PROJECT 8

Cluster of Excellence PRISMA++ Precision Physics, Fundamental Interactions and Structure of Matter

To strengthen its neutrino research program, the Johannes Gutenberg University Mainz invites applications for

1 PhD position (66% EG13 TV-L)

to work on the Project 8 experiment (https://www.project8.org/).

The Project 8 collaboration is pursuing the method of single-electron Cyclotron Radiation Emission Spectroscopy (CRES) as a new avenue towards the next-generation neutrino mass experiment. The electron's kinetic energy is determined from the frequency of the microwave-range cyclotron radiation emitted by the electron when gyrating in the precision field of a magnetic bottle. We have extracted a very first frequency-based antineutrino mass limit. Because of ro-vibrational broadening of the final state, any next-generation experiment requires an ensemble of spin-polarized and ultra-cold tritium atoms confined as a high-brilliance source of decay electrons to reach a sensitivity beyond the inverted mass ordering. To investigate the suitability of commercially available hydrogen crackers a test stand was commissioned at Johannes Gutenberg University Mainz to investigate the cracking efficiency, beam temperature and angular distribution. This setup is used to explore the operational limits of atomic hydrogen sources and serves as the prototype test bed for a setup compatible with tritium operation. In the next step this setup will be replicated at Germany's premier Tritium Laboratory Karlsruhe (TLK).

The PhD student will investigate the interaction of hot hydrogen atoms with cryogenic surfaces to accommodate their velocity distribution to a range that can be captured in subsequent beamline elements. These will provide further beam cooling and trapping of the tritium atoms. The accommodation efficiency and recombination rate on various material will be investigated. The results provide key input parameters for the size and performance specifications of a closed tritium re-circulation loop at TLK. Embedded within the stimulating environment of the PRISMA++ Cluster of Excellence, outstanding working conditions are provided including e.g. access to a detector development laboratory or various soft-skill development opportunities.

Highly motivated candidates send their application material, including a cover letter including a research statement regarding past and current research experience (2 page max., 12 pt, single line spacing), a CV, copies of relevant certificates and grades, and transcripts of records to project8jobs@lists.uni-mainz.de. Please suggest the names and email address of two providers of a letter of reference (no letters initially required).

Review of the received application will start on January 15th, 2026, but the position will remain open until filled. The candidate must hold a master's degree in physics equivalent to a "good" grade in the JGU system. A very good command of spoken and written English is required for this position. Please do not hesitate to contact Prof. Dr. Sebastian Böser (sboeser@uni-mainz.de) in case of any questions.