

## MODELING AND OPERATION OF AN EDGE-OUTCOUPLED FREE-ELECTRON LASER

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### *Abstract*

We report on the design, and broadly tunable operation, of a high average power free-electron laser using edge-outcoupling. For this type of outcoupling, the cavity mode has a larger area than the mirror diameter, and the mode ‘spills’ around it. While used in positive branch unstable resonators, in this case, the resonator was in a stable configuration. Using an edge-outcoupler composed of an aluminum-coated sapphire substrate, the IR Upgrade FEL at Jefferson Lab achieved a maximum power of 260W at 3.87 microns, with an output power of 20 W or higher from 0.8 to 4.2 microns. Measurements of gain, loss, and output mode are compared with our models.

**CONTRIBUTION NOT  
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