EUROPEAN **S**YNCHROTRON **R**ADIATION **F**ACILITY

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ESRF	**Experiment title:** Structural characterization of quantum wire arrays with lateral periods below 100 nm	**Experiment number**: HS-398
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Report:

The investigation of quantum wire arrays produced for confinement of the carriers and the excitons in two dimensions aims at the analysis of the influence of strain fields and crystal defects on the optical properties of quantum wire laser structures. Only samples with the real quantum dimensions allow for the investigation of the influence of the different technological parameters. Sample (1) is a reference sample: a bare InP substrate with a surface grating. Sample (2) has the real quantum wire structures. Sample (3) has covered quantum wire arrays.

From the lateral surface gratings we expected superstructure maxima with a rod shape in reciprocal space directed perpendicular to the crystal surface (grating crystal truncation rods, CTR). We found a wavelength of 1.54 Angstrems to be more sensitive for the surface corrugations than harder radiation. An area map of sample 1 near the 113 reflection showed an inclination of the sidewalls by an angle of 57.8 degrees (obtained from the splitting of the superstructure satellites).

We measured the grating CTR of sample (2) directly by scans in q_z-direction (i.e. perpendicular to the surface). By this procedure we could compare the grating CTR with an appropriate signal to noise ratio for the symmetrical 004 and the asymmetrical 224 and 113 reflections. In each of the rods clear interferences due to the layer sequence of the quantum wire system are observed. Using the precise slit system, we were able to restrict the beam to a single structured area and could improve the signal to noise ratio.

Area maps of sample (3) show a pronounced influence of the mismatched cover layers on the strain state of the quantum wires. The results were compared with the results of photoluminescence measurements. Besides the quantum confinement by means of the grating structure (laterally) and the layer sequence (vertically) also the strain field has an influence on the optical properties of the quantum wire array.

These results are published in more detail in Journal of Phys. D (Applied Physics) Vol.32(1999)A21-A25.