In 1992, Claude Weisbuch with co-workers published their work (*Phys. Rev. Lett.* **69**, 3314-3317 (1992).), being a breakthrough in the study of VCSEL-type (*Vertical-cavity surface-emitting laser*) microcavity structures, indicating the existence of microcavity exciton-polaritons. Since then, the subject of these quasiparticles has become one of the most dynamically developing fields in semiconductor physics. Despite much theoretical and experimental research over the years, there is still a large area of unexplored phenomena in this system, especially in structures based on semiconductors from II-VI groups of periodic table of elements.

Microcavity exciton-polaritons are quasiparticles formed under conditions of strong light-matter coupling in an optical microcavity. In this structure, a quantum emitter (usually a quantum well) is placed between two semiconductor mirrors made of Bragg pairs. Photons confined by the cavity and the electron-hole pair (excitons), which are excited states of the quantum well, under strong coupling conditions form quasiparticles with double nature. Thanks to a photonic contribution, the polaritons are characterized by a small mass ($\sim10^{-7}$ of a hydrogen atom). At the same time they preserve a possibility of mutual interactions, due to their excitonic component. The total spin and interactions of the polaritons provide the ability to create a condensate of polaritons, which can be described by a common wave function, in the same way as it is in the case of a Bose-Einstein gas condensate. In a non-equilibrium condensate, the lifetime of these quasiparticles ranges from several hundred of femtoseconds to several of hundred picoseconds, which gives a chance of building a new type of optoelectronic devices. In addition, the properties of photons and excitons in this system provide it with unique properties from the point of view of fundamental research.

The main task of the project is to investigate the effect of exciton-polaritons ordered motion (*flow*) in a semiconductor optical microcavity based on II-VI group materials. The subject of the project is relevant to the domains of photonics, Cavity Quantum Electrodynamics (CQED), quantum optics, quantum information. Previous experiments related to condensate flow manipulation were mainly limited to III-V semiconductors. Due to the larger oscillator strength than in the case of III-V counterparts and the shorter lifetime of polaritons, materials II-VI give hope to produce faster devices based on polariton flow manipulation such as optical switches or modulators. Discovery in this field using materials with potentially better parameters could offer new possibilities for improved optoelectronic devices.

In the project, using the structures containing optical microcavities with quantum emitters, we intend to demonstrate the ability to manipulate the polariton flow through photonic waveguides, which will be produced by dry etching methods. In addition, the trapping of polaritons in structural defects will be investigated. We also plan to observe polariton tunneling between microstructures (e. g. two micropillars or photonic waveguides) and we will present a new concept of reflectivity based focusing system inspired by the analogous effect found in the domain of plasmonic-polaritons and geometrical optics.

The problem of polariton fluid is the basis of a new field of science related to the coherent, spatial flow of polaritons. Determining of the flow parameters such as the free path and the lifetime of these quaziparticles is crucial in the considering this group of materials as a potential candidate for applications. Thanks to controlled manipulations the paths and circuits can be produced, which can be used to build quantum devices. Issues in the field of polaritronics are also an important in the field of fundamental research revealing of quantum mechanics.

Producing and observing mentioned effects in II-VI semiconductors is an interesting challenge from a point of view new material concepts, which is attractive from the perspective of fundamental research and also indicate a real opportunity for introduction the new materials into the field of polaritronics.