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Developing a Python-based Computational Model for Photoluminescence from a single, strained InGaAs/GaAs Quantum Well.[1] JOHARI DRAMIGA, TONI SAUNCY[2], Texas Lutheran University — An empirically obtained relationship, the Varshni Equation, has been successfully used to model the temperature dependence of photoluminescence for most bulk semiconductor materials. However, for quantum wells, the model does not show good agreement with observations in many cases. Using python, the photoluminescence emission of a single, strained InxGa1- xAs/GaAs quantum well has been modeled. The model accounts for variations in x (In mole fraction) in the alloy material, and differences in the temperature dependence of the lattice constant in each material, to determine the compressive strain present in the well layer. First order elastic theory is used to understand the role of that strain on the InxGa1-xAs band structure. Vegard's Law was used to interpolate material parameters for the InxGa1-xAs alloy. Standard finite square well solutions are used to determine quantum confinement within the well to determine initial and final electron transition states and includes temperature dependence of the barrier and well band gaps. The model then loops through temperature steps to produce a model of the PL emission as a function of temperature. The model output was compared to experimental data for several well widths and In mole fraction and has successfully demonstrated observed subtleties in the low temperature (<30K) temperature range.

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