Conformal symmetry in the very early Universe

The project consists of two parts. The first part, in collaboration with the winner of the Nobel Prize in Physics in 2020 sir Roger Penrose is devoted to the research in the so called Conformal Cyclic Cosmology proposal. Within this theory our Universe is one in the series of subsequent Universes (eons). The project is devoted to looking for possible traces of the previous eon, mostly in the form of patterns on the Cosmic Microwave Background maps which are precise photos of our Universe when it was very young (380 000 years old i.e. almost 14 billion years ago). The research can also provide a probable description of the future of our Universe. The second part, in collaboration with prof. Hermann Nicolai from the Albert Einstein Institute in Potsdam, Germany, is devoted to an attempt to explain several unclear issues in our understanding of the Universe. These issues include, among others, the question about the origin of huge black holes (more than a billion solar masses) in the very early Universe more than 13 billion years ago, the origin of ultra high energy cosmic rays (of the energy effectively much bigger than the energy available at the Large Hadron Collider) and the nature of Dark Matter.