University of California at San Diego – Department of Physics – Prof. John McGreevy

Quantum Mechanics C (130C) Winter 2014
Midterm exam front page

Thursday, February 13, 2013, 11am-12:20pm

Please remember to put your name on your exam booklet. This is a closed-book exam. There are 4 problems, each with several parts, of varying levels of difficulty; make sure you try all of the parts as there are many opportunities for partial credit. None of the problems require very extensive calculation; if you find yourself involved in a morass of calculation, step back and think. Good luck.

Possibly useful information:

$$\boldsymbol{\sigma}^x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad \boldsymbol{\sigma}^y = \begin{pmatrix} 0 & -\mathbf{i} \\ \mathbf{i} & 0 \end{pmatrix}, \quad \boldsymbol{\sigma}^z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$|\uparrow_{\check{n}}\rangle = e^{-\mathbf{i}\varphi/2}\cos\frac{\theta}{2}|\uparrow_{\check{z}}\rangle + e^{+\mathbf{i}\varphi/2}\sin\frac{\theta}{2}|\downarrow_{\check{z}}\rangle \;\text{ satisfies }\; \vec{\boldsymbol{\sigma}}\cdot\check{n}|\uparrow_{\check{n}}\rangle = |\uparrow_{\check{n}}\rangle$$

$$e^{-i\alpha\check{n}\cdot\vec{\boldsymbol{\sigma}}} = \mathbb{1}\cos\alpha - i\check{n}\cdot\vec{\boldsymbol{\sigma}}\sin\alpha.$$