

## Harmonic Gyrotrons at 94 GHz

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20-100 kW, 94 GHz, s=2-8 harmonic gyrotrons utilizing both MIG and Cusp electron guns are being developed at a new facility at UCD. The initial experiment will test a 50 kW, sixth-harmonic slotted gyrotron with a predicted efficiency of 20% that is driven by a 70 kV, 3.5 A,  $v_{\perp}/v_z=1.5$ , axis-encircling electron beam from a Cusp gun on order from Northrop Grumman. For a fixed ratio of Larmor radius to inner vane radius, slotted gyrotrons are fairly insensitive to the electron energy. The operating voltage was chosen for favorable beam propagation. Designs will also be presented for other planned 94-GHz high-harmonic gyrotrons with axis-encircling electron beams:

a 4th-harmonic, 35 kW, 14% efficient, smooth-bore TE<sub>41</sub> gyrotron; a 4th-harmonic, 75 kW, 30% efficient, slotted gyrotron; and an 8th-harmonic, 22 kW, 9% efficient, slotted gyrotron.

The 8th-harmonic device is of considerable interest because its magnetic field can be supplied by a lightweight permanent magnet. In addition, the high-T<sub>c</sub> superconducting magnet and predicted characteristics will be described for a 25 kW, second-harmonic TE<sub>02</sub> gyrotron using a 25 kV, 4 A,  $v_{\perp}/v_z=1.5$ , MIG electron beam with a predicted device efficiency of 25%.

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