactions that shape the interstellar medium of galaxies and drive galactic evolution (e.g., shock waves from stellar winds and jets, supernova explosions, etc.) are best observed in the 4.744 terahertz (THz) spectral region for the oxygen line. Observations of this spectral line have rarely been performed, however, because the 4.744-THz frequency is beyond the reach of most existing local oscillators that operate in heterodyne receivers sensitive enough to make such observations. A NASA-sponsored team at Massachusetts Institute of Technology (MIT) is working to advance technologies that will enable upcoming NASA missions to include receivers that observe this important spectral line.

Heterodyne detection compares the incoming light signal with a reference light from a local oscillator (LO). Key challenges of this project are to increase the LO output power from the currently achievable level of