Physikalisches Institut
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SONDERKOLLOQUIUM

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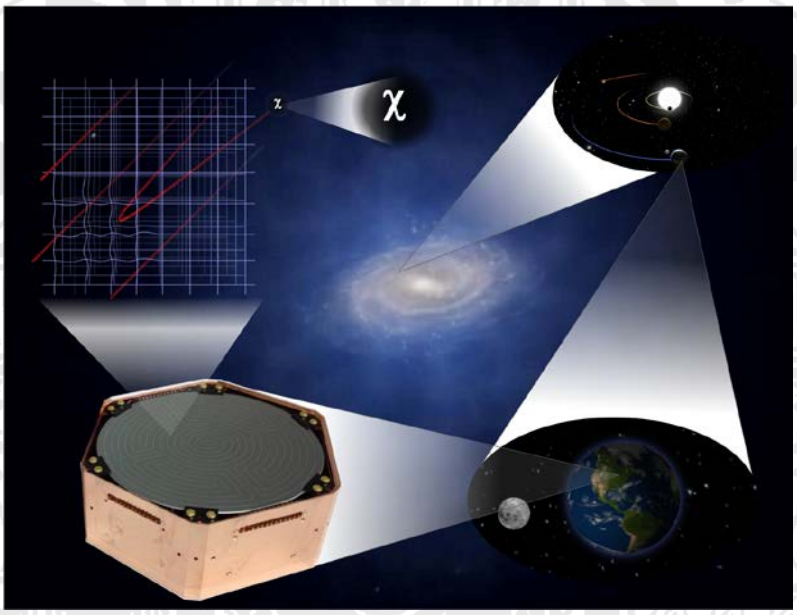

Bringing "Light" into the Discussion of Dark Matter: The Power of Cryogenic Detectors

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We observe striking discrepancies between the gravitation excerted by the visible objects in the universe and the gravitation they experience, as measured by their motion. This has led to the hypothesis that a large fraction of the matter in the universe is of completely different nature than the atomic or baryonic matter we experience in our environment. Since it is not directly observable in optical astronomy, it is called Dark Matter. The Standard Model of Particle Physics does not provide any particle candidate that can explain the observations. However, a diversity of proposed extensions of this model, motivated primarily by theoretical considerations, predict the existence of new heavy elementary particles which may well have the properties needed to account for the above mentioned observations.

The intensive search for interactions from such Weakly Interacting Massive Particles (WIMPs) has been going on since about two decades, yet only recently were we able to reach a sensitivity needed to test some of the most favored models. The lack of a convincing signal from WIMP searches together with the absence of a clear sign for new physics from the LHC have forced us to reconsider some of the basic assumptions and consequently opened the parameter space to include lighter and lighter particles.

Cryogenic detectors are uniquely positioned to explore this new area of interest of light WIMPs with masses below about 10 GeV/c^2. After its recent results made it a trailblazer for this new parameter space, SuperCDMS has been approved for its next phase to be hosted by SNOLAB, one of the worlds best locations to explore low-energy astroparticle physics. The planned setup provides the opportunity to form a transatlantic collaboration and incorporate detectors from Europe (CRESST and EDELWEISS) and North America (SuperCDMS) to form the most powerful cryogenic dark matter search experiment yet.

In this presentation we will quickly review the evidence for dark matter before we learn about the fascinating technology of cryogenic detectors, discuss some details about recent results and shine light on the future of this field, including some of the challenges we face.