Unit 10 - Week - 8 Implementing QC using Ion Traps and revisiting concepts

Course outline

How to access the portal

Week - 0

Week 1 - Introduction

Week 2 - Glimpse of Quantum Informatics

Week 3 - Quantum Algorithms

Week 4 - NMR Quantum Computing

Week 5 - Critical optical tool for QC " LASERS "

Week 6 - Linear Optical approach towards Quantum Computing

Week 7 - Approaches other than Linear approaches to " QIQC "

Week - 8 Implementing QC using Ion Traps and revisiting concepts

- Lecture 23 - Basics of Ion Traps
- Lecture - 24 Applications of Ion Traps in " QIQC "
- Lecture 25 - Reviewing Concepts and clarifying problems - 1
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- Week 8 - Feedback Form
- Assignment - 8 Solution

Week 9 - Various Aspects of Qubits in Action

Week 10 - Justifying Implementation Aspects from the Basics

Week 11 - Importance of Density Matrix in Quantum Computing Implementation

Week - 12 - An Overview of the Implementation of Quantum Computing

Assignment-8

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-09-25, 23:59 IST.

1) An ion trap works by trapping ions in an oscillating electric field. The electrodes in ion traps *1 point*

- are two,which gives rise to the necessary pulsed infrared radiation for trapping ions
- are four, which gives rise to the necessary radial radio frequency field for trapping ions
- are enough in number to give rise to the necessary optical field for addressing the trapped ions
- are four in number that gives rise to the necessary quadrupole field for trapping ions

No, the answer is incorrect.
Score: 0
Accepted Answers:
are four in number that gives rise to the necessary quadrupole field for trapping ions

2) Scaling of ions trap quantum computer is difficult. This is because as the number of trapped ions for computing is increased *1 point*

- more motional-modes become possible leading to "greater noise". also, the ion string gets heavier and the gates get slower
- the gates get faster with heavier ion string
- more motions possible leading to "lesser noise"
- the ion trap based quantum computing becomes classical

No, the answer is incorrect.
Score: 0
Accepted Answers:
more motional-modes become possible leading to "greater noise". also, the ion string gets heavier and the gates get slower

3) *1 point*

Ion trajectories inside an ion trap that are trapped in an oscillating electric field are stable if and only if the amplitude and frequency of the oscillating electric field are correct. Most common ion(s) used in successful trapped ions used for quantum computing are:

- Be^+
- Hg^+, Yb^+, NO^+, Pd^+
- Be^+, Ca^+, Hg^+, Yb^+
- NO^+

No, the answer is incorrect.
Score: 0
Accepted Answers:
Be^+, Ca^+, Hg^+, Yb^+

4) The use of trapped ions as qubits has been an attractive approach to quantum computing as *1 point*

- It is one of the most intuitive approaches in terms of qubits
- It is a very easy approach experimentally as it has long lived coherences
- Both internal states as well as the collective phonon mode are possible
- All the above are true

No, the answer is incorrect.
Score: 0
Accepted Answers:
All the above are true

5) The single ion in an ion trap behave like a mass on a spring. Wavefunctions corresponding to the eigenvalues of the single ion in the ion trap are *1 point*

- doubly degenerate
- triply degenerate
- nondegenerate
- superposition of sine and cosine functions

No, the answer is incorrect.
Score: 0
Accepted Answers:
nondegenerate

6) Manipulation of ions in traps is critical in achieving quantum computation, which differ with the choice of trapping principle. The ions trapped in a radio-frequency trap interact by *1 point*

- exchanging electronic excitation
- exchanging translational interactions
- exchanging rotational excitation
- exchanging vibrational excitations

No, the answer is incorrect.
Score: 0
Accepted Answers:
exchanging vibrational excitations

7) An attractive approach to quantum computing has been the use of trapped ions as qubits though it has suffered from scaling to larger number of usable qubits. Maximum number of qubits achieved with ion trap quantum computing till date is *1 point*

- entangled states of a fully controlled 20-Qubit
- DJ algorithm with 10-Qubit
- Trapped Hg^+ ions with 12-Qubit
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
entangled states of a fully controlled 20-Qubit

8) Implementation of Deutsch-Jozsa algorithm using trapped ions shows the suitability of ion traps in scalable quantum information processing. Interesting, this uses only one trapped ion that acts as two qubits through the typical strong coupling amongst *1 point*

- molecular degree of freedom
- electronic quantum state of the ion
- intramolecular vibrational relaxation
- all of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
all of the above

9) Typical ion traps have their fields in 2-dimensions (2D). In case you can extrude into a 3rd dimension, this will be giving you a trap in all regards (electrodes, trapping region), that is *1 point*

- linear along the direction of extrusion in addition to the 2D quadrupolar field
- quadratic in nature in addition to the 2D linear field
- harmonic in nature in addition to the 2D quadrupolar field
- circular in nature in addition to the 2D quadrupolar field

No, the answer is incorrect.
Score: 0
Accepted Answers:
linear along the direction of extrusion in addition to the 2D quadrupolar field

10) Classical bits are either in state 0 or 1. In case of a laser interacting with individual atoms that acts as qubits, one produces an additional state, which is *1 point*

- a random mixture of states 1 and 0.
- a coherent superposition of states 1 and 0.
- an incoherent superposition of states 1 and 0.
- the state of the laser shining on the atom.

No, the answer is incorrect.
Score: 0
Accepted Answers:
a coherent superposition of states 1 and 0.