On the role of vibrational excitation in CO₂ plasmas

Area: Modelling of atmospheric pressure MW plasma

Duration: 6 months or 1 year

Different strategies are being currently investigated around the world to mitigate carbon dioxide emission. The re-capture of CO₂ and conversion into fuels is the key step for carbon neutral energy cycles. Low temperature microwave plasmas are one of the most promising candidates and energy efficient process for the conversion of CO₂ into solar fuels.

Previously, a complete CO₂ plasma chemistry model was implemented in the plasma modelling platform PLASIMO (Technical University of Eindhoven, prof. Jan van Dijk). At IPP, this model was evaluated and benchmarked versus other existing models and a roadmap for future improvements defined for neutral and ionic species in their ground states. A self-consistent description of vibrational excitation, not only for calculating (and predicting correct) vibrational distribution functions but also to obtain a realistic energy balance of the plasma is still necessary. A predictive model will depend critically on its data input and several (semi-empirical) theories have been proposed so far but still need to be rigorously tested. The theoretical results based on different approximations will be then benchmarked against available experimental data for CO₂ vibrational excitation. The model will also be used to support the experimental campaigns performed at IPP on CO₂ conversion by microwave plasmas.

The master thesis work will be based at IPP in Garching. There may however be the additional possibility of traveling to the Technical University of Eindhoven (The Netherlands) in the frame of the bi-lateral collaboration between the two groups.

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