

What's the Matter?

For millennia, humans have tried to make sense of the world around us. What it is made of, what holds it together and what laws govern it? Scientists have successfully identified and studied normal matter, the matter that everything we see around us is made of. Normal matter and the forces it interacts with is described by the Standard Model. However, it turns out only 25% of all matter in the universe is normal matter and the rest is the unidentified, mysterious dark matter(DM). Physicists have conducted countless experiments in the search for the nature of dark matter, however none have yet been successful.

To tackle this issue a group of physicists started a project called The Initiative for Dark Matter in Europe and beyond (iDMEu). The project sets out to create a platform which enables communication and encourages collaboration between physicists working on different approaches to identify and detect DM in hopes of advancing DM research.

Due to the limited information we know about DM, there are many different possible particle candidates. The most popular contender is the weakly interacting massive particle (WIMP). WIMPs are heavy elementary particles with a mass between 10 to one hundred thousand times greater than that of a proton, that interact gravitationally and through the weak force. WIMPs not only fit the evidence for DM but also support other models, such as supersymmetry, which predicts the existence of new stable, WIMP- like particles. The discovery of WIMPs would kill two birds with one stone and greatly further our knowledge about the makeup of the universe. For this reason, WIMP experiments are the starting point of the iDMEu project.

DM experiments is a broad term that consists of experiments both space and ground based, looking at different energy ranges, and exploiting various characteristics of DM. Direct detection experiments are placed deep underground and attempt to measure the recoil energy of the occasional interaction of a DM particle with a target nuclei. Indirect experiments are located both in space, on ground, and underground and look for the normal matter particles that come from the annihilation or decay of DM particles. Collider experiments do the reverse process and attempt to generate DM particles by colliding standard model particles. The iDMEu platform will contain a list of all such experiments and will potentially expand to experiments connected to other DM models .

Dark matter research is a broad scientific field with a community that spans many countries, various institutions and facilities that support numerous theories and experiments. Collaboration and result sharing in this diverse community could spark innovation that would boost the decades long search for dark matter.