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Quantum-Dot Arrays: a Periodic KAM-Island System For The Study of Dynamical Tunneling and Environmental Dephasing

PS-A1

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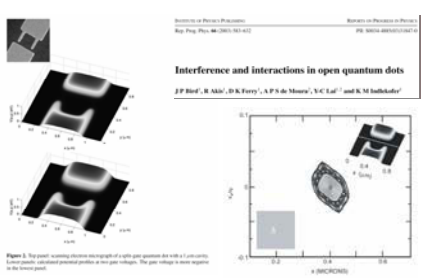
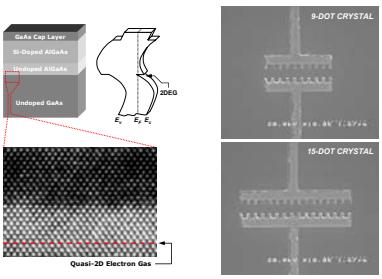
Open quantum dots provide a controlled model environment for the study of the quantum implications of chaos in dynamical systems. In our previous work on this problem, we have studied the signatures arising in the conductance of single dots, in connection to problems such as wavefunction scarring, dynamical tunneling and dephasing due to coupling to the external environment. In this presentation, however, we report on recent work on the use of coupled quantum dot arrays as a controlled periodic KAM-island system. We demonstrate how an applied magnetic field may be used to manipulate the classical phase space of this system, resulting in a concomitant modulation of dynamical (phase space)-tunneling that is manifest as the observation of a giant backscattering resonance in the conductance of the array. We also discuss the results of other experiments that explore the influence of environmental coupling on quantum coherence in the arrays

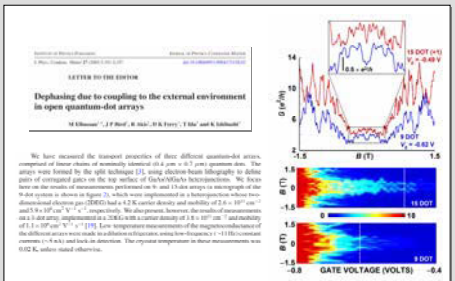
1. **Abstract**



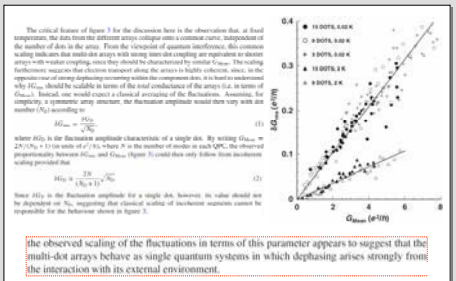
2. **Open Quantum Dots: a Tunable KAM System**



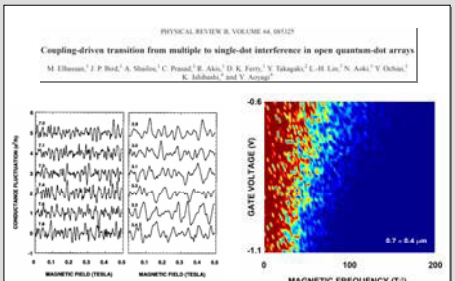
3. **Quantum-Dot Arrays: a Periodic KAM System**



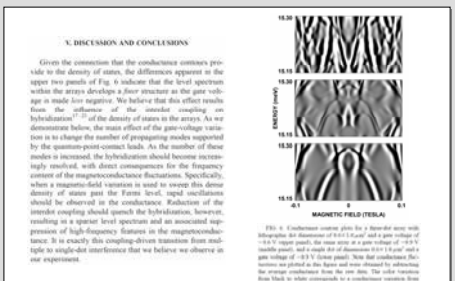
4. **Quantum Fluctuations**



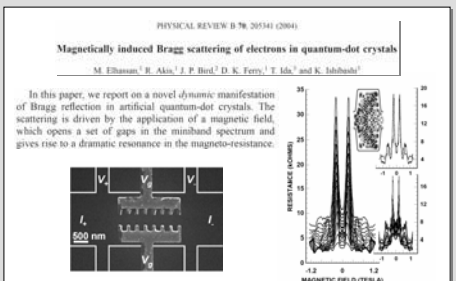
5. **Quantum Fluctuations: Universal Scaling?**



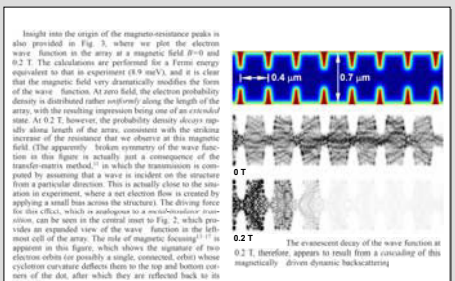
6. **Quantum Fluctuations: Signature of Molecular State?**



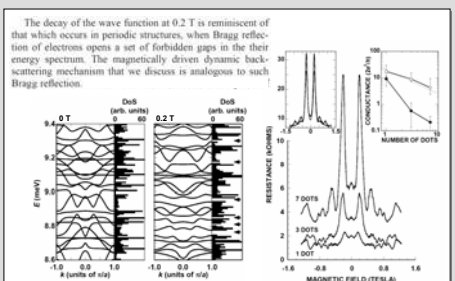
7. **Quantum Fluctuations: Signature of Molecular State?**



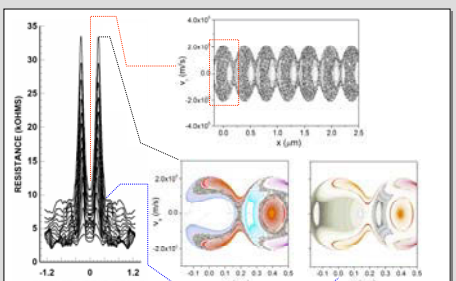
8. **Magneto-Resistance Resonance**



9. **Wavefunction in the Artificial Crystal at Resonance**



10. **Magnetically-Induced Bragg Scattering**



11. **Classical Phase Space: Magnetic Tuning of KAM System**

- *We have demonstrated a number of collective features of electron transport in open quantum-dot arrays*
- *An apparently universal scaling of the fluctuation amplitude suggests decoherence is strongly influenced by the environmental coupling*
- *The spectral content of the fluctuations shows signatures of a transition from single-dot to miniband characteristics as the inter-dot coupling is varied*
- *Another collective phenomenon is a magnetically-induced magneto-resistance resonance that reflects the ability of the magnetic field to dynamically induce Bragg scattering*

12. **Conclusions**

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