345 GHZ RADIATION FROM A QUASIOPTICAL JOSEPHSON OSCILLATOR

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At 345 GHz, 0.7 μW has been detected from an 24 × 116 array of Josephson junctions fabricated using Hypres's standard niobium process. The power is radiated directly into free space above the surface of the two-dimensional array of junctions. Detection is made by a commercial bolometer in a separate cryostat from the one which cools the array to 4.2 K. The junctions in the array are closely spaced in the y-dimension, but spaced by more than one-half wavelength in the x-direction. This asymmetry results in mutual phase-locking between adjacent junctions suitable for the production of y-polarized radiation. Microwave models show that this array geometry presents a low antenna impedance which favors efficient coupling from the junction to free-space radiation.

The design of the 345 GHz array is very close to a two-times scaling of an array reported at the 1994 THz Symposium.[1] In particular, the horizontal and vertical spacing between junctions in the array is half as much in the 345 GHz array as in the previously reported 190 GHz array. Since the total area of the two arrays, 3 x 3 mm, is about the same, the 345 GHz array includes about 4 times as many junctions as the 190 GHz array. At least for this factor of two, scaling has worked approximately as follows: half the spacing horizontally and half the spacing vertically result in 4 times as many junctions, oscillating at twice the frequency, emitting twice the power. This result is quite encouraging towards the possibilities of further frequency and power increases through further reduction of vertical and horizontal spacing in a future array.

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[1]Wengler, Guan, and Track, "190 GHz Radiation from a Quasioptical Josephson Junction Array," *IEEE Trans. on Microwave Theory and Techniques*, **vol. 43**, April, 1995, in press.