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Simulation of metacrystal formation in RF trap

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Statement of the Problem: It is well known that the orderly ion structure localized in the radiofrequency (RF) trap can be used for realizing the classical Coulomb crystal. We utilize this idea for obtaining a metacrystal formed by the semiconductor quantum dots (QDs). In this case, we can change the properties of the metacrystal varying the distance and spatial orientation of QDs by properly choosing the RF trap parameters. The implementation of this idea implies the ability to control the dynamics of the QDs in the RF trap. This study presents universal method for the QD dynamical calculations and metacrystal formation in the 3D RF trap.

Methodology & Theoretical Orientation: We offer detailed numerical analyses of non-linear equations of the QD motion in 3D-RF Paul trap, and we propose a model of averaged equations to describe quasi-equilibrium positions of the constituent elements of QD structure.

Findings: Actual RF trap parameters for forming the metacrystal are defined and the mappings of the initial conditions are determined. The experimental and theoretical results are compared.

Conclusion & Significance: The presented numerical methods well approximated the experimental results. The numerical simulation can be applied for describing of the dynamics of QDs and complex biological structures.

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