

# Exam Report

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**Module Code/Title: Advanced Quantum Physics (PHYS6003)**

**Module Leader: Dr Andrew Akeroyd**

*Feedback comments:*

The average score was about 54%.

A1: Answered well in general, although some still not understanding that an operator acting on a ket is still a ket. A2: Answer can be found on p29 of handwritten notes. A few derived it in a different way. A3: Was the most difficult (unseen) one, which was only answered correctly by a few. First relate the two eigenbases using a unitary transformation and then makes use of the spectral decomposition. A4: Solution can be found on p52 of the handwritten notes. Many attempts contained faulty steps in the working, which (erroneously) led to the correct answer. A5: Generally answered well. Some forgot to normalise the state vector.

B1: In part b), the eigenvectors and eigenvalues can be written down immediately since the matrix  $S^2$  is just proportional to the identity matrix, and so all states in the vector space are eigenvectors with eigenvalue  $3\hbar^2/4$ . Several answers tried to derive the eigenvectors/eigenvalues by the standard formalism, and made mistakes in doing so. The answer to part c) is "no", and the explanation is on p85 of the handwritten notes. The answer to part d) can be found on p93 of the handwritten notes. Part e) was done quite well by most, but marks were lost for not realising that a and b are complex numbers.

B2: Marks were quite low for this question. The answer can be found on p103 of the handwritten notes, and requires the successive application of the lowering operators to both sides of the equality  $|1,1\rangle = |1/2\rangle|1/2\rangle$ .

B3: Fewer attempts at this one, but marks were quite good. Answers on p105-> p108 of notes.