Dark Matter

Engineering the search for the elusive particles composing the universe

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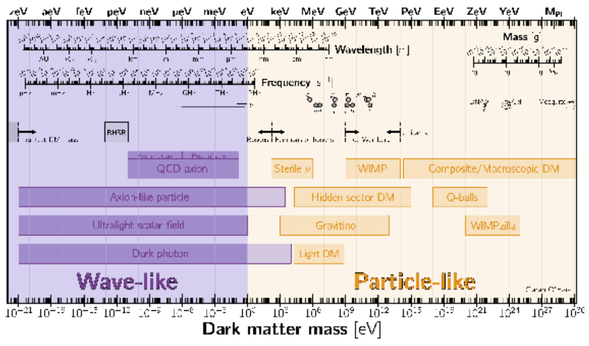
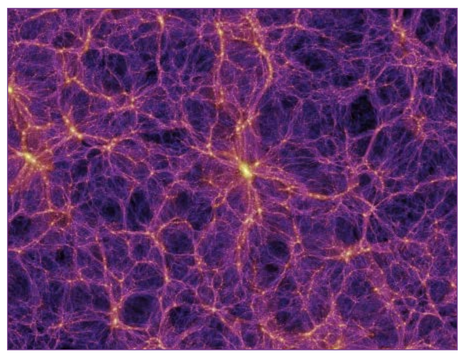
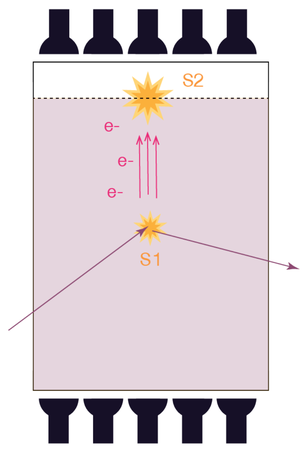
What is Dark Matter?





Most of the universe appears to be made of matter which doesn't interact with light or E&M fields.

How do you detect it?

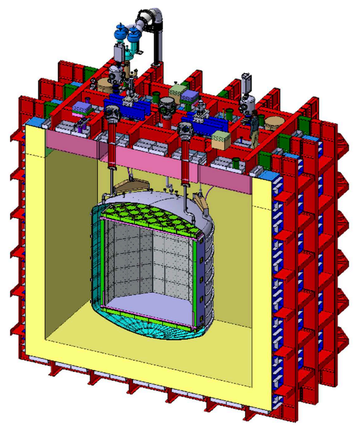


Evidence for this "dark matter" includes the large scale structure of the universe and the rotation curves of spiral galaxies.

However, we may be able to directly detect interactions of dark matter with liquid noble gasses using a time projection chamber (TPC)

What is DarkSide-20k?

DarkSide-20k is a massive liquid argon TPC under the Gran Sasso mountain in Italy. Filled with 50 tons of argon, it will allow for large exposures that will either detect dark matter or eliminate a large paramter space of possible candidates.



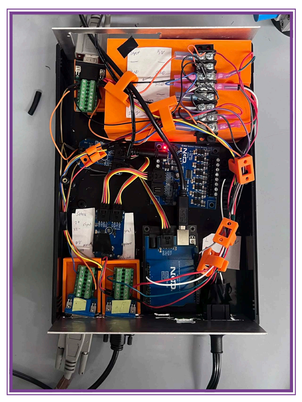
What are we doing at Williams?

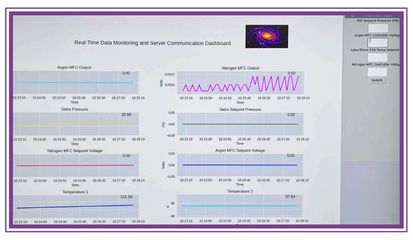
In order to broaden DarkSide's search into lower mass models, we must understand the nature of the background noise found at high sensitivities. To do so, we are creating our very own LAr TPC!

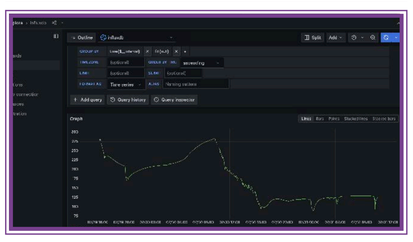
R&D Detector Summer Goals

Improving Diagnostic Tools

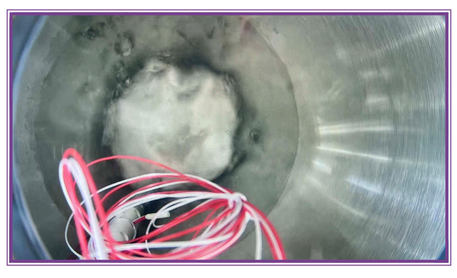
We've created a number of sensing and control systems, which are fed into a Raspberry Pi, allowing us to centrally operate the whole system. Data is also sent to a server for remote storage and access.

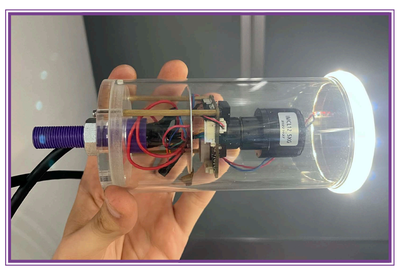




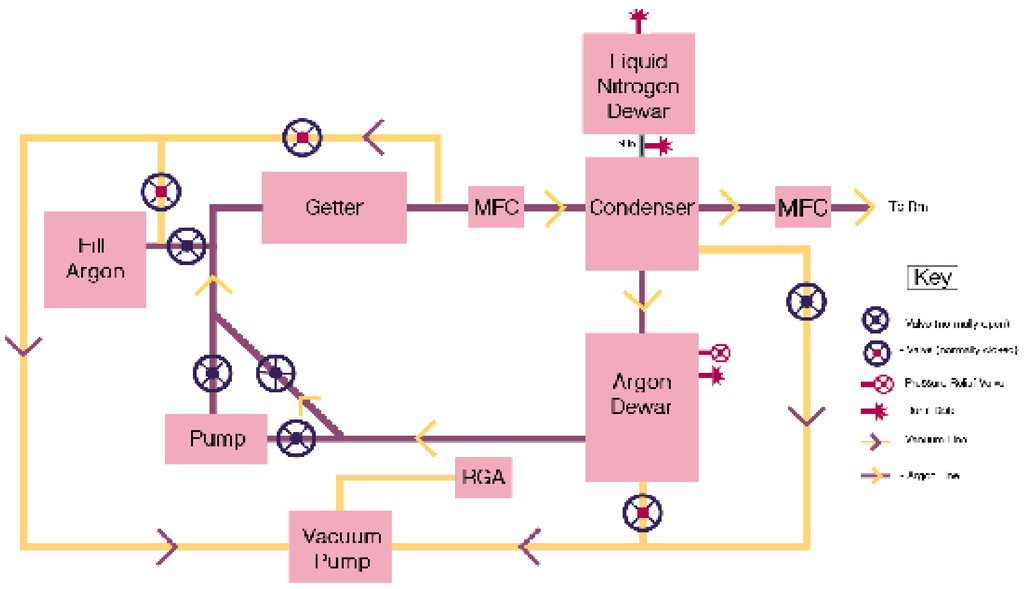


We also constructed a cryogenic camera system for monitoring argon condensation quality.

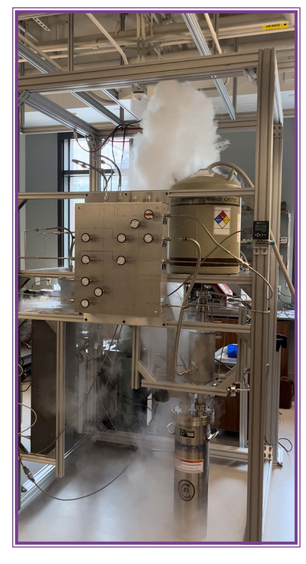




Argon Condensation System



We built a system which uses liquid nitrogen to condense gaseous argon into a liquid and a PID controller (integrated into the Raspberry Pi system) to maintain a stable pressure within the argon dewar at all times.



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