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*Seminar room, DFA*

***Scientific Seminar***

# Prospects of AI-automated electron microscopy for material science and energy applications

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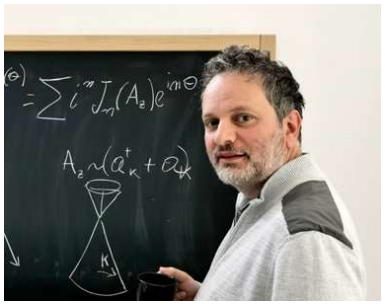
I will report here of the role of the electron microscopy group in the Nanoscience Institute and iEntrance@ENL infrastructure, and our research in the direction of automation of electron microscopy measurements thanks to the use of AI.

AI and automation can be used for instance for beam alignment, conduction of the experiments, analysis of the resulting data, their denoising and classification, and in the implementation of new techniques.

We imagine next generation microscopes to be able to autonomy correct the microscope condition, count particles and make statistics by automatic segmentation, or search for interesting areas in the specimen. The microscope could even produce in a few examples a 3D model of the structure to connect with theoretical analysis.

I will show a few examples of our research regerding these methodologies and how this approach will conduct to a better and faster analysis of materials especially for energy applications. Monochromated EELS and the support from AI in imaging and spectroscopy in our new SPEQTEM will support future research on solar cells, light harvesting or photocatalysis, and batteries materials.



Vincenzo Grillo is the head of the electron microscopy group and Research Director at CNR. He graduated in physics from the University of Genova (110/110 cum laude). He received his PhD in electron microscopy at the University of Parma, while performing collaborative work with Erlangen university (Germany). In 2001 he was a visiting scientist at the Tokyo Institute of Technology working on cathodoluminescence in TEM. Since 2003 he has been working at INFM (from 2006 merged in CNR) as a scientist in electron microscopy. He has developed innovative TEM-STEM methodology and published the first quantitative use of STEM with HAADF detector for chemical analyses. To this aim he developed the first parallel computing implementation of STEM simulations. He is now working on beam shaping and innovative electron optics. He and his group are now among the world's leading groups in this sector for their work on MEMS based optics, phase holograms, vortex beams, spin-orbit coupling in a TEM and Light-Electron interaction based beam shaping. In 2015 he was a visiting researcher at the University of Oregon. In 2016 he received the Humboldt Foundation's BESSEL research award for his work on Beam shaping. In 2022 he received the Ernst Ruska Prize, one of the most important international recognition in electron microscopy. Dr. Grillo is co-author of at least 150 articles and 5 book chapters and was invited or plenary speaker in at least 30 conferences. He has coordinated or acted as a WP leader in 3 EU projects of microscopy and advisor for a few important laboratories. The H-factor of his publications is 42.

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