Introduction to Quantum Mechanics 1 Quiz 3

Name:

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Suppose that a system can be described either by measurements of property A, or of property B, or of property C. That is, knowing the value of A = a', or of B = b', or of C = c' fully specifies the state of the system, so that knowing the value of A precludes us from knowing the value of B, etc. Using the completeness of the C measurement symbols,

$$1 = \sum_{c'} |c'c'|,$$

derive the composition property of transformation functions,

$$\langle a'|b'\rangle = \sum_{c'} \langle a'|c'\rangle \langle c'|b'\rangle.$$

From this, work out the value of

$$\sum_{c'} |\langle a' | c' \rangle|^2.$$

Solution:

$$\langle a'|b'\rangle = \langle a'|\sum_{c'}|c'\rangle\langle c'||b'\rangle = \sum_{c'}\langle a'|c'\rangle\langle c'|b'\rangle$$

Put b' = a':

$$\langle a'|a'\rangle = 1 = \sum_{c'} \langle a'|c'\rangle \langle c'|a'\rangle = \sum_{c'} |\langle a'|c'\rangle|^2.$$