DESCRIPTION FOR THE GENERAL PUBLIC

This project aims at the investigation of the β decay of the uranium fission products and the upgrade of the Modular Total Absorption Spectrometer (MTAS) for future experiments.
The results will remove the ambiguity existing between experimental and calculated data for the decay heat as well as for the reactor anti-neutrino anomaly.

The term "decay heat" refers to the energy from delayed beta and gamma radiation emitted by the fission products and accounts for about 8% of the total energy produced in a reactor by fission. After a reactor shutdown, the decay heat is the dominant source of heating the nuclear fuel and the reactor itself. Nuclear power, as a CO2-free energy source, will continue to contribute to the energy generation technologies. However, even before the Fukushima accident, the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development called for new studies of decay heat to reduce the uncertainties in computer codes and nuclear data used in the analysis of emergency core-cooling performance. These studies are intended to provide a better understanding of the reactor safety and nuclear waste management and improve the designs of the new generation of nuclear power plants.

The term "reactor anti-neutrino anomaly" refers to the deficit of anti-neutrinos detected in short baseline experiments conducted near nuclear reactors. Since 2011, a value of about 94% is quoted as the ratio of the observed to the expected number of anti-neutrino interactions in a single detector placed within 100 meters from a reactor core. The predicted number of anti-neutrino interactions depends on the properties of the anti-neutrino flux as well as the energy of the anti-neutrinos created in the beta decay of fission products occurring during the experiment. In order to interact with detector matter, anti-neutrinos requires energy above 1.8 MeV and the interaction rate increases as the energy above this threshold increases.
Here, we do not discuss the assumptions leading to the anti-neutrino flux causing the *reactor anti-neutrino anomaly*, as well as the far reaching consequences of such *anomaly*. We point out that a proper measurement (with high efficiency detectors) and careful analysis of beta decay schemes of fission products most abundant in the nuclear reactors reduces dramatically the expected flux of reactor anti-neutrinos interacting with detector matter. The analysis of the decay of ^{86}Br and ^{139}Xe fission products already performed supports this approach.

Results of the data analysis proposed within this project should significantly impact the decay heat calculation as well as the so called *reactor anti-neutrino anomaly*. The new detectors built in the framework of this project will enhance the performance of the MTAS detector, when used at the new radioactive beam facilities in USA and will constitute a starting point for construction of the University of Warsaw owned total absorption spectrometer to be used at the European facilities. The work performed within this project will be part of at least one PhD thesis and one master thesis prepared at the Faculty of Physics of the University of Warsaw.