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Electronically Guided Self Assembly within Quantum Corrals[1]

RONGXING CAO, BINGFENG MIAO, ZHANGFENG ZHONG, LIANG SUN, BIAO YOU, WEI ZHANG, DI WU, AN HU, Department of Physics, Nanjing University, SAMUEL BADER, Center for Nanoscale Materials, Argonne National Laboratory, HAIFENG DING, Department of Physics, Nanjing University, LOW DIMENSIONAL MAGNETISM TEAM, CENTER FOR NANOSCALE MATERIALS COLLABORATION — A grand challenge of nanoscience is to master the control of structure and properties in order to go beyond present day functionality. The creation of nanostructures via atom manipulation by means of a scanning probe represents one of the great achievements of the nano era. Here we build on this achievement to self-assemble nanostructures within quantum corrals. We constructed circular and triangular Fe quantum corrals on Ag(111) substrate via STM manipulation and studied the quantum confinement of electronic states and the diffusion of Gd atoms inside the corrals. Statistical results reveal the motion of the Gd atoms forming several individual orbits that are closely related to the local density of states. We experimentally demonstrate that different self-organized Gd atomic structures are formed within 30-nm circular and triangular Fe quantum corrals with a step-by-step guiding process. The findings demonstrate that quantum confinement can be used to engineer atomic structures and atom diffusion. And 30-nm resolution can be reached by means of advanced lithography. Adding quantum engineering to augment it opens new possibilities for local functionality design down to the atomic scale.

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