Fluorine (F) is the most reactive of all known elements. It forms many exotic compounds such as noble gas fluorides (*e.g.* KrF_2, XeF_2) or connections featuring elements in their highest possible oxidation state (*e.g.* HgF_4). The fluoride anion is also an important element in systems exhibiting different magnetic order, such as ferromagnetism or antiferromagnetism.

Recent calculations indicated that the peculiar properties of fluorine can become even more exotic when this element is compressed to pressures exceeding 1 GPa (about 10 000 atm). Such pressures can be simulated in calculations, but also probed experimentally by the use of the so-called diamond anvil cell (DAC).

In this project we plan to verify, both by theory and experiment, the hypothesis of the increased reactivity of compressed fluorine. We also want to establish how squeezing fluorides of selected transition metals changes their structure and magnetism. We will study by calculations the reactivity of fluorine towards oxygen, sulphur, chlorine, and bromine. Experimentally we will investigate the pressure-induced phase transitions in compounds containing fluorine alongside with alkali metals (sodium, potassium, rubidium) and transition metal (nickel, copper, zinc). Our study will be conducted for pressures up to 100 GPa, that is nearly a million atmoshperes.

Apart from predicting the formation of new compounds and observation of new properties, an important result of this project will be gaining a deeper understanding of the chemistry of fluorine. Our study will also be a way of testing important concepts used in chemistry such as electronegativity, oxidation state, or atomic radii.