

To strengthen its neutrino physics research program, the University of Mainz offers

### **1 PhD position (67% EG13)**

at the Cluster of Excellence PRISMA+ to work on “Project 8”, a next generation neutrino mass experiment (<http://www.project8.org>).

Neutrino oscillations provide a clear indication that neutrinos are not massless as assumed in the Standard Model of particle physics. Yet the masses of the neutrinos are several orders of magnitude lower than those of other fermions, and only upper limits have been set so far. Today, the most sensitive method to observe neutrino masses in the laboratory is the observation of the tritium  $\beta$ -decay spectrum endpoint region.

Towards this goal, the Project 8 collaboration has developed the novel method of Cyclotron Radiation Emission Spectroscopy (CRES), in which the electron energy is determined by its radio frequency emission when trapped in a magnetic field. Recently, we have succeeded in measuring the tritium spectrum with a small volume inside a waveguide, read out by a single antenna. In order to scale up to the final experiment, several techniques will need to be developed and tested.

Led by Prof. Böser and Prof. Fertl, the Mainz group is strongly involved in the development of Project 8’s atomic tritium source. Our test stand uses hydrogen (a non-radioactive tritium alternative), and produces an atomic hydrogen beam via dissociation. The resulting atomic beam is hot (2500K), and will need to be cooled in several stages: first to 160K, then to 8K, in preparation for trapping. The goal of this PhD project is to develop a beam cooling strategy and implement it. The project is mainly hardware-oriented but will include some simulation to inform the design. The successful candidate is inquisitive, creative, and has hardware experience. The candidate must hold a Master degree in Physics or Astrophysics with at least a German grade "good" (or equivalent) by the starting date. For inclined applicants with non-Physics degrees, the university’s FastTrack program may offer an attractive route to obtain a Physics Master as well as a PhD: <https://physics.uni-mainz.de/de/degrees/fast-track-phd-2/>