University of Freiburg . 79085 Freiburg . Germany

Press Release

University of Freiburg

Rectorate

Public Relations

Fahnenbergplatz
D -79085 Freiburg

Contact:
Rimma Gerenstein
Tel. +49 (0)761 / 203 - 8812
rimma.gerenstein@pr.uni-freiburg.de
www.pr.uni-freiburg.de

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Light in a dark universe

With a grant of two million euros, physicist Marc Schumann aims to spearhead the search for dark matter

It makes up some 25 percent of the universe – and forms a kind of cosmic glue, which holds together galaxies and entire clusters of galaxies. Yet no-one has ever seen it. Dark matter is one of the Universe's biggest mysteries. **Marc Schumann**, Professor of Experimental Astroparticle Physics at the University of Freiburg, is seeking to improve the search for dark matter. Schumann plans to carry out studies on a large underground detector, thereby taking the quest to find dark matter to the limits of what is possible. The biggest challenge is to reduce the background "noise" caused by natural radioactivity. The European Research Council (ERC) has selected Schumann and his plan, ULTIMATE, for a Consolidator Grant of two million euros over the next five years. The ERC grant was decided while Schumann was at the University of Bern, Switzerland; ERC grants are among the most sought-after prizes for European researchers.

Dark matter is so called because it neither emits nor reflects light, and reacts only minimally with other matter. No elementary particle we know of can account for the properties of dark matter: cold – that means slow-moving, very weakly interacting, massive, and stable. That's why researchers assume that dark matter is made of a new particle – the discovery of which would mark a breakthrough in particle physics. Researchers believe that on Earth, some 100,000 dark matter particles per second pass through the area of a thumbnail. Highly sensitive detectors are used in the hunt for these particles. The apparatus has to be constructed deep underground, where it

is shielded from the interference of cosmic radiation. Schumann's working group is already collaborating with more than 130 international researchers to operate the world's biggest dark matter detector, XENON1T, which is located in Gran Sasso, Italy. It is filled with the noble gas xenon in liquid form. When a dark matter particle collides with a xenon nucleus, light and electric charge signals are emitted which can be measured by the delicate sensors.

But even the kilometer-thick layers of rock above the underground laboratories cannot filter out all the undesirable backgrounds. The Sun is constantly emitting extremely light neutrinos, which pass effortlessly through any material and produce signals which cannot be distinguished from those of dark matter. Schumann's goal is to enable the construction of the ultimate detector - which will search for the existence of dark matter in 40 tonnes of highly-purified, liquid xenon. The sensitivity of the apparatus will then only be limited by neutrinos.

More on Marc Schumann's research
www.app.uni-freiburg.de

Contact:
Professor Dr. Marc Schumann
Institute of Physics
University of Freiburg
Phone: +49(0)761/203-96894
E-Mail: marc.schumann@physik.uni-freiburg.de