



2nd SALVE Summer Workshop: 9. 7. - 11. 7. 2012 in Hirscheegg, Kleinwalsertal, Austria.

SALVE I-II Summer Workshop

REPORT

The **second SALVE Summer-Workshop** was organised by Prof. Ute Kaiser (Ulm University) and held in Hirscheegg (Austria, Vorarlberg, Kleinwalsertal) in the Alps, from July 9 to 11, 2012. The 34 participants of the workshop were SALVE Team members from UUlM, Zeiss, and CEOS, Prof. Christoph Koch and group members (UUlM) as well as the guest Prof. Hannes Lichte (University of Dresden) with young researchers from his group, and one participant from the Leibniz Institute for Solid State and Materials Research (IfW), Dresden.

At the opening of the second SALVE meeting, Prof. Ute Kaiser (UUlM) welcomed all SALVE- friends and gave in her presentation an overview of the current state of the SALVE I-II project. Prof. Max. Haider (CEOS) showed the first pictures from the assembly of the Cc-corrector to the SALVE II microscope in Heidelberg taken just 4 days before the SALVE workshop.

The following presentations and discussions were focusing in detail on topics related to

- (1) the development of the instrument, its components and applications;
- (2) image formation with inelastic/elastic scattered electron at low voltages;
- (3) new methods for retrieving information on the 3D atomic structure of the object; and, as one of the major points;
- (4) the current understanding of radiation damage processes at lower accelerating voltages between 20 and 80kV;
- (5) SALVE applications to EELS and cryo microscopy at low voltages.

Speakers to topic (1) were Gerd Benner (Carl Zeiss AG), Heiko Mueller (CEOS), and Stephan Meyer (Carl Zeiss AG). G. Benner and H. Mueller evaluated special properties of the in-

column-filter for low-voltage applications and S. Meyer compared the two SALVE detectors (from Oxford and from TVIPS) at 80 and 20kV operation.

In topic (2) on image formation, Hannes Lichte discussed questions regarding coherence, in particular the coherence of inelastic scattered electrons. The second presentation by Zhongbo Lee (UUlM) was held on the progress achieved in the simulation of images by factorizing the mixed dynamic form factor. Problems and methods for obtaining 3D information on the structure and the electronic properties of the object were addressed by D. Wolf (Triebenberg), W. van den Broek (UUlM), and A. Lubk (Triebenberg) in session (3).

In the session on radiation damage (4), Ute Gollaschindler (UUlM) reported on her investigations of quantum dots and the differences between TEM and STEM operation (which in fact goes back to discussions started by Otto Scherzer). Simon Kurasch (UUlM), Gerardo Algara-Siller (UUlM), and Thilo Zoberbier (UUlM) presented their results on radiation damage of carbon nanotubes (CNTs) and graphene used for creating special traps for attaching molecules. Felix Boernert (IfW) reported on his results related to engineering of graphene with the electron beam.

In the 5th, the SALVE-application session, Ralf Hambach (UUlM) and Philipp Wachsmuth (UUlM) discussed their results on momentum-resolved EELS measurements of 2D-systems. Endre Majorovits (Carl Zeiss AG) presented measurements performed at 20kV and 60kV. with SALVE associate Prof. R. Schröder and Prof. Kaiser



Group photo of the 2nd SALVE Workshop in Hirschegg, Kleinwalsertal, Austria.

(in the case of the 20kV measurements) of high contrast in organic materials embedded in ice.

One session was very different; it was held in the Alps; hiking guide was Harald Rose and we can confirm, that the nature is very inspiring for stimulating scientific discussions! Hannes Lichte added an excellent “after-dinner talk” on motivation at work. In his talk he discussed the requirements for the advancement of science and the motor of new concepts choosing creativity as the guiding principle. At the end of his talk, the Hannes Lichte stimulated the young participants with the words: “your creativity will change the world”.

In the final discussion, we all agreed that we learnt and discussed a lot, got new ideas which will be proved during the next SALVE experiments. The good mood of the second SALVE workshop will bring us through the next steps to our third SALVE meeting to which we are, in fact, already looking forward very much. Prof. Rose and Prof. Kaiser admired in particular the contributions of the PhD students and postdoc, who showed exciting new results. We clearly see them developing to the next generation microscopist, the “low-voltage microscopist”.

Sponsors:

German Research Foundation
Ministry for Science, Research and the arts Baden-Wuerttemberg

WORKSHOP PROGRAM

Monday, July 25

17:00 - 17:15	Welcoming remarks from Ulm University - U. A. Kaiser
17:15 - 18:00	Structure of the SALVE II TEM - concepts and status - S. Eyhusen
18:30	**Dinner**
19:45 - 20:30	Quantitative determination of the information limit in the TEM with achromatic rings - H. Müller
20:30 - 21:15	Using Dynamical Scattering and Ewald Sphere Curvature for 3D Potential Reconstruction at Low Accelerating Voltage Cc-corrector - C. Koch

Tuesday, July 26

8:30 - 9:00	Spatially resolved EELS - H. Kohl
9:15 - 10:00	Collective Excitations in Nanostructures: Towards Spatially-Resolved EELS from First Principles - R. Hambach
10:15 - 11:00	Inelastic interaction and coherence - H. Lichte
11:00 - 11:45	Optimum HRTEM contrast for low voltages - Z. Lee
12:00	**Lunch**

- 18:30 **Dinner**
- 20:00 - 20:30 Presentation of the SALVE corrector
concept - F. Kahl
- 20:30 - 21:15 Outline of a multislice procedure tak-
ing into account elastic and inelastic
scattering - H. H. Rose
- 21:15 - 22:00 **Evening** Report on the Wolf Prize
- M. Haider

[Wednesday, July 27](#)

- 9:00 - 11:00 Low Voltage (Cryo)-Microscopy:
Beam Damage vs. Contrast,
what wins? - R. Schröder / U.
A. Kaiser
- 11:00 - 11:45 Summary / Outlook
- 12:00 ** Dinner **

**** Close of workshop ****

WORKSHOP participants

Participants

Algara-Siller, Gerardo
Benner, Gerd
Bernhard, Jörg
Biskupek, Johannes
Boernmert, Felix
Eswara Moorthy, Santhana
Eyhusen, Sören
Geiger, Dorin
Golla-Schindler, Ute
Haider, Max
Hambach, Ralf
Kahl, Frank
Kaiser, Ute A.
Kinyanjui, Michael
Kister, Thomas
Koch, Christoph
Kohl, Helmut
Kurasch, Simon
Lee, Zhongbo
Lichte, Hannes
Lubk, Axel
Majorovits, Endre
Meyer, Stefan
Mueller, Heiko
Orchowski, Alexander
Pennington, Robert
Qi, Haoyuan
Rose, Harald H.
Schröder, R
Schweigert, Werner
Sedighi, Mona
van den Broek, Wouter
van Mierlo, Willem
Wachsmuth, Philipp
Wolf, Daniel
Zoberbier, Thilo

Institutions

Ulm University - EMMS
Carl Zeiss
Ulm University - EMMS
Ulm University - EMMS
IfW Dresden
Ulm University - EMMS
Carl Zeiss
Ulm University - EMMS
Ulm University - EMMS
CEOS
Ulm University - EMMS
CEOS
Ulm University - EMMS
Ulm University - EMMS
Ulm University - EMMS
Ulm University - EMMS
Münster University
Ulm University - EMMS
Ulm University - EMMS
Technical University Dresden
Technical University Dresden
Carl Zeiss
Carl Zeiss
CEOS
Carl Zeiss
Ulm University - ELIM
Ulm University - EMMS
Ulm University - EMMS
Heidelberg University
Ulm University - EMMS
Ulm University - EMMS
Ulm University - ELIM
Ulm University - EMMS
Ulm University - EMMS
Technical University Dresden
Ulm University - EMMS