PHYS2210 Homework Problem 41

Problem 41) Townsend 6.09

6.9. The spherical harmonic $Y_{0,0}$ is an eigenfunction of $L_{z\,\mathrm{op}}$ with eigenvalue 0. Show it is also an eigenfunction of $L_{x\,\mathrm{op}}$ and $L_{y_{\mathrm{op}}}$ with eigenvalue zero as well. Thus for $l = 0$, all three components of the orbital angular momentum are zero simultaneously. Is this consistent with the uncertainty relation

$$\Delta L_x \Delta L_y \geq \frac{\hbar}{2} |\langle L_z \rangle|$$