

# Electric plasmas

The transport and distribution of electrical energy takes place through an electrical network that must be protected. Protection devices, although increasingly replaced by power electronics systems, are mainly based on the creation of an electric arc that dissipates the energy contained in the network to open the circuit and thus protect the downstream circuit. The implementation of models and experiments necessary for their validation is a prerequisite for the development of new equipment, particularly in the field of continuous currents.

Thermal plasmas, which are the basic components of the electric arc, correspond to a partially ionized gaseous medium, with a temperature varying from the electronvolt fraction to several electronvolts. In particular, we study physico-chemical phenomena in arc-based systems related to industry or other academic laboratories.

## High Energy phenomena in plasma shocks

The study of production of ionizing radiation in plasma discharges (lightning arc, electric arc and plasma close to electrical contacts) is an emerging activity in the laboratory. Lightning arcs are natural accelerators of particles: the difference of potential and the low pressure of the upper atmosphere favor the acceleration of the electrons. Relativistic electron avalanches can occur by emitting Gamma radiation and X-rays through Bremsstrahlung process. Known as terrestrial gamma-ray flashes, these phenomena were first observed by the Compton Gamma Ray Observatory satellite and will be studied by CNES's TARANIS satellite after its launch in 2019. The first detection of flash gammas produced by lightning was performed by a Japanese team in 2017.

The study of the production of ionizing radiation in plasma discharges at LPC is part of a regional and national collaboration on the risks induced by lightning. The impact of atmospheric electricity in general, and especially lightning, on the climate, the mineral world and living organisms remains poorly understood.

Contact person

Pascal André, Pr

[Pascal.Andre@uca.fr](mailto:Pascal.Andre@uca.fr)(mailto:Pascal%2EAndre%40uca%2Efr?Subject=&body=)

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