## Quantum Calculations on a Ring III

Consider the following normalized abstract quantum state on a ring:

$$
\Phi(\phi)=\sqrt{\frac{8}{5 \pi r_{0}}} \cos ^{3}(2 \phi)
$$

1. If you measured the $z$-component of angular momentum, what is the probability that you would measure $2 \hbar$ ? $-3 \hbar$ ?
2. If you measured the $z$-component of angular momentum, what other possible values could you have obtained with non-zero probability?
3. If you measured the energy, what possible values could you have obtained with non-zero probability?
4. What is the probability that the particle can be found in the region $0<\phi<\frac{\pi}{2}$ ?
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