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"From Tracking Atoms to Harnessing Electron Spin: Pioneering Pathways to Green Energy"

Magalí Lingenfelder[1,2]

[1]Swiss Institute for Science,1004, Lausanne (Switzerland), https://lingenfelder-lab.com, 2-MPI-EPFL Laboratory for Molecular Nanoscience and IPHYS, 1015, Lausanne (Switzerland).

maggie@lingenfelder-lab.com

The journey from the simple desire to “see atoms” to the exploration of the electron spin for green energy applications reflects a path of profound advancements in our understanding of the atomic and subatomic world over the past decades. These advancements are not only intellectually satisfying but also hold the potential to address critical global challenges, such as sustainable energy.

In our research group, we tackle the challenge of sustainable energy by creating customized nanostructured materials that draw inspiration from nature (biomimicry), integrating fundamental principles from interfacial chemistry and surface physics. For this presentation, I draw inspiration in the process of photosynthesis for the design of earth-abundant materials that drive electrocatalytic energy conversion processes: such as CO_2 electroreduction and water splitting.

The use of cutting-edge scanning probe microscopy enables us to visualize dynamic electrochemical processes at the nanoscale through in-situ imaging [1]. The detailed atomic-scale information we gather inspires us to explore further: to use unconventional strategies that harness electron spin to enhance electrocatalytic conversion processes [2-4]. This innovative approach has allowed us to develop state-of-the-art materials that are two to three times more efficient in electrocatalysis [3-4].

References

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