Combined effects of thermodynamic factors and external fields for nonlinear optical processes of deformed Mathieu quantum dot containing central impurity

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Abstract

The theoretical impact of external parameters such as the hydrostatic pressure, temperature, electric field, magnetic field, as well as the Indium (In) concentration and quantum dot width on the nonlinear optical properties of a Mathieu quantum dot (MQD) with a screw dislocation and a hydrogenic impurity at its center, formed by an InxGa1-xAs/GaAs heterojunction, is presented. The wave equation of the system is solved in cylindrical coordinates using the effective mass approximation and the Runge-Kutta-Fehlberg (RKF) method, taking into account the direction of the screw dislocation and the symmetry of the structure. In addition to the screw dislocation, thermodynamic effects, electric and magnetic fields, In concentration, and the width of the MQD have significant effects on the electronic energy levels, dipole matrix elements, and transition frequencies, resulting in important consequences for the nonlinear optical properties. The effects and alternatives of the relevant parameters on the nonlinear optical properties of the MQD with a screw dislocation are discussed in detail. The optical properties that can be altered by these parameters may also be important for experimental studies in determining the optimality of the structure.& COPY; 2023 Elsevier B.V. All rights reserved.

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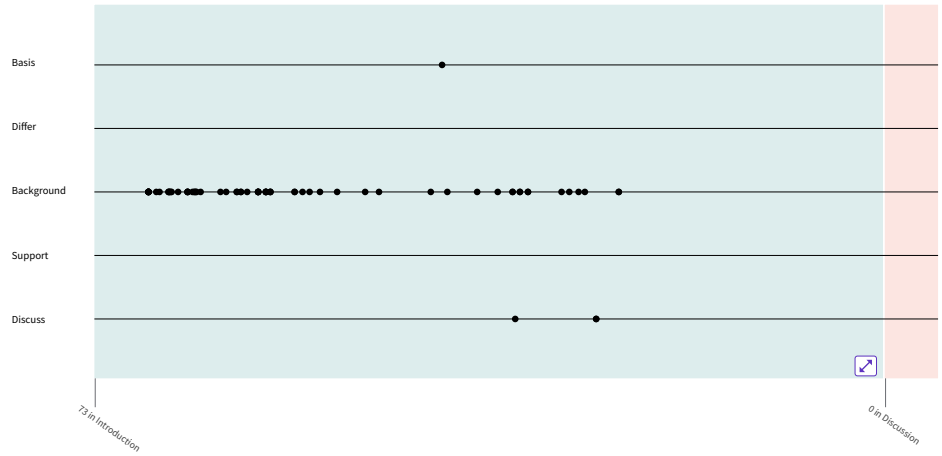

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