

PHYS 512- *Solution*

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.

Solution

Superconducting quantum circuit, Ion trap, Semiconductor spin qubit, NV center in diamond, Photonic system

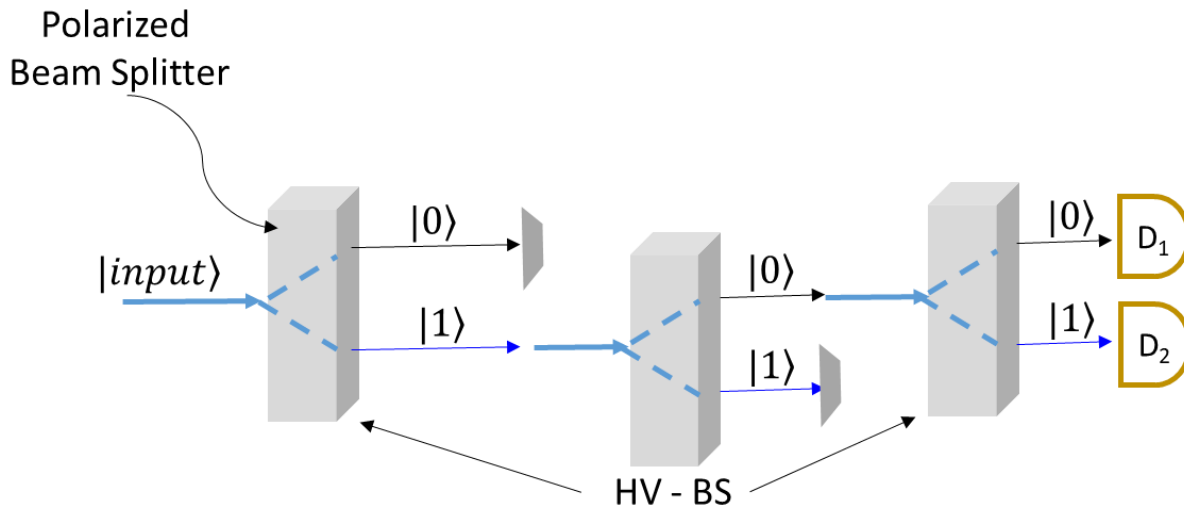
Q.2 Photonic Qubits [6]

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

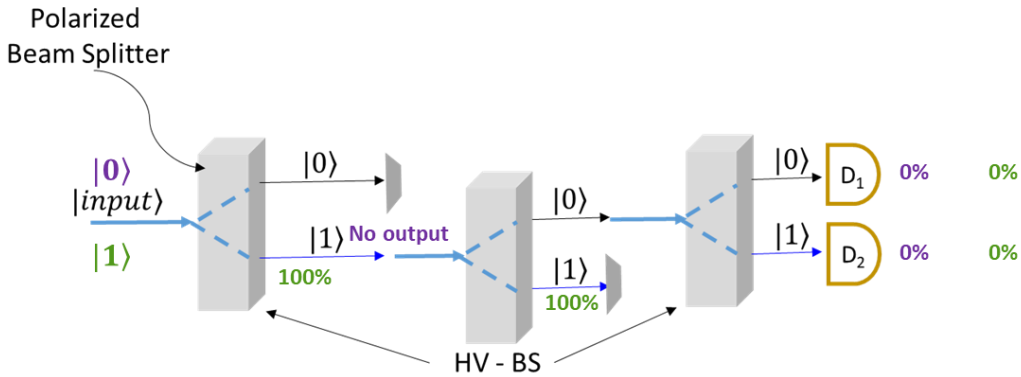
(i) $|0\rangle$

(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)



Solution



Q.3 Photonic Qubits [6]

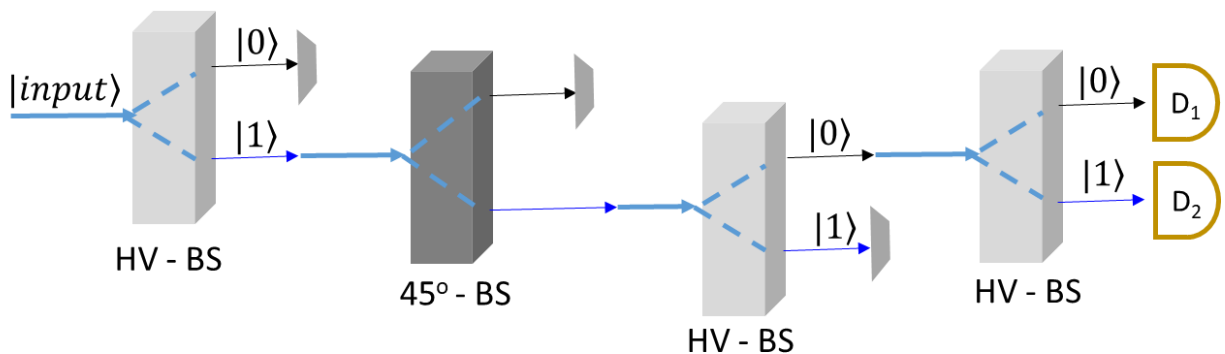
If the $|input\rangle$ state in the figure given below is

(i) $|0\rangle$

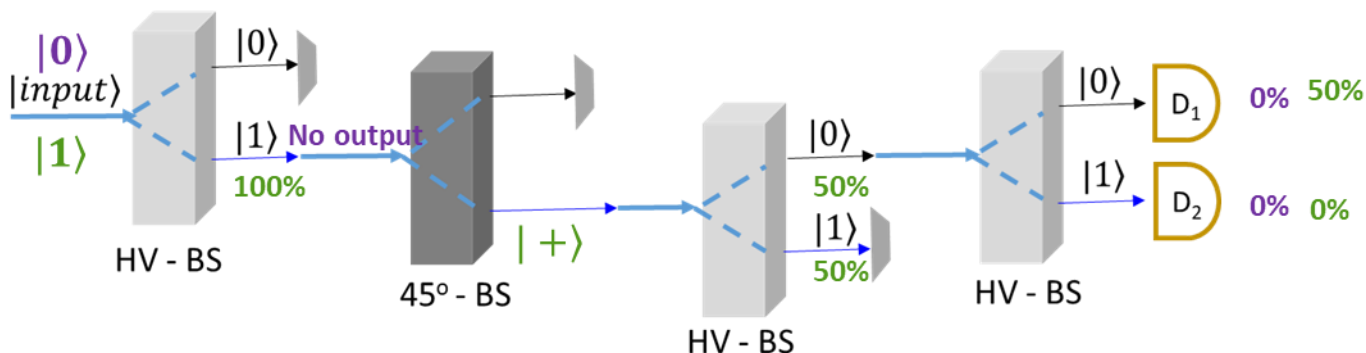
(ii) $|1\rangle$

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).



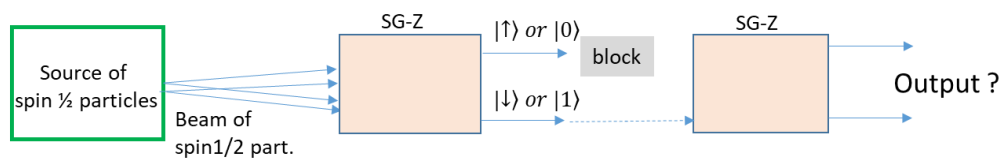
Solution



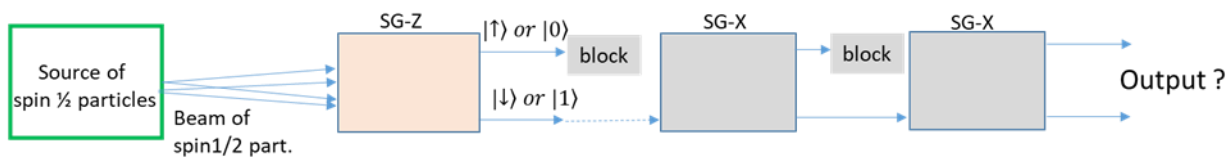
Q.4 Spin Qubits [12]

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.

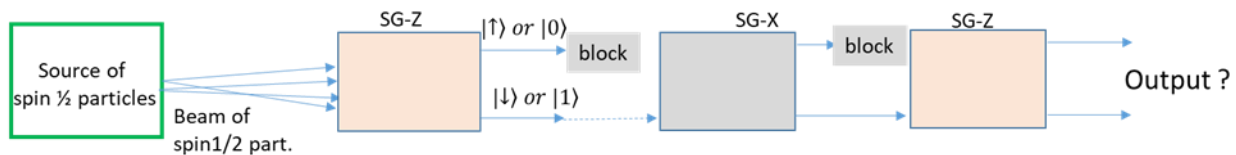
(a)



(b)



(c)



Solution

