Phys 652 Winter 2024

Worksheet # 5

Friday, February 2, 2024

Name

Questions (5 pts):

As we discussed last time, for the matrices $R_{\mathbf{n}}$ representing geometrical rotations around an axis **n** by a small angle ε the following relation is valid:

$R_x(\varepsilon)R_y(\varepsilon) - R_y(\varepsilon)R_x(\varepsilon) = R_z(\varepsilon^2)$ -1

Using this relation, as well as direct correspondence between $R_{\mathbf{n}}$ and the QM rotation operator $D(\mathbf{n},\varphi)$ and the fact that for small angles ε the operator $D(\mathbf{n},\varepsilon)$ is:

$D(\mathbf{n},\varepsilon) \approx 1-(i/\hbar)\,(\mathbf{J}\cdot\mathbf{n})\varepsilon +(1/2)(i/\hbar)^2((\mathbf{J}\cdot\mathbf{n})\varepsilon)^2$,

derive the commutation relations for the angular momentum operators J_i.