CLAIMS

1. A method for measuring a spin state of a first electron in a first quantum dot that is tunnel coupled to quantum element, wherein the quantum element is a reservoir or a second quantum dot, the method comprising:

measuring the spin state of the first electron while applying a ramped detuning for a first time period.

2. The method of claim 1, wherein the quantum element is the reservoir further comprising emptying the first quantum dot.

3. The method of claim 1, wherein the quantum element is the reservoir further comprising injecting the first electron in the first quantum dot by applying a constant voltage pulse for a second time period.

4. The method of any one of claims 1-3, wherein applying the ramped detuning comprises continuously ramping electrochemical potentials of the spin states of the first electron from below Fermi energy of the reservoir to above the Fermi energy of the reservoir.

5. The method of any one of claims 1-4, wherein measuring the spin state of the first electron comprises monitoring a charge signal of the first quantum dot using a charge sensor.

6. The method of claim 5, wherein:

a blip in the charge signal of the first quantum dot before a threshold time indicates a spin-up state of the first electron; and

an increase in the charge signal of the first quantum dot after a threshold time indicates a spin-down state of the first electron.

7. The method of any of the preceding claims, wherein a rate for the first electron to tunnel out of the first quantum dot and into the reservoir increases during the first time period and a rate for an electron to tunnel from the reservoir to the first quantum dot decreases during the first time period.

8. A method for initializing a spin qubit in a quantum dot that is tunnel coupled to a reservoir, the method comprising:

injecting an electron in the quantum dot by applying a ramped detuning for a first time period.

9. The method of claim 8, further comprising:

emptying the quantum dot; and/or measuring a spin state of the injected electron while applying a ramped detuning for a second time period.

10. The method of any one of claims 8-9, wherein applying the ramped detuning for the first time period comprises continuously ramping electrochemical potentials of the spin state of the electron from above Fermi energy of the reservoir to below the Fermi energy of the reservoir.

11. The method of any one of claims 8-10, wherein measuring the spin state of the injected electron comprises monitoring a charge signal of the quantum dot using a charge sensor.

12. The method of any one of claims 8-11, wherein the spin state of the injected electron depends on a rate of the ramped detuning.

13. The method of any one of claims 8 to 12, further comprising the step of selecting the first time period to control the relative population of the two spin states of the injected electron.

14. The method of claim 1, wherein:

the quantum element is the second quantum dot, and

the spin state is an overall spin state of two electrons, including the spin state of the first electron.

15. The method of claim 14, further comprising injecting a second electron in the second quantum dot to set the state of the two electrons to a singlet state such that the first quantum dot includes zero unpaired electrons and the second quantum dot includes the first and second electrons by applying a constant voltage pulse for a second time period.

16. The method of any one of claims 14-15, wherein applying the ramped detuning comprises continuously ramping electrochemical potentials of the spin state of the second electron from below Fermi energy to above the Fermi energy.

17. The method of any one of claims 14-16, wherein measuring the spin state of the first and second electrons comprises monitoring a charge difference between the first and second quantum dots using a charge sensor.

18. The method of claim 17, wherein a step in the charge difference between the first and second quantum dots before a threshold time indicates a singlet quantum state.

19. The method of claim 17, wherein an increase in the charge difference between the first and second quantum dots after a threshold time indicates a triplet zero quantum state.

20. The method of any of claims 14-19, wherein a rate for the second electron to tunnel out of the second quantum dot and into the first quantum dot increases during the first time period.