Lecture 20

Entangling electrons and photons

Quantum dot in excited "trion" state (2 electrons + 1 hole)

- decays to electron + photon; photon observed along z-axis
- eigenstates of $\widehat{S}_z$ emit circularly polarised photons
- decay represented by operator $\widehat{Q}$

$$\widehat{Q}\alpha_{Tz} = \beta_z C_R \qquad \widehat{Q}\beta_{Tz} = \alpha_z C_L$$

Dot in magnetic field along x-axis

- energy eigenstates are eigenstates of $\widehat{S}_x$
- decay to entangled states

$$\begin{aligned}\widehat{Q}\beta_{Tx} &= \frac{1}{\sqrt{2}}\left(\beta_z C_R - \alpha_z C_L\right) \\ &= \frac{1}{\sqrt{2}}\left(-\beta_x V + \mathrm{i}\alpha_x H\right)\end{aligned}$$