In the continuously evolving area of optoelectronics, the quest for tunable, multicolor, and white light sources has become a highly desirable objective. In this context, it is worth noting the fascinating laser technologies. Recent advancements, especially the introduction of laser televisions to the market, already represent a significant technological breakthrough, surpassing competing devices and gradually becoming accessible to everyone. Lasers can offer an increase in the color gamut by up to 70%, compared to the achievements of conventional energy sources, translating into the highest quality of television imagery. Additionally, they ensure precise and well-defined resolution, as well as the advantage of creating compact and flexible devices. Their efficient energy consumption makes them a promising choice for various applications, such as displays or medical imaging. **The scientific goal of this project is to demonstrate the great potential of white and multicolor light emission by exploring the properties of luminescent materials and presenting innovative systems that can provide these effects. The motivation for these studies stems from the awareness of the impact that these systems can have in various fields, from technologically advanced applications like laser displays and automotive headlights to bioimaging and medical diagnostics.**

This particular research is also motivated by the fact, that white lasers can be very useful in communication through Light-Fidelity (Li-Fi). This is a novel concept that surpasses Wi-Fi tenfold in the context of data delivery speed (considering the speed of data transfer). Moreover, with the use of laser, this technology can be better than current technology even a hundredfold. It gives a chance for light-based communication in sensitive environments like aircraft and hospitals. To achieve these breakthroughs, researchers are currently searching and pushing the boundaries in fundamental research to find the most intriguing, and simplified systems capable of providing both white and multicolor, tunable fluorescence and laser emission. **This project focuses on understanding and exploring materials at a fundamental level.** Questions arise: Can direct synthesis produce luminescent materials capable of generating both white fluorescence and laser emission? How can these materials be combined into easily tunable systems for multicolor fluorescence and lasing?

Undoubtedly, the importance of this research is underlined by the surge in interest following the groundbreaking introduction of the first white laser. The scientific literature in this field is still relatively limited, given that the inception of the first white laser took place a mere eight years ago (in 2015). This recent advancement positions the literature as exceptionally novel and distinctive on a global scale. Also, it is rapidly expanding, revealing the dynamic and captivating essence of this subject. **The innovative nature of the project lies not only in its pursuit of novel two and three-dye systems but also in paving the way for simplified studies using a single dye, which will serve as the breakthrough.** The development in the scientific discipline extends across three dimensions: advancing foundational knowledge, showcasing the impact of molecular engineering, and achieving a breakthrough in materials science and optoelectronics. The project's timeline unfolds through meticulously planned stages, from the synthesis of luminescent compounds to the integration of various dye systems for multicolor and white light emission. Each stage is planned toward achieving milestones such as white fluorescence and multicolor fluorescence using a single dye, and the characterization of spectroscopic properties (both, the basic ones, as the advanced, lasing methods) in diverse systems. Complementary, microscopic studies not only reveal the morphology and structural features of the samples but also provide insights into anisotropic media like liquid crystals. The meticulous analysis involves techniques ranging from bright-field examination to crossed polarizers and fluorescence microscopy, offering a comprehensive understanding of the samples' composition and behavior. In the final phase of the project, the integration of materials from two distinct groups — TAZ and PDIs — takes center stage. **The goal is ambitious: achieving multicolor and white light emission using a single compound, a feat yet to be documented in scientific literature. The project's milestones and deliverables promise not only scientific publications but also a deeper understanding of the dynamic interplay between luminescent materials.**