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THEORETICAL STUDY OF INJECTION-LOCKED GYROTRON BACKWARD WAVE OSCILLATORS

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The injection locking technique has been applied on the experiment of gyrotron backward wave oscillator (gyro-BWO) for phase control and spectral purity. The efficiency of the gyro-BWO was considerably enhanced when it was locked by an injected signal, which has never been thorough examined in the locked oscillator. Therefore, the physics underpinning is still unclear. A stationary model with modified boundary conditions was applied on studying the phenomena. The numerical results show that the injected power is absorbed by the electron beam when the oscillator is locked, then relative phases between the electrons and the wave are adjusted to increase the time the bunched electrons staying in the phase of losing energy, thus enhance the efficiency of the gyro-BWO. The various detuning determined by tuning the beam voltage or the external magnetic field is another critical factor to affect the efficiency enhancement of the locked oscillators, in addition to the power and frequency of the injected signal. The detailed results will be presented in the paper.

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NEW EXPERIMENTAL RESULTS FROM a 1.5 MW, 110 GHz GYROTRON AT MIT

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Recently, the 1.5 MW, 110 GHz gyrotron with a new cavity has been tested at MIT. The new cavity (V-2005) significantly reduces Ohmic loss and, therefore, it is very promising for CW operation of a gyrotron. The gyrotron with the new cavity has been tested in the axial configuration. The maximum power is 1.67 MW in the design mode $TE_{22,6}$, and the corresponding efficiency is 42 %, which is consistent with theory. The detailed gyrotron simulations using the code MAGY, developed by the Univ. Maryland and the Naval Research Lab, will be presented. Also new results from the gyrotron including an internal mode converter and a depressed collector incorporated to increase the efficiency will be discussed.

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