



This workshop will bring together those who develop new technologies and those who use cutting-edge technology for posing new scientific questions. The first group are the “developers” of new time-resolved imaging techniques from the physics and engineering community. The second group are (potential) “expert users” of such techniques from both the life sciences and the physics/chemistry community.

During the workshop the latest technology developments will be showcased to potential expert users. Conversely, the intricacies of specific topics in the life sciences and physics/chemistry will be exposed to developers. The aim is to get a clear picture of the needs that should be addressed in the near future, and create a road map for further developments that will expand the capabilities of dynamic electron imaging.

	Monday 28th	Tuesday 29th	Wednesday 30th	Thursday 31 st	Friday 1 st
09:00		Day goals	Day goals	Day goals	Day goals
		09:15 Plenary talk <i>S. Helveg</i>	09:15 Reports and plenary discussion	09:15 Plenary talk <i>A. Polman</i>	09:15 Plenary talk <i>E. Karagöz</i>
10:00		10:15 Coffee break + Poster session	10:30 Coffee break + Poster session	10:15 Coffee break + Poster session	10:15 Coffee break 10:30 Reviews
11:00		10:45 Discussion sessions	<i>B. Špačková</i> <i>V. Petráková</i> <i>S.K. Kraus</i> <i>J. Toyfl</i>	10:45 Plenary discussion "propositions"	10:50 Plenary discussion "road map towards 2040"
12:00		Lunch and coffee	Lunch and coffee	Lunch and coffee	Closing discussion
13:00				13:30 Organization, working groups	12:30 Lunch
14:00	Registration 14:30 welcome address	Discussion sessions cont.	<i>H. Lalandec-Robert</i> <i>A. Annys</i> <i>S. Borrelli</i> <i>A. Mahadevegowda</i>	13:45 Discussion sessions "needs and opportunities"	<i>Excursion to Boerhaave science museum and the Leiden wall formulas</i>
15:00	Plenary talk <i>R. Tromp</i>	Plenary talk <i>S.J. van der Molen</i>	Plenary talk <i>F. Ross</i>	15:15 coffee break	
16:00	Plenary talk <i>A. Briegel</i>	Lab tour	15:30 Coffee break + Poster session Day summary	15:30 Plenary talk <i>P. Abellan</i>	
17:00	Welcome reception	Closing	17:30 Dinner	16:30 Reports and plenary discussion	
				17:45 Closing	

Program

Day 1 (Monday): Defining the state of the art

The workshop kicks off with setting the scene and recapitulating the status of the fields with two review presentations: One focusing on the state of the art in dynamic, label-free microscopy and one on hot questions in life sciences that require time-resolved imaging.

14.00 *Registration*

14.30 Welcome and practical introduction by Lorentz Center team

14.45 Welcome by the scientific organizers; definition of workshop goals.

Day chair: S.J. van der Molen

15.00 Talk: *Electron microscopy: developments and possibilities*, by R. Tromp (IBM & Leiden U.)
(40 min talk + 20 min discussion)

16.00 Talk: *Towards high-resolution cryoEM imaging inside tissues and organs* by A. Briegel (NECEN, Leiden U.)

17.00 *Welcome reception*

Day 2 (Tuesday): Starting up the interaction

Continuing the previous philosophy, the day starts with a talk on hot questions in chemistry that require time-resolved imaging. The first discussion sessions will happen in small groups aiming to define common needs and possibilities and to find overlap where possible. The day ends with a lab tour of the Leiden set-ups to see dynamic electron imaging.

09.00 Introduction of today's goals, by session Chair (Mariana Amaro)

09.15 Talk: *Electron microscopy advances in catalysis* by S. Helveg (T.U. Denmark)

10.15 *Coffee break and posters*

10.45 Discussion session in smaller groups

12.00 *Lunch break at Snellius building and coffee at Lorentz Center*

14.00 Discussion session continues

15.00 Talk: *Optical near-field electron microscopy, ONEM* by S. J. van der Molen (Leiden U.)

15.40 *Lab tour Leiden set-ups*

17.10 Closing

Day 3 (Wednesday): Possibilities and opportunities

Today we review the outcome of yesterday's discussions in a plenary session. The latest research, ideas and developments will be introduced in short talks format. At the end of the day the chair will introduce propositions based on the day's outcomes to discuss by the sea side during the conference dinner.

09.00 *Introduction of today's goals, by session chair (Rudolf Tromp)*

09.15 Report of yesterday's discussion sessions by the group representatives, including questions

10.30 *Coffee break and posters*

11.00 Short talks: *Advancing the frontier of biomolecular research with next-generation label-free single-molecule microscopy tools* by B. Špačková (Inst. of Physics CAS)

11.15 Short talks: *DNA-mediated Assembly of Plasmonic and Fluorescent Nanoparticles for Nanophotonics* by V. Petráková (J. Heyrovsky Inst. Physical Chemistry CAS)

11.30 Short talks: *Extended coherent electron acceleration on a nanophotonic chip* by S. Kraus (Friedrich-Alexander U.)

11.45 Short talks: *Spin Resonance Spectroscopy with an Electron Microscope* by J. Toyfl (T. U. Wien)

12.00 *Lunch break at Snellius building and coffee at Lorentz Center*

- 14.00 Short talks: *Analytical ptychography framework for live and event-driven imaging of dose-sensitive materials* by H. Lalandec-Robert (EMAT, U. of Antwerp)
- 14.15 Short talks: *Bridging the gaps between advanced low-dose STEM techniques and the TEM community* by A. Annys (U. of Antwerp)
- 14.30 Short talks: *Direct Observation of Sub-Poissonian Temporal Statistics of Free Electrons with Subpicosecond Resolution* by S. Borrelli (Eindhoven U. T.)
- 14.00 Short talks: *Mapping of cracking-prone planes in Ni-rich cathodes for Li-ion batteries via electron microscopy* by A. Mahadevegowda (U. Cambridge)
- 15.00 Talk: *Imaging dynamics within individual atomic columns through picometer-scale targeting of the electron beam* by F. Ross (MIT) *remote speaker*
- 15.30 *Coffee break and posters*
- 16.00 Summary of the day by chair and introduction of three propositions for discussion, dealing with opportunities, possibilities and needs.
- 17h30 *Conference dinner at beach restaurant Zilt, Katwijk aan Zee.*

Day 4 (Thursday): From A to B

This day is devoted to thinking together. The plenary discussion will focus on the propositions introduced yesterday. The afternoon aims at defining the wish list for the future, with discussions in smaller groups and a plenary follow-up discussion to report ideas.

- 09.00 *Introduction of today's goals, by session chair* (Sense Jan van der Molen)
- 09.15 Talk: *Plasmon interferometry using high-energy electrons* by A. Polman (NWO-I AMOLF)
- 10.15 *Coffee break and posters*
- 10.45 Plenary discussion based on yesterday's propositions
- 12.00 *Lunch break at Snellius building and coffee at Lorentz Center*
- 13.30 Central introduction of the afternoon. Defining discussion groups
- 13.45 Discussions on the key theme: where do we see needs and opportunities for dynamic (electron) microscopy of the future? What should a road map look like?
- 15.15 *Coffee break*
- 15.30 Talk: *Radiolysis damage in water-solid interfaces and battery materials in transmission electron microscopy and spectroscopy* by P. Abellan (CNRS - IMN)
- 16.30 Short reports by the groups and plenary discussion
- 17.45 Closing

Day 5 (Friday): Where are we headed? Beyond incremental

To end the workshop with truly outside-the-box discussion and thinking, two excellent scientists review the meeting's input and provoke a discussion on microscopy of the future. This will flow into an outlook session in which we define innovations and collaborations needed to make non-incremental scientific goals a near-future reality.

- 09.00 *Introduction of today's goals, by session chair* (Ruud Tromp)
- 09.15 Talk: *Unique mechanisms for monitoring endoplasmic reticulum homeostasis* by E. Karagöz (Max Perutz Labs Vienna)
- 10.15 *Coffee break*
- 10.30 Review by Barbora Špačková (Inst. of Physics CAS)
- 10.40 Review by Oliver Schaff (SPECS GmbH)
- 10.50 Discussions with panel: *What should be in the road map towards 2040?*
- 12.00 Closing discussion: towards a road map in first version* (Panel: Tromp, Amaro, Van der Molen)
- 12.30 *Lunch in the Snellius building (13.15 internal ONEM consortium meeting)*
- 14.00 *Excursion to Boerhaave science museum and the Leiden wall formulas.*

* The road map will be worked out after the workshop by the organizers