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Simulated Annealing for Ground State Energy of Ionized Donor Bound Excitons in Semiconductors

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Abstract: We present a global optimization method, called the simulated annealing, to the ground state energies of excitons. The proposed method does not require the partial derivatives with respect to each variational parameter or solving an eigenequation, so the present method is simpler in software programming than the variational method, and overcomes the major difficulties. The ground state energies of ionized-donor-bound excitons (D^+, X) have been calculated variationally for all values of effective electron-to-hole mass ratio σ. They are compared with those obtained by the variational method. The results obtained demonstrate that the proposed method is simple, accurate, and has more advantages than the traditional methods in calculation.

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Key words: ground state energy, bound exciton, simulated annealing, helium atom