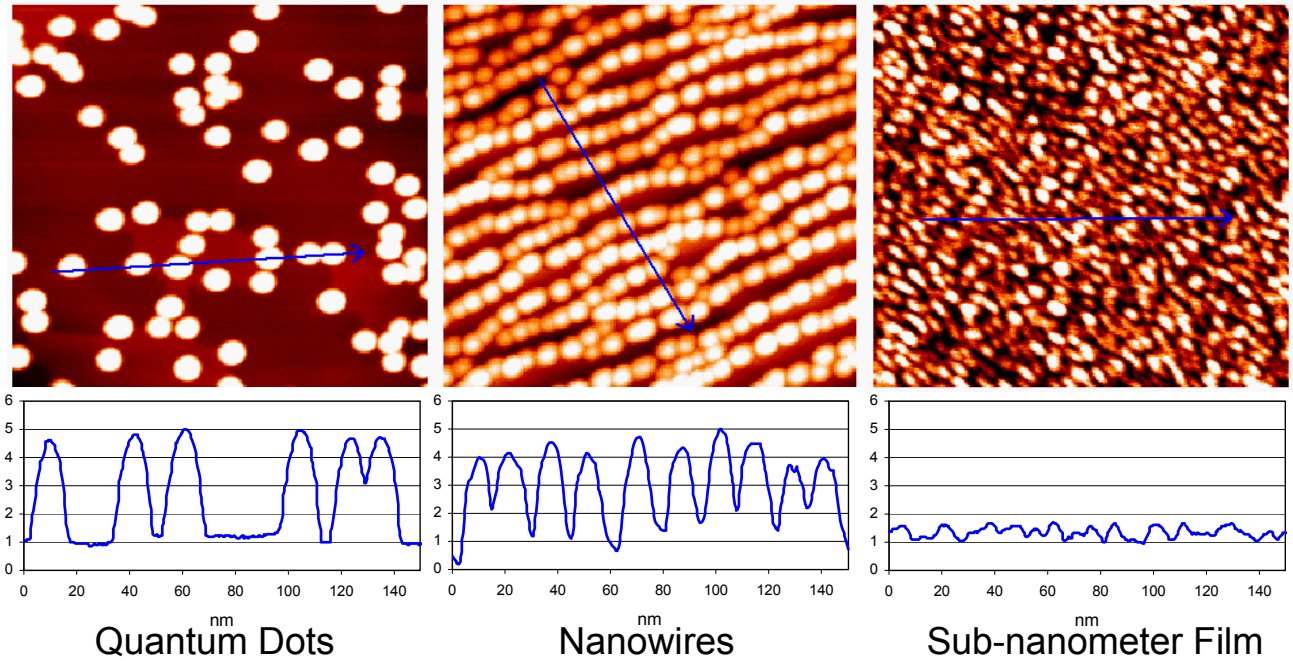
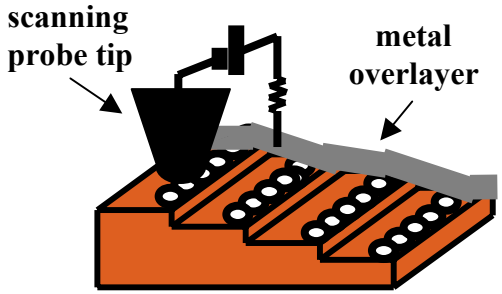
Low Dimensional Magnetic Nanostructures I
Plummer, University of Tennessee, DMR-0105232

Throughout the last decade, work on two-dimensional ultrathin films has shown that reducing the size of magnetic structures to the nanometer scale can awaken surprising and useful quantum mechanical effects that are not observed in larger structures. We are striving to push this size scale to its lower limit by studying 1-D nanowires and zero-D magnetic quantum dots. In the last year, we've learned how to grow these nanostructures on an **insulating** substrate, which is important because it will allow the conducting properties of the magnetic structures themselves to be investigated.



Above: Atomic force microscope images of quantum dots, nanowires, and and an ultrathin film formed from 1.7 atomic layers of iron on a cleaved NaCl (100) surface. Each image is 200 nm x 200 nm. The blue linescan under the image to the left shows the height and surprising uniformity of the dots, which could be important for technological applications.

Right: Future studies of the conducting properties in the presence of a magnetic field could show how these nanostructures can be used in device applications as interconnects or switches.



Low Dimensional Magnetic Nanostructures II
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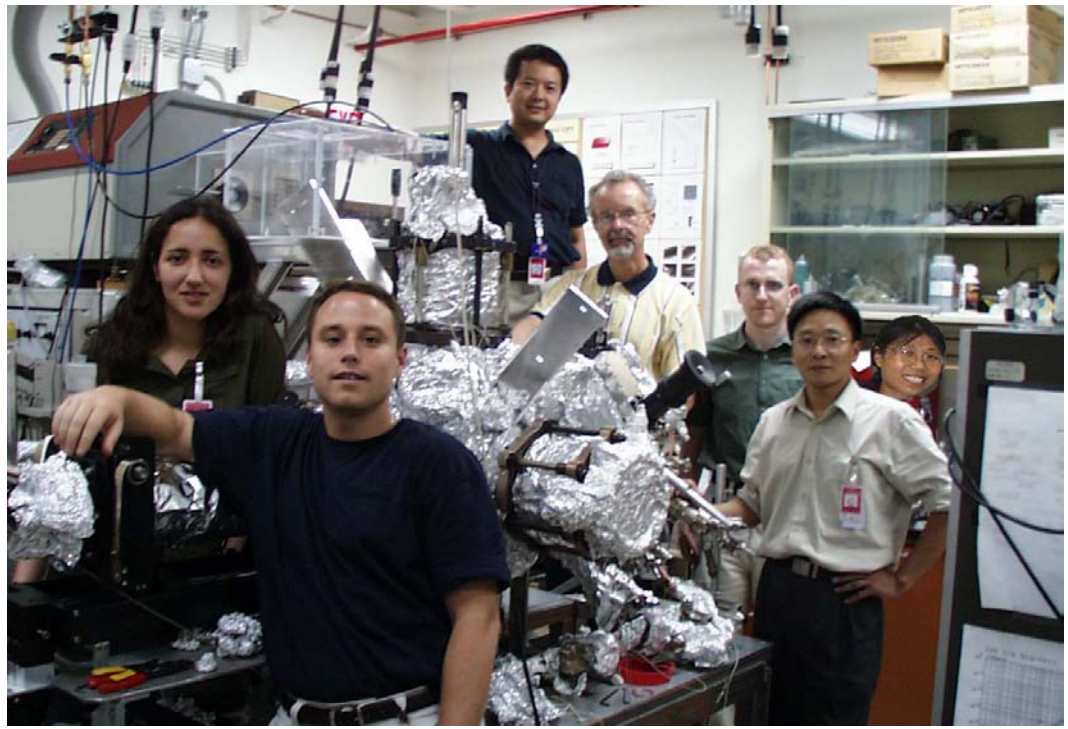
Maria Torija (far left) first became involved in this work in 1999 as an undergraduate exchange student who was visiting from Spain. She is now a graduate student at the University of Tennessee and her Ph.D. research will involve synthesis and characterization of magnetic nanostructures.

John Pierce (front) will finish his doctorate in December of 2002. His Ph.D. studies have focused on magnetic quantum dots, nanowires made from alloys of Fe and Co, and magnetization reorientations in ultrathin films.

To expose the first- and second-year undergraduates in Plummer's Modern Physics course to cutting-edge physics, John presented the results of these studies as a guest speaker. The young students learned about the exciting opportunities that await them, should they choose to continue their studies at a higher level.



This project, a partnership between the University of Tennessee and Oak Ridge National Laboratory, has allowed Maria, John, and Ward to benefit from a close collaboration with the Shen group in the Solid State Division at ORNL. In the back row, from left to right, are ORNL staff scientist Jian Shen and Ward Plummer, together with ORNL post-docs Gareth Farnan, Jianxing Ma, and Zheng Gai.