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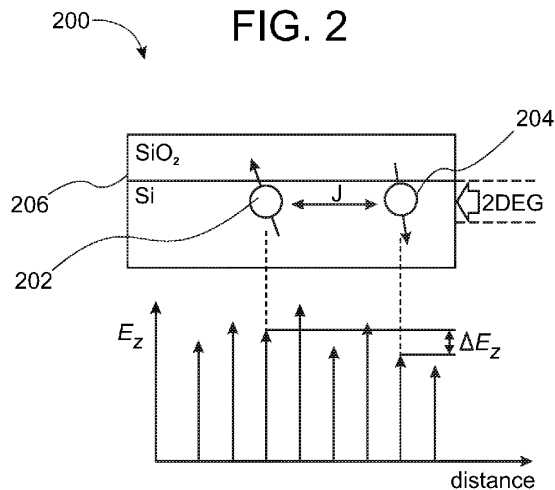
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(54) Title: ADVANCED QUANTUM PROCESSING SYSTEMS AND METHODS FOR PERFORMING QUANTUM LOGIC OPERATIONS



(57) Abstract: Quantum processing element and method to perform logic operations on a quantum processing element are disclosed. The quantum processing element includes: a semiconductor, a dielectric material forming an interface with the semiconductor, a plurality of dopant dots embedded in the semiconductor, each of the dopant dots comprising one or more dopant atoms and one or more electrons or holes confined within the dopant dots, wherein spin of an unpaired electron or hole of each dopant dot forms at least one qubit. The method includes the step of: controlling orientation of nuclear spins of the one or more dopant atoms in a pair of dopant dots and/or controlling a hyperfine interaction between nuclear spins of one or more dopant atoms and electron or hole spins of the unpaired electron or hole in the pair of dopant dots to perform a quantum logic operation on a corresponding pair of qubits.

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