

PHYS 512

Assignment – 01 $\langle Quantum | Computing \rangle$

Due Sunday Sep 01 – 11:59 pm (NO late submission)

Submit the solutions of Question 1, 2, and 4 (You are strongly encouraged to solve all of them)

Please clearly write down your ID and PHYS 512 - Assignment – 01 on the submitted solution

Q.1 *Quantum Hardware* (Qubits) [3]

Name different quantum hardware options under consideration.

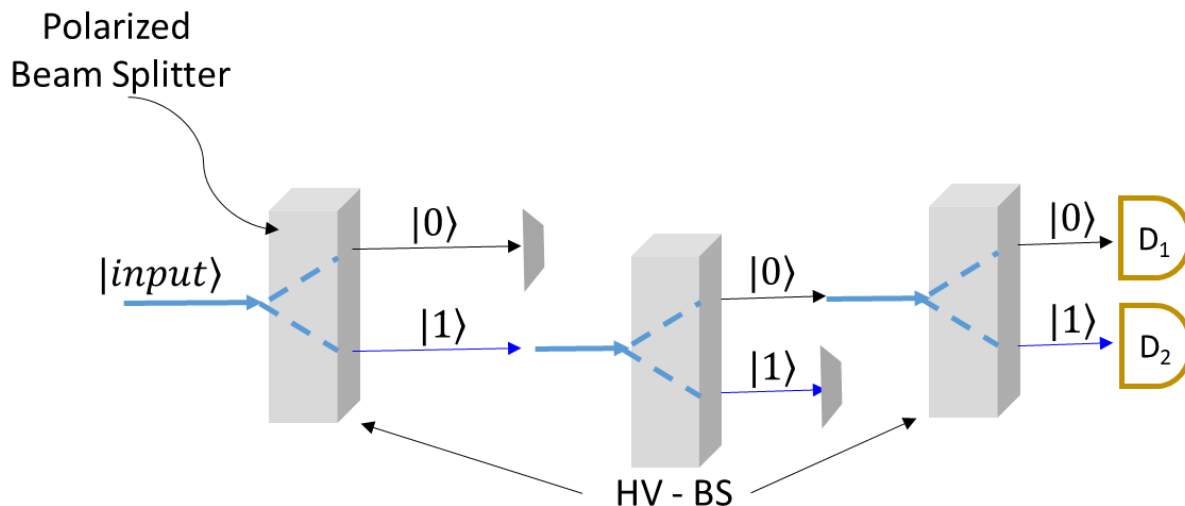
Q.2 *Photonic Qubits* [6]

(a) If the $|input\rangle$ states, in the figure given below is

(i) $|0\rangle$

(ii) $|1\rangle$,

Find the probabilities of clicking detectors D_1 and D_2 . **Clearly show the state of the system at each BS** before you calculate the final probability. (HV-BS is a not 50-50 beam splitter)



Q.3 Photonic Qubits [6]

If the $|\text{input}\rangle$ state in the figure given below is

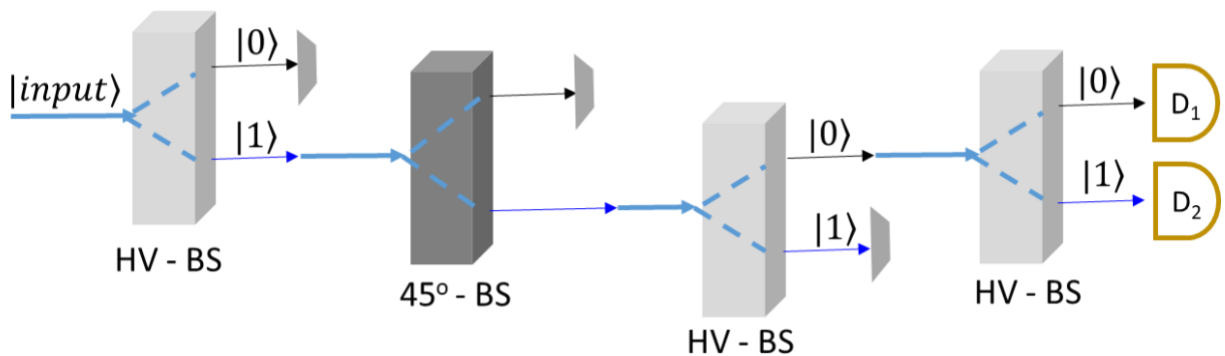
(i) $|0\rangle$

(ii) $|1\rangle$

Find the **probabilities of clicking** detectors D_1 and D_2

Clearly show the state of the system at each BS before you calculate the final probability.

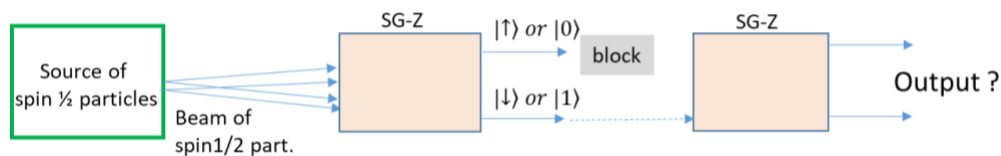
(Functioning of 45° -BS is same as given in slides).



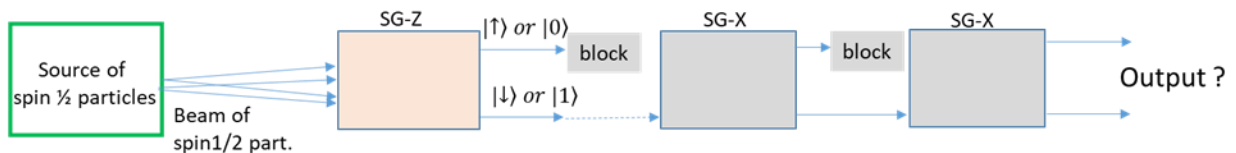
Q.4 Spin Qubits [12]

Write down all the unknown outputs of each SG-X/Z boxes in all three given arrangements of SG experiments. Further write down the probability of final output as well, assuming 100 % is at left of first SG-Z box.

(a)



(b)



(c)

