Computational Electronics: Scattering

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1. Derive and expression for the polar angle after scattering for ionized impurity scattering and for polar optical phonon scattering for parabolic bands.

2. As discussed in lecture notes, updating the carrier momentum after scattering is most easily accomplished in the rotated coordinate system. The rotated *x*-axis is related to the original *x*-axis by $\hat{x}_r = Y_\theta Z_\phi \hat{x}$, where Y_θ describes a rotation of θ about the *y*-axis, and Z_ϕ describes a rotation of ϕ about the *z*-axis. The angles θ and ϕ represent the polar and the azimuthal angles of the carrier momentum in the original coordinate system before the scattering event.
   (a) Calculate the rotation matrices Y_θ and Z_ϕ.
   (b) If the azimuthal and the polar angles after the scattering event in the rotated coordinate system are α and β, and the scattering process is elastic, calculate the wavevector components along the principal axes in the original coordinate system after the scattering event.