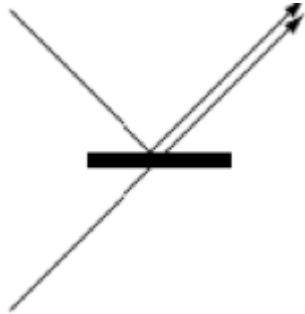


Assignment 6

1) The celebrated Hong-Ou-Mandel interferometric effect (http://en.wikipedia.org/wiki/Hong-Ou-Mandel_effect) shows that two single photons impinging from either side of a balanced beam splitter team up in one path and the other (being an interference effect this obviously assumes that the photon wave functions, the photons pulses, overlap). The original paper can be found here: http://prl.aps.org/abstract/PRL/v59/i18/p2044_1.

a) Show that the two photons do indeed team up. In other words, show that only the first two options are realized:



and ('and' = in superposition with)

but not **!**

b) Check for the photon number in either channel, i.e. determine the expectation values of the number operators $\langle N_{a_1} \rangle$ and $\langle N_{b_1} \rangle$. Explain why you get the value '1' in either case.

c) Determine the expectation values of the product of the number operators $\langle N_{a_1} N_{b_1} \rangle$.

Explain your result.

2) Consider the Elitzur-Vaidman bomb-testing setup:

a) Check for the photon number in either channel, i.e. determine the expectation values of the number operators $\langle N_{a_1} \rangle$ and $\langle N_{b_1} \rangle$. Explain why you get the value '1/2' in either case.

b) Determine the expectation values of the product of the number operators $\langle N_{a_1} N_{b_1} \rangle$.

Explain your result.

*Solution (to be submitted via email until Monday 8.March 2011 12:00h): to
O.Steuernagel@herts.ac.uk*

**Email subject line: lastname.firstname.6.mws
as in: steuernagel.ole.6.mws**

Do only submit *mws* and *pdf* files...

Name all of your submitted files:

lastname.firstname.6a/b/c.mws/pdf...

Note! Remove output before sending file (ALT-E V W)

*You can only expect full marks if you submit an executable file that works
throughout and gives the correct result.*

*Please do not expect me to debug your code or try to "see" what you might have
intended to program.*

*I will only be able to run your program and mark the output. Keep your answers
brief and meaningful.*