## DESCRIPTION FOR THE GENERAL PUBLIC

The project concerns the searching for novel luminescent materials based on lanthanide ions combined with a specific organic anion named tricyanomethanide. **Luminescence** is the ability of the material to emit light after the absorption of photons, due to the chemical reaction, electric current passage, mechanical action, or the impact of other external stimuli. The scientific interest devoted to luminescent materials is related to the wide range of their applications in science, technology, and everyday life. For instance, solid luminophores are used in displays, light-emitting devices (LEDs, OLEDs), optical communication, optical memories, photovoltaics, chemical sensors, X-ray detectors, bioimaging tools, and molecular thermometry.

One of the greatest stimuli for the development of novel luminescent materials is related to their exploration in light-emitting devices and displays. Considering the broad range of advanced optical features offered by solid luminophores, the most attractive effects from the viewpoint of light-emitting applications include tunable multicolored visible emission, white light emission (WLE), sensitized near-infrared (NIR) luminescence, and up-conversion luminescence (UCL). Another important direction in the field of luminescent materials, especially photoluminescent materials (emitting light due to the absorption of the light of a different wavelength) is the quest for visible-light emissive solids exhibiting the efficient switching of emission color, and other optical features, by external stimuli, such as temperature, pressure, excitation wavelength, or guest molecules. In this regard, particular interest is given to thermosensitive photo-luminescent materials that can be used in the construction of **optical molecular thermometers** enabling contactless temperature sensing in chemical nanoreactors or biological objects at the nanometric scale. On the other hand, a special place among solid luminophores is occupied by light-emitting devices (LEDs), consisting of **electroluminescent materials** (emitting light as a result of the passage of an electric current), which are widely used in solid-state lighting, full-color displays, as well as other consumer electronics.

The goal of the project is to design, synthesize, and characterize a new class of photo- and electro-luminescent molecular materials showing diverse energy-conversion functionalities including tunable visible emission, WLE, NIR emission, and UCL, further expanded towards luminescent thermometry. To achieve this, we will employ **trivalent lanthanide ions combined with tricyanomethanides** within **luminescent coordination networks**, prepared in the crystalline form, which will be used as the source of **thermosensitive photoluminescent materials**. Under UV light irradiation, most of the lanthanide ions exhibit luminescence covering the wide range of electromagnetic radiation from UV ($Gd^{3+}$) through the visible ($Eu^{3+}$, $Sm^{3+}$, $Tb^{3+}$) to the near-infrared regions ($Nd^{3+}$, $Yb^{3+}$). Moreover, they can reveal the combined emission related to the mixture of lanthanides within the solid, as well as two-photon processes giving the non-standard NIR-induced emission of an up-conversion type. We will explore these unique properties of lanthanides, moreover, we will modulate them by the incorporation of lanthanide ions into the coordination networks with tricyanomethanide ions. They will be further functionalized by supporting counter-ions and organic ligands to achieve the efficient luminescent thermometric effect. It is also planned to test the obtained materials for **electroluminescence properties** by constructing the related light-emitting devices, also checking their sensitivity toward temperature changes. Therefore, in the project, we will show novel synthetic pathways toward advanced solid luminophores with the ultimate goal of combining **thermosensitive photo- and electroluminescent effects** to obtain unique multifunctional energy conversion systems (see scheme below). Besides the materials science viewpoint, the project will also contribute to the increase of general knowledge in the field of lanthanide luminescent materials and the interactions between light and matter as well as electric current and matter both within primarily prepared crystalline solids as well as the subsequent forms of electroluminescent thin films.