

exercise: A 2D square lattice possessing a weak periodic potential

Consider a square lattice in two dimensions having a lattice constant of $[a]$ with a crystal potential $U(x, y) = -4UCos(\frac{2px}{a})Cos(\frac{2py}{a})$. Using Fourier analysis and determining which reciprocal lattice vectors fulfill the condition for Bragg reflection of electron waves, find approximately to first order the energy gap (E_g) at the corner point $(\frac{p}{a}, \frac{p}{a})$ of the first Brillouin Zone.