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Minimizing the Lasing Frequency Fluctuations Arising from Temperature Variations in Terahertz Quantum Cascade Lasers CHRISTOPHER BAIRD, MARISSA LAFFERTY, West Texas AM University — A terahertz quantum cascade laser (QCL) is designed to emit coherent terahertz radiation. We built and validated numerical code that calculates the electron wavefunctions, energy levels, and lasing frequency for any QCL structure when the space charge, doping, and temperature effects are included. The code accomplishes this by self-consistently solving the Schroedinger, Poisson, space charge, and doping equations. The laser power of terahertz QCL's is limited by internal thermal effects. We therefore used our code to determine how small changes to the QCL structure can reduce the lasing frequency fluctuations across a range of lattice temperatures from 50 K to 150 K. Less lasing frequency fluctuation indicates a structure that is more resistant to thermal effects. The structure used in this project is known as the 2.9 THz Barbieri structure. The small changes consisted of varying the width of the first quantum well from 80% to 120% of its original width. The first well was chosen because this is the well where much of the lasing and the detrimental thermal effects occur. We found that the lasing frequency fluctuation across different temperatures can indeed be reduced, helping to develop structures that are more resistant to thermal effects.

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