Quantum cascade laser (QCL) is a relatively new type of semiconductor lasers with a different principle of operation than those which are already in common use: as indicators, inside printers or for medical applications. Quantum cascade lasers use only one type of charge carriers: electrons, while other types of semiconductor lasers (diode lasers) use two types of carriers: electrons and holes. It leads to many implications for QCL operation.

One of these implications is polarization selection rule. As a rule, light generated by QCLs should be polarized linearly in a predetermined direction. However, we have already done preliminary research and we know that this statement is not entirely true. Indeed, most of the light is polarized in the typical direction but not all. Up to 11% of the light has the second, theoretically forbidden polarization. So we know that this polarization is present but we do not know why. We consider several options: Firstly, the theory is inaccurate, because it assumes that we have infinitely vast ideal layers of ideal semiconductor. Secondly, the polarization changes by reflection from metalizations inside the laser. Finally, shape of the laser inferior forces change of the plane of polarization that the light can propagate in this.

To check which of these hypotheses are true, we are going to examine several series of quantum cascade lasers with various construction parameters: width, length or shape. At the same time, we are going to perform computer simulations of this lasers. Performing computer simulations we can "turn on and off" particular physical phenomena in them. Comparing thus obtained theoretical results with the experimental ones, we can assess which phenomena occur and to what extent. In this way we are going to verify which of our hypotheses is true. We suspect that more than one. Maybe even all of them. In this case we will have to determine the importance of each mechanism of the polarization change. Which is dominant and which is only a minor addition.

Finally, there is the most important questions: Is it important? Is this few percent of other polarization a big difference? Yes, if we want to use quantum cascade laser in some particular applications we have to know exactly the polarization. These include ellipsometry and certain types of spectroscopy. Additionally, if we know the origin of the polarization which is nonstandard for quantum cascade lasers, then we will able to control the polarization and, if necessary, intentionally change it.