Semiconductors and DLTS
Semiconductor devices are central to information technology. Their importance stems from the fact that their electrical conductivity and charge density can be tailored to construct, e.g., transistors. Several material defects however can trap electrical charges and re-emitting them at varying rates. The exponential nature of these processes makes the decomposition of several simultaneously occurring components rather difficult.

DLTS, which uses a pulsating electric field and temperature variation to detect and analyze these defects, is among the most sensitive characterization techniques available today.

The DLTS Setup
A basic DLTS/MCTS setup exists at our institute but we are reaching the limits of the system in every possible way. Using the old system as a guideline, a new setup should be constructed. In DLTS, the measured capacitance transients extend over <0.2pF in amplitude for a duration in the ms-s range. Accounting for sample background doping, the sensitivity of the measurement system must be around $\Delta C/C \approx 10^{-6}$ and higher to detect deep traps. The focus therefor lies on maximizing the instruments sensitivity and signal-to-noise ratio. Using the optimized electronics, not only DLTS but also several other electrical characterization methods can be set up. These methods (MCTS, DLOS, PICTS,..) are all based on capacitance or current transient measurements and differ in their use of optical, thermal (77-700K) or electrical trap filling and emptying mechanisms. The exact direction and extent of the master thesis project depends on the interest of the student.


Contact
Ian Booker
Semiconductor Materials Group
Dept. Of Physics, Chemistry and Biology, IFM
Linköping University
Tel.: +46 13 282527
e-mail: ianbo@ifm.liu.se
Office: Room F P328