Atmospheric pressure plasma:
From basic physics to environmental applications

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Low temperature plasmas have been used for surface modifications for more than five decades. However, this interface represents a highly dimensional multiscale problem. It is therefore a challenge to identify specific physical processes by studying them individually. Currently, only a small fraction of the potential of these plasmas is being exploited, the bottleneck being the poor fundamental understanding of how these plasmas interact with matter.
A new focus in this field is the combination of plasmas with catalysis as a key process to store renewable energy in chemical resources. In light of the current climate crisis, this process could play a major role in electrification of the industry. By combining conventional catalysts with non-equilibrium plasmas, synergy has been demonstrated, but current studies are mostly empirical. Research shows that synergies between classical catalysis and plasma processes can be obtained due to the distinct non-equilibrium character of atmospheric pressure plasmas and their interaction with surfaces. However, the underlying mechanisms are hard to entangle as typical reactor designs for plasma catalysis are packed bed reactors. While advantageous for industrial processes, the diagnostics and analysis of these reactors is challenging.

This talk will focus on the peculiarities of atmospheric pressure non-equilibrium plasmas and their characteristics and suitability for applications. We will start with fundamentals and deduce different forms of applications such as biocatalysis, gas conversion and catalyst design, e.g. for electrolysis. We will demonstrate theoretical and experimental work conducted in the field and highlight current constraints and challenges.

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