ESRF

ESRF	**Experiment title:** The Structure of a superlattice of InAs/GaAs Quantum Dots	**Experiment number**: 28-01-603
Beamline: BM28	**Date of experiment**: from: 30 January 2003 to: 4 February 2003	**Date of report**: 16/9/2004
Shifts: 15	**Local contact(s)**: David Paul	*Received at ESRF:*

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Report:

A series of experiments were performed on quantum dots in semiconductors. The samples were obtained from NRC in Ottawa and all had been examined at the ESRF before. The first one examined consisted of InAs dots grown on a GaAs substrate. The dots were grown by depositing a few angstroms of InAs on GaAs. The InAs then formed dots because of the lattice mismatch. GaAs was then deposited and a further thin layer of InAs deposited and the process repeated 20 times. The strain caused by the first quantum dot causes successive quantum dots to align directly on top of the earlier dots.

The sample was aligned on BM28 in a triple axis configuration with the (004) and (062) reflections in the scattering plane where (004) is the approximate direction of growth. Detailed information was collected about the scattering near the GaAs (002), and (004) Bragg reflections. Further information was collected about the reflectivity. The results near the Bragg reflections consisted of strong scattering in planes perpendicular to the growth direction corresponding to a superlattice period of 54Å. Transverse to this structure the scattering consisted of a sharp peak and a broad peak with subsidiary peaks corresponding to

mean spacing of about 650Å. This corresponds to the mean spacing between the quantum dots. The structure of the dots was shown to be a two-dimensional liquid with the quantum dots repeated regularly on top of one another. These profiles are being analysed in detail and will be presented in a publication.

Some of the beam time was used to obtain more information about quantum dots in the Si/Ge system. The growth procedure is similar to that described above except that the dots are formed from alloys of Ge in Si with approximately 50% concentration of Ge. The samples were aligned as for the InAs on GaAs system and detailed measurements were made of the scattering near the (004) and (062) Bragg reflections and of the reflectivity. The results were qualitatively similar to those of the InAs on GaAs system with a superlattice period of 165Å and a repeat distance between the dots in the superlattice layers of 1400Å. The results are being more fully analysed and will be published.