PLASMA IN INTERFACES
INTERACTION OF A PLASMA WITH A SURFACE

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Plasma jets are studied a lot for biomedical applications. Microdischarges provide a lot of reactive species able to interact with a surface. The propagation can occur over long distances, so the electrical source is far away from the region to threat, which avoids electrical risks. Strong interaction between the plasma and the surfaces.
Experimental setup

Typical signals of a Helium discharge fed with a low frequency sinusoidal voltage

- Pin electrode
- Ring electrode
- Grounded tube
- Dielectric capillary (length: 50cm)
Diagnostics

Electrical diagnostic: antenna signals along the capillary (He)

Optical diagnostic: fast imaging

Optical emission spectroscopy

(Ar)  (He)
During the cycle, the propagation length increases after each discharge

Charge deposition

Each discharge deposits charges on the surface on which they propagate, which causes a progressive charge of the capillary.
Charge deposition (He)
A discontinuity is observed during the propagation of each discharge.
Simulations

Configuration without any charges on the surfaces of the capillary

Total potential on the axis \((r=0)\)

Total electric field on the axis \((r=0)\)
Simulations

Charged surfaces:
-3nC.cm$^{-2}$

Charged surfaces:
+3nC.cm$^{-2}$

The electric field locally increases in the transition region
A discharge appears at the water surface and joins the jet coming from the capillary. When the gap is shorter the discharge goes faster.
Perspectives: Laser Absorption Spectroscopy - $H(\alpha)$

\[ n = \frac{4 \varepsilon_0 m_e c^2 \tau(\lambda)}{e^2 \lambda_0^2 f_{12} L \cdot P(\lambda)} \]

\[ P(\lambda) = \frac{\tau(\lambda)}{\int_0^{\infty} \tau(\lambda) d\lambda} \]

Density of excited H atoms

Work in collaboration with J. Winter (INP Greifswald, Germany)
Perspectives: Laser Absorption Spectroscopy - H(α)

Fitting method (lorentzian and gaussian profiles)

Gas temperature

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Thank you for your attention