



## **High-speed TLE observation systems complementing the ASIM and TARANIS missions**

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We here present the design and development of two high-speed Transient Luminous Event (TLE) ground-based observatories designed to support current and future space missions such as ASIM and TARANIS.

The advantage of the presented systems is that they are based on a low-cost high-speed camera (Chronos 1.4, imaging at 1000-38000 fps). The design is such that all components are placed inside a camera housing, including power supply, instruments and a mini PC for controlling and data handling. The high-speed camera is equipped with 8-80 mm remotely controllable motorized lens and has been programmed to be automatically triggered and to save the relevant data. The first system includes a sensitive Watec camera (WaT-902H) commonly used for TLE observations and the second system includes a photometer (Hamamatsu R2949) sampled at 122 kHz and a very sensitive EMCCD camera, ideal for imaging elves and the fainter parts of sprites. Both systems are mounted on a QuickSet motorized Pan-Tilt unit allowing for active and automatic tracking of thunderstorms. The systems are partly autonomous and can be controlled fully remotely.

The first system is installed in Provence on a location at 1025 m altitude made available by the “Laboratoire Souterrain à Bas Bruit” in Rustrel. The second system will be installed in summer 2019 at 2870 m altitude on the Pic Du Midi at the “Observatoire Midi-Pyrenees”. Both systems have a range of ~700 km and are in the vicinity of two lightning mapping array (LMA) systems which allow for 3D mapping of lightning inside the cloud. One LMA operates over the Ebro valley and the other over Corsica.

The combination of our ground-based systems together with 3D LMA data and data from space missions will improve our understanding of the generation and development of TLEs.