## 12. Exam Hints

Equations used in examples sheet, for example the $J_+$ ladder operator, will have to be memorized.

Derivations to remember:

- Evolution in time of expectation values
  $\frac{d\langle A\rangle}{dt} = \left\langle \left[ \hat{A}, \hat{H} \right] \right\rangle$
- Evolution in time of conservative systems
  $\psi(x,t) = \sum_n \varphi_n e^{-\frac{i}{\hbar}E_n t}$
  $H\varphi_n = E_n \varphi_n$
- Anomalous Zeeman Effect
- Strong field
  $\langle H_m \rangle = \beta_B B(m_e + 2m_s)$
- Weak field
  $\langle H_m \rangle = \mu_B B g m$
- Perturbation theory
  $E_n' =$ , $\varphi_n' =$