£4m Award Gets Space Research Ready For Liftoff

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Scottish space research has been given a major boost with the announcement of £4m in support for projects on solar flares and the exploration of Mars.

The University of Glasgow's Space Glasgow group is spearheading two of 12 new UK-led projects which have received funding from the European Commission's Seventh Framework Programme (FP7) for space-related research. The University's two projects have received a total of €4.8m (£3.95m) in support.

Dr. Lyndsay Fletcher and Dr Nicolas Labrosse from the School of Physics and Astronomy will investigate the physics of solar flares, and the School of Engineering's Dr. Patrick Harkness and Prof. Margaret Lucas will build a new type of drill tool to extract and contain samples from the surface of Mars.

The F-CHROMA project (Flare CHRomospheres: Observations, Models and Archives) will bring together experts from seven institutions to collect, synthesise and analyse data from satellite and earthbound observations of solar flares. Solar flares are energetic outbursts of solar radiation which span the whole electromagnetic spectrum. Mid-sized flares can release energy equivalent to a hundred million megatons of TNT in just a few minutes, most of which ultimately turns into electromagnetic radiation. This radiation is emitted primarily by a thin, and complicated, part of the Sun's atmosphere called the chromosphere.

Dr Fletcher said: "This project will allow us to combine ultra-high detail observation of solar flare events with advanced theoretical and computational modeling to shed light on the way a flare's energy is stored, released, and converted into other forms.

"The material of the solar atmosphere, in common with 99% of the visible universe, is an electrified gas, or plasma, carrying a magnetic field. By studying energy release and radiation in solar flares we'll be learning more about how astrophysical plasmas work, as well as probing a solar system event that has a direct impact on our planet's environment."

The outcomes of F-CHROMA will be used to inform preparations for major forthcoming projects including the Daniel K. Inouye Solar Telescope which will see first light in 2019 in Hawai'i and ESA's Solar Orbiter Mission which is expected to start beaming back solar images and spectra from its orbit in the inner solar system at around the same time.

The Ultrasonic Planetary Core Drill (UPCD) consortium brings together four partner organisations to build a tool capable of drilling and storing samples from the uniquely challenging surface of Mars.

Dr Harkness said: "The Martian surface has features that look like dried up river-beds, suggesting that the planet may have been much wetter in the past. Even today, there may be brine near the surface. Samples of the surface rocks would be extremely useful to develop our understanding of how similar Mars might have been to the Earth and how the planets have diverged.

"We will build a tool that can core-drill a sample and then seal it inside the coring bit itself, so that the bit can serve as a sample return capsule. Planetary drilling is difficult because the low gravity makes it difficult to apply the large forces that are normally used to shatter rock on Earth, while the need to preserve the samples means that the rock temperature must be kept close to ambient. Once we have the samples, they cannot be returned directly to Earth because of the risk – however remote – that they could contain pathogens dangerous to our planet. They must be sealed inside a container that will only be opened in a secure laboratory."

Power ultrasonics, or high frequency vibrations, can be applied to both aspects of this challenge. The UPCD device will use these vibrations to generate percussion that will shatter the rock and allow the coring bit to progress, and then apply the vibrations directly to the tip of the coring bit to weld it closed with the samples and volatiles still trapped within. The device will be field tested at one of the most Mars-like places on Earth, the permafrost of Devon Island in Canada's Baffin Bay, in summer 2016. This should demonstrate the ability of the device to both extract samples and prepare them for return to Earth.

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