The primary objective of the project is to obtain and investigate the luminescence properties of materials that combine the properties of up-conversion, i.e. the process of luminescence as a result of multiphoton excitation (up-conversion) and persistent luminescence (PersL), and investigate the possibility of controlling PersL properties through the process of up-conversion.

Up-conversion is a process observed in specific materials mostly doped with lanthanide ions (i.e. Yb^{3+}, Er^{3+}), when two or three photons of lower energy, usually from infrared range, are converted into one photon of higher energy, usually in the range of visible or ultraviolet light.

The phenomenon of persistent luminescence (often referred to as delayed and long-lasting luminescence or, confusingly, simply phosphorescence) is controlled by the slow, thermal deexcitation-induced release of trapped charge carriers leading to the populating of excited states of luminescent dopants. The resulting emission is usually in the visible or near-infrared light range. Depending on the type of host material, dopants, method of excitation, use (or not) of photostimulation and temperature changes, it can last from a few minutes to several hours after removal of the excitation source. As a result of the project and the combination of persistent with up-conversion properties in a single material, the observed PersL will be able to be induced for the first time not by high-energy excitation such as X-ray or UV, but by laser excitation in the infrared range.

The rare earth ion doped fluoride nanomaterials obtained in this project with such complex luminescent properties, are highly desirable for future applications as specific markers in biotechnology, but also potentially in other fields, such as security, for authenticating valuable objects.