Karlsruhe Institute of Technology

Institute for Data Processing and Electronics
Prof. Dr. Marc Weber
http://www.ipe.kit.edu

PhD Position: Advanced image reconstruction algorithms for 4D X-ray microtomography of living organisms

Scientific Context: X-ray microtomography is a powerful tool to analyze and understand internal otherwise invisible mechanisms in small animals. Resolution and duration of experiments with living specimens are currently limited by radiation damage. The quality of reconstruction is also significantly affected by the motion of the objects during the data acquisition. The compressed sensing theory has demonstrated the feasibility to recover signals from the under sampled data and, hence, opens up the possibility to reduce the radiation dose. These reconstruction techniques are computationally very demanding and have, therefore, been not used for synchrotron experiments up to now.

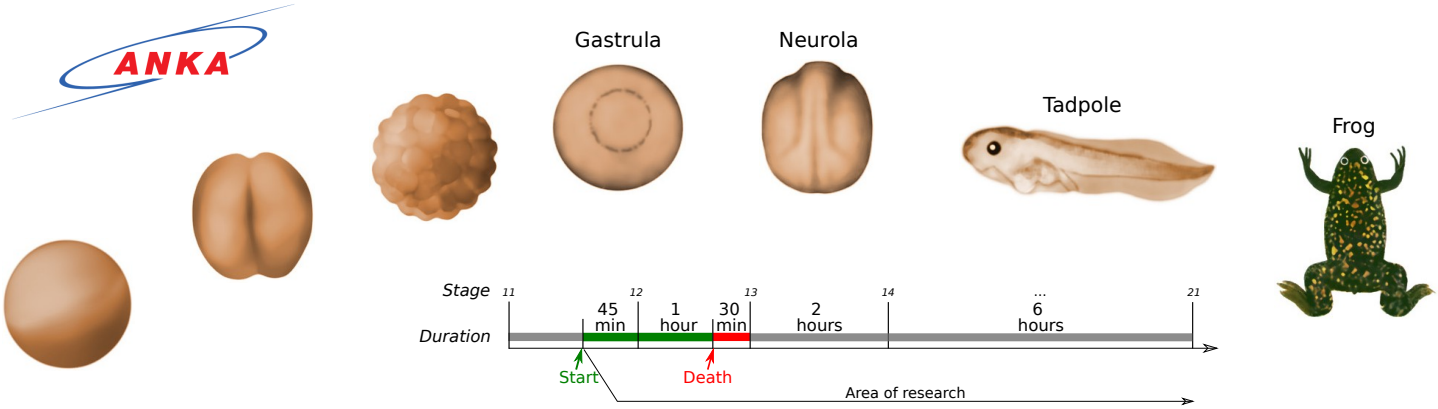

***Figure**: Development stages of Xenopus Laevis embryo. Due to the radiation damage, the current research is restricted to individual stages.*

Subject Description: The PhD thesis is embedded within an international project that aims to develop a novel instrumentation for ultrafast imaging at synchrotron light sources. To reduce radiation dose and, hence, prolong the life-time of species under investigation, new image-reconstruction and motion-compensation techniques, working fully in 3-D or 4-D, have to be proposed for selected experiments. For the production use, the reconstruction algorithms should be evaluated with respect to feasible execution times on the existing computing hardware. An adequate compromise between data throughput and achieved image quality has to be found. Also, emerging parallel architectures have to be considered as possible co-processors to speed-up the reconstruction process.

Qualification: Master in Computer Science, Mathematics or Physics

Required Skills: Good background in linear algebra and mathematical theory of optimization, strong C and Python knowledge, understanding of performance constrains for parallel algorithms, and prior experience with numerical algorithms in image processing.

***Conditions:** The anticipated duration of the PhD is 3 years.*

***Application Deadline**: December 1, 2013*

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