

### 1 Spin-1/2 Time Dependence Practice

Two electrons are placed in a magnetic field in the  $z$ -direction. The initial state of the first electron is  $\frac{1}{\sqrt{2}} \begin{pmatrix} 1 \\ i \end{pmatrix}$  and the initial state of the second electron is  $\frac{1}{2} \begin{pmatrix} \sqrt{3} \\ 1 \end{pmatrix}$ .

- (a) Find the probability of measuring each particle to have spin-up in the  $x$ -,  $y$ -, and  $z$ -directions at  $t = 0$ .
- (b) Find the probability of measuring each particle to have spin-up in the  $x$ -,  $y$ -, and  $z$ -directions at some later time  $t$ .
- (c) Calculate the expectation values for  $S_x$ ,  $S_y$ , and  $S_z$  for each particle as functions of time.
- (d) Are there any times when all the probabilities you have calculated are the same as they were at  $t = 0$ ?