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Surrey Uni on space mission to darken the skies

More than 8,000 low Earth orbit (LEO) satellites already orbit Earth, and projections estimate a rise to 60,000 by 2030, partly driven by the development of mega-constellations. The rate of growth means the issue of light reflecting from satellites back to Earth is pressing for astronomers and stargazers, as images from the Vera C Rubin Observatory in Chile have highlighted.

To combat this problem, satellite operators have begun experimenting with mitigation strategies, including dark coatings and changes to satellite position, though the negative impact on ground-based measurement persists. Surrey NanoSystems, with a heritage in ultra-black technologies, have developed an innovative new solution: Vantablack 310 is a handleable, customer-applied coating, resistant to the challenging LEO environment.

The technology will be trialled on Jovian 1, the first satellite mission from JUPITER – the Joint Universities Programme for In-Orbit Training, Education and Research. The mission, scheduled to launch in 2026, will carry payloads from the Universities of Surrey, Portsmouth and Southampton, AMSAT-UK, and one designed, built and tested by students from the three universities, giving them invaluable hands-on space industry experience.

One side of the shoebox-sized CubeSat will be coated with Vantablack 310, marking the first UK-led initiative to explore solutions for reducing satellite brightness. The initiative aims to not only improve space sustainability but also demonstrate the efficacy of Vantablack 310 as a hull-darkening solution. Researchers from the University of Surrey are developing ways to evaluate the experiment from Earth.

Dr Keiran Clifford, Senior Technologist and project lead at Surrey Nanosystems, said:

“The proliferation of satellite constellations is expected to bring huge societal benefits in technology areas, including global communication and remote sensing. Unfortunately, the current brightness of these satellites severely disrupts ground-based astronomy.

“Our latest coating technology, Vantablack 310, offers super-black performance across a wide range of viewing angles, while remaining robust to the challenging LEO environment. We’re proud to be working with our partners at the University of Surrey to deliver innovations in the satellite sector, ensuring sustainable and equitable access to a night sky for all.”

Astha Astha, the postgraduate astrophysics researcher at the University of Surrey who will develop tests to measure how much Vantablack 310 reduces light pollution when viewed from Earth, said:

“Studies show that satellite mega-constellations could increase sky brightness by up to 1% in the worst-affected regions, posing a serious threat to astronomical observations and dark sky preservation. Our project directly tackles that challenge by exploring innovative ways to reduce satellite reflectance. It brings together key areas of Surrey’s expertise — astrophysics, space engineering, and nanotechnology — with Surrey NanoSystems, which itself spun out of the University’s Advanced Technology Institute.”

The relationship between Surrey NanoSystems and the University of Surrey is deeply rooted in research and innovation. As a spinout company in 2006, Surrey NanoSystems leveraged the University’s expertise in nanomaterials and advanced manufacturing techniques to develop its groundbreaking Vantablack® technologies.

Image: Artist’s impression of a large satellite constellation in low Earth orbit circling above the LOFAR telescope. Credit: International Astronomical Union Creative Commons Attribution 4.0 International

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Surrey Uni making self-driving cars safer

With self-driving cars expected to hit British roads next year (2026), a new motion forecasting framework developed by the University of Surrey and Fudan University, China, promises to make autonomous cars both safer and smarter.

Researchers have combined their expertise to create RealMotion – a novel training system that seamlessly integrates historical and real-time scene data with contextual and time-based information, paving the way for more efficient and reliable autonomous vehicle technology.

Dr Xiatian Zhu, senior lecturer at the Centre for Vision, Speech and Signal Processing and the Insitute for People-Centred AI at the University of Surrey and co-author of the study, said:

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“Driverless cars are no longer a futuristic dream. Robotaxis are already operating in parts of the USA and China, and self-driving vehicles are expected to be on UK roads as early as next year. However, the real question on everyone’s mind is: how safe are they?

“While AI operates differently from human drivers, there are still challenges to overcome. That’s why we developed RealMotion – to equip the algorithm with not only real-time data but also the ability to integrate historical context in space and time, enabling more accurate and reliable decision-making for safer autonomous navigation.”

Existing motion forecasting methods typically process each driving scene independently, overlooking the interconnected nature of past and present contexts in continuous driving scenarios. This limitation hinders the ability to accurately predict the behaviours of surrounding vehicles, pedestrians and other agents in ever-changing environments.

In contrast, RealMotion creates a clearer understanding of different driving scenes. Integrating past and present data enhances the prediction of future movements, addressing the inherent complexity of forecasting multiple agents’ movements.

Extensive experiments conducted using the Argoverse dataset, a leading benchmark in autonomous driving research, highlight RealMotion’s accuracy and performance. Compared to other AI models, the framework achieved an 8.60% improvement in Final Displacement Error (FDE) – which is the distance between the predicted final destination and the true final destination. It also demonstrated significant reductions in computational latency, making it highly suitable for real-time applications.

Professor Adrian Hilton, Director of the Surrey Institute for People-Centred AI, said:

“With self-driving cars reaching British roads imminently, ensuring people’s safety is paramount. The development of RealMotion by Dr Zhu and his team offers a significant advance on existing methods. By equipping autonomous vehicles to perceive their surroundings in real-time, and also leverage historical context to make informed decisions, RealMotion paves the way for safer and more intelligent navigation of our roads.”

While researchers encountered some limitations, the team plans to continue its research to further improve RealMotion’s capabilities and overcome any challenges. The framework has the potential to play a critical role in shaping the next generation of autonomous vehicles, ensuring safer and more intelligent navigation systems for the future.

About the Surrey Institute for People-Centred AI (PAI)

Taking a different approach to much AI activity in the UK, the Surrey Institute for People-Centred AI puts the needs of individuals and society at the very heart of everything it does: we believe that the starting point for AI should be people rather than technology.

This people-centred approach drives our research and enables us to design AI technologies and systems that are ethical, responsible, and inclusive. The pan-University Institute brings together Surrey’s core AI-related expertise in vision, speech and signal processing, computer science, and mathematics, with its domain expertise across engineering and physical sciences, human and animal health, law and regulation, business, finance and the arts and social sciences. With this distinctive approach, PAI builds on Surrey’s track record of collaboration with industry, the public sector, government and other relevant institutions to develop solutions to shared challenges.

Image: Waymo self-driving vehicle. Credit Grendelkhan CC by SA 4

Surrey Uni joins top beam team

The creation of a first-of-its-kind imaging system at the **University of Surrey** could help the UK lead a revolution in materials sciences. The new facility promises a better understanding of the effects of pharmaceuticals and could eventually lead to better drug development.

Thanks to a £3 million grant from the Engineering and Physical Sciences Research Council, Surrey will work with the UK SME Ionoptika and the University of Manchester to deliver a new Multimodal Ion Beam Imaging Facility, which will allow researchers and businesses to understand materials at an unprecedented microscopic level.

Professor **Melanie Bailey**, Principal Investigator of the project from the University of Surrey, said:

“The fact that Surrey and, indeed, the UK has the ambition to build this truly unique facility should not only excite researchers in academia and industry, but it signals that we are serious about breaking new ground in a range of scientific areas.”

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The facility will house a “multimodal 3D elemental and molecular imaging system at a sub-micron scale”. This highly advanced system, similar to a powerful microscope, will be able to see the tiniest details of materials and molecules, smaller than a speck of dust.

The new system will be the first in the world to use beams of charged particles at high and low energies to measure biological systems and materials. The high-energy beams will be delivered by a particle accelerator at the UK National Ion Beam Centre, a national research facility funded by EPSRC and led by Professor **Roger Webb** at Surrey. The system will produce X-rays, gamma rays, and particles, and the combination of this information will give a detailed map of the elemental and molecular makeup of materials.

Professor Roger Webb, co-investigator of the project and Director of the Surrey Ion Beam Centre, said:

“This is a really exciting development for the Surrey Ion Beam Centre. We have been a national research facility since 1979, and we support over £100 million in funding from more than 30 universities. This is one of several upgrades to our centre, and we are looking forward to opening our doors to researchers across the UK to make the most of this investment.”

Surrey’s new facility is expected to benefit more than 25 UK universities and companies in health, energy, technology, and engineering.

Professor **Paul Townsend**, co-investigator of the project, said:

“There is currently nothing in the world quite like this new facility of ours. It signals to the global scientific community that the UK means business. We are confident that we will attract researchers worldwide to use this facility, giving the UK an edge in materials science.”

Along with medical breakthroughs, Surrey’s researchers believe the facility could help the energy sector create more efficient solar cells and durable batteries. The team also hopes this project will allow them to understand pollutants better and develop new ways to reduce climate change.

Paul Blenkinsopp, Managing Director of Ionoptika, said:

“Ionoptika is delighted to have been chosen to build the new imaging system in collaboration with Surrey. Whilst an SME, we have established ourselves as global experts in ion beam technology over the past 30 years and will be very proud to bring our decades of imaging expertise to this unique facility.”

This project contributes to the United Nations Sustainable Development Goals (SDG), especially SDG 3 (Good Health and Wellbeing), SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action).

Image of Ionoptika’s J105