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Helping make the invisible visible

X-rays are a powerful tool to aid scientific research. Circular particle accelerators can produce brilliant X-rays that are especially useful for scientific research in areas such as, preservation of cultural heritage and understanding strange phenomena of materials. These strange materials and their phenomena have the potential to play a big part in future human advancements.

Circular particle accelerators or Synchrotrons are a revolutionary tool for scientific investigation. Synchrotron light has special properties which enable it to be a fantastic probe to understand the chemical, structural and electronic properties of newly discovered materials.

There are a range of powerful scientific techniques that harness the properties of synchrotron light in many interesting ways. In the coming years, these techniques will help to reveal the previously unknown and unexplained phenomena of exotic and futuristic materials.

MAX IV is a new generation of synchrotron light source, it takes advantage of new developments in engineering to improve the design of the accelerator. My bachelor thesis was performed at the MAX IV synchrotron which houses a variety of different experiments called beamlines. The project is to assist in bringing the MAX IV synchrotron into working condition, specifically the HIPPIE beamline. Synchrotrons are very large and complex facilities which require the use of diagnostic tools and experiments to provide constructive feedback from the machine. This feedback can be used to improve the beamlines performance and gives researchers a more powerful tool for human development.

The potential applications for a synchrotron are vast and span a variety of disciplines across the scientific spectrum. From the generation of energy via superconducting materials, the creation of tiny nanoparticles to treat cancers and the protection of the environment from pollutants.

The HIPPIE beamline uses a technique called ambient pressure photoelectron spectroscopy. In this technique photons are shot at a sample, emitting photoelectrons. These electrons are detected and help to understand key properties of the surface. The technique operates at ambient pressures allowing experiments to be conducted in earth-like conditions. These conditions are very important for the understanding of material systems that exist in the real world.

Applications of the HIPPIE beamline will be aid research into environment protection by helping to identify how poisonous carbon monoxide gases are released from car exhausts. The beamline will assist in efforts to understand how tiny nano machines are assembled atom by atom.

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