The **French-German Research Institute of Saint-Louis (ISL)** situated in the border triangle of Germany, France and Switzerland is an internationally renowned research institute belonging to a global industrial and economic network.
The spectrum of our core activities comprises a variety of topics: aerodynamics, energetic and advanced materials, lasers and electromagnetic technologies, protection, security and situational awareness. Our activities are related to both basic and applied research.

ISL is offering a **PhD Position**

Keywords: Hypersonic flows, Aerothermodynamics, Shock tunnel experiments, Spectroscopy, Numerical simulations

Thermochemical characterization of blunt-body flows in hypersonic test-facilities

Context

Hypersonic flows are characterized by real-gas effects occurring due to vibrational and electronic excitation as well as chemical reactions, e.g. dissociation, recombination and ionization of molecules or atoms. These real-gas effects alter the thermodynamic properties and individual species concentrations in the flow. This is of importance for hypersonic applications like atmospheric re-entry vehicles, where the design of the heat-shield is crucially dependent on the thermal loads, which are strongly affected by real-gas effects. Furthermore, the electrically charged particles generated by chemical ionization reactions can result in radio-blackout phenomena and altered radar signatures of hypersonic objects. The interaction of plasma sheaths forming around hypersonic flight objects with electromagnetic waves, however, has not yet been studied conclusively.

Goals of the project

The main goal of the thesis is to characterize the thermochemical non-equilibrium flowfield of a blunt body in hypersonic test-facilities by experimental means. Key quantities would be species concentrations and temperatures that could be obtained, for example, by spectroscopic measurement techniques or electrostatic Langmuir probes. This will include the adaption of existing measurement techniques to the application within hypersonic test-facilities and, if necessary, the development of new measurement techniques. Another goal is the assessement of existing simulation capabilities for thermochemical non-equilibrium flows by comparison of numerical simulation results to experimental data. This will eventually enable in-detail analyses of plasma sheaths forming around hypersonic objects, their influence on the heat loads and the propagation of electromagnetic waves within hypersonic plasmas.

Candidate profile

- Master's degree in Physics, Aerodynamics, Thermodynamics or similar engineering discipline
- Interest in measurement techniques (experience in spectroscopic or electrostatic measurements is advantageous)
- Proficiency in spoken and written English
- Personal initiative, reliability, teamwork and communication skills

Benefits

- Ph.D. degree in the domain of Aerospace (Engineering)
- Interdisciplinary work experience
- International research environment
- Hands-on experience on unique experimental facilities at ISL

Localization

The experimental and numerical studies will be conducted in-house at the French-German Research Institute of Saint-Louis (ISL).

French-German Research Institute of Saint-Louis (ISL)

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