

Popular science summary of the PhD thesis

PhD student	Diego Paredes Sanz
Title of the PhD thesis	High Energy Optics Development for Future Astrophysical Missions
PhD school/Department	DTU Space/Astrophysics and Atmospheric Physics

Science summary

* Please give a short popular summary in English (approximately half a page) suited for the publication of the title, main content, results and innovations of the PhD thesis also including prospective utilizations hereof. The summary should be written for the general public interested in science and technology.

Exploring the most energetic events in the Universe requires telescopes that can “see” in X-rays and gamma rays. Current space observatories like ESA’s *XMM-Newton* and NASA’s *NuSTAR* have been vital for such studies, but their operational lifetimes are drawing to a close. The next generation of space telescopes, including ESA’s ambitious *NewATHENA* mission, aims to look deeper into this high-energy cosmos with sharper vision and broader sensitivity.

This PhD project focused on developing the advanced mirror technologies that make such observations possible. Conventional mirrors cannot reflect high-energy X-rays directly; instead, they rely on ultra-thin coatings made of alternating layers of heavy and light materials that allow these energetic photons to be gently deflected and focused. We contributed to *NewATHENA* by improving these coatings and demonstrated that they can withstand the manufacturing procedures and the harsh environment of space without loss of performance.

A major part of the work also involved modernizing the specialized laboratory infrastructure at DTU Space used to produce and test these coatings. The upgrades improved film uniformity, measurement precision, and production capacity, strengthening Denmark’s contribution to future European space missions.

Finally, we took a step beyond current limits, developing novel mirror coatings that could one day enable telescopes to focus not just X-rays but also soft gamma rays, radiation up to a thousand times more energetic than visible light. Such technology could open new observational windows on cosmic phenomena, from the sites of matter-antimatter annihilation to the inner workings of extreme astrophysical objects. In the long term, these advances may help lay the foundation for a new generation of high-energy telescopes exploring the most powerful processes in the Universe.

Please submit the summary to the department PhD coordinator together with your thesis