

# **Longitudinal Vortex Plasmoid Created by Capacity Coupled HF Discharge**

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## **Abstract**

Study of a long-lived longitudinal HF plasmoid in swirl flow at atmospheric pressure is important for basic plasma physics and modeling of electric phenomena in tornado [1]. Remind that vortex plasmoid was studied by P. Kapitsa more than 60 years ago [2] at the first time. However the experimental results obtained by him are not clear and studied in detail up today. So, our work is real continuation of Kapitsa's work.

The following tasks are studied in this work [3]:

1. Plasma-chemical kinetics and stimulated relaxation processes in a non-equilibrium longitudinal plasmoid created by capac-

ity coupled HF discharge (CHFD) in high-speed swirl airflow. Study of their roles in vortex plasmoid structure and its dynamics.

2. Stable HF plasmoid creation in high-speed swirl airflow by CHFD.

3. Physical properties and parameters of a longitudinal vortex plasmoid at different airflow parameters and electric HF discharge parameters.

4. Vortex amplification and its decay (destruction) by HF plasmoid

5. Control of a longitudinal plasma vortex location in space and time by additional external electrical field or external ionizer.

The new experimental results on a longitudinal vortex plasmoid (LVP) structure and its evolution are obtained and discussed in this work both at *pulsed repetitive HF power pumping and continuous HF power pumping namely*. This task is very important from the point of view of electric HF plasma parameters optimization for vortex control.

LVP's creation and its structure in swirl airflow are studied by optical interferometer, high-speed camera and electric probe simultaneously at the first time. The obtained experimental results will be used in a theoretical model formulation and its creation.

It is revealed that there is considerable vortex attenuation (decay) at HF plasma on.

It is revealed that plasma parameters are closed to equilibrium ones near axis of HF plasmoid. There is non-equilibrium plasma halo around plasmoid's kernel also in this plasmoid. It is revealed that a longitudinal vortex plasmoid creation is associated with V-T relaxation process of preliminary excited molecules. It is obtained that a longitudinal vortex plasmoid is not created in vortex argon flow.

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1. Nalivkin D., Storms and Tornados, RAS, L.1969, P.488

2. Kapitsa P., MW Plasmoid at High Pressure, JETPh, 1969, V.57, No.6 P.1801 (in Russian)

3. Klimov A., Bityurin V., et.al., AIAA Paper 2006-0670. P.10