Light plays one of the crucial roles in our lives. It allows us to see the world around us, it is required for plants to grow but also is the basis for functioning of many devices. It is foreseen that in XXIst century the development of photonics will be as important as development of electronics in XXth century. Given the outburst of soft (e.g. wearable) electronic systems working at the forefront of human–machine interface, it is crucial to develop photonic systems with flexible, chiral and adaptable structure. Preparation of such materials for perspective photonic applications is the main goal of the outlined project. It is also worth to mention that another goal is building a dynamic, interdisciplinary scientific team that will be prepared to undertake crucial scientific and engineering problems from the boarder of chemistry, physics and biology.

One of the most promising strategies to produce chiral photonic materials is by using extremely small building blocks (nanoparticles), that exhibit unique properties related to absorption, focusing and light emitting. Unfortunately, often to prepare such materials it is required to use lithographic methods which are not cost-effective. Other methods often rely on solvent use, thus these are not integrable with devices. Moreover, majority of such materials are static, which means that one cannot change the materials structure and properties after the synthesis. Also, these are usually stiff structures which cannot be bent to follow the contour of a human body. By resolving these problems we should open the access to new intriguing photonic applications which makes this task extremely interesting both from scientific and applicative point of view.

Within this project we will resolve above mentioned problems by using an innovative strategy of building materials by combining chiral liquid-crystalline templates (in general materials known e.g. from LCD displays) and chosen, very small building blocks (nanoparticles). The latter, will be made chemically similar to the templates. This approach will enable spontaneous, cheap and quick formation of chiral structures, that both in function and properties mimic the most complex natural materials. Moreover, our methodology will provide access to flexible photonic materials crucial for a variety of applications, determined by the types of building blocks used.

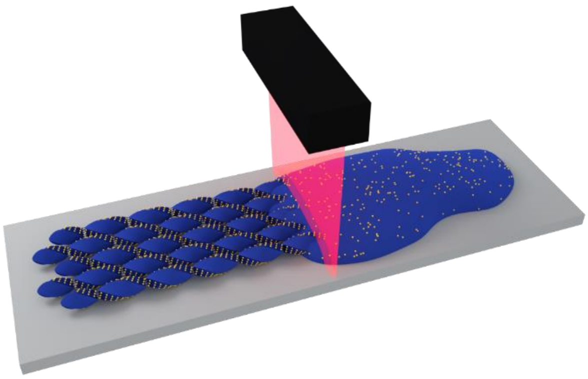

Fig. 1. *Chiral (helical) nanomaterials formation in a crystallization process (indicated by the pink light). In this process gold nanoparticles (yellow spheres) crystallize together with the matrix materials (blue), to form helical nanostructures. Such materials are the aim of the study, but further manipulated to render them flexible.*