

In this report, development of a scientific field at the intersection of high-energy physics and physics of super-strong light fields is discussed. Currently, several laboratories around the world are building laser complexes with multi-petawatt and subexawatt power, which allow focusing laser pulses with a duration of about 10 femtoseconds to giant intensities exceeding  $10^{23}$  W/cm<sup>2</sup>. The states of matter and vacuum that arise in such fields are still the subject of theoretical studies that predict amazing properties and promise unique applications. The report will present the possibilities for obtaining super-dense electron-positron plasma, giant magnetic fields and powerful sources of highly directed gamma radiation in the laboratory, for studying the spatio-temporal structure of the quantum vacuum, and will discuss approaches for further moving along the intensity scale and approaching the level of Schwinger fields.