Background in DS-20k

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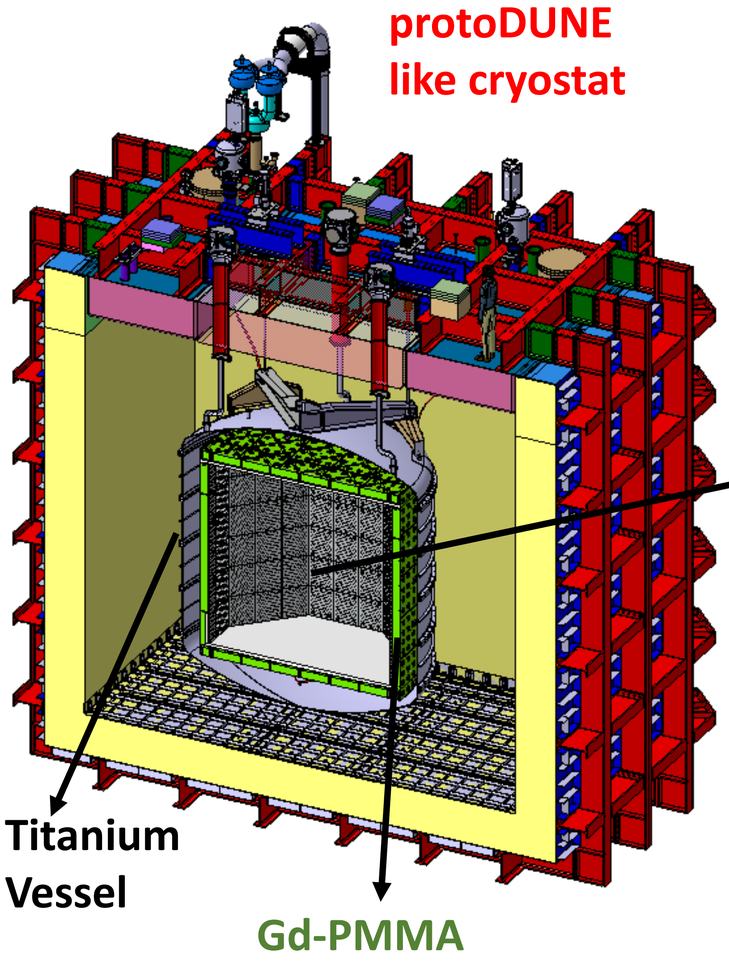
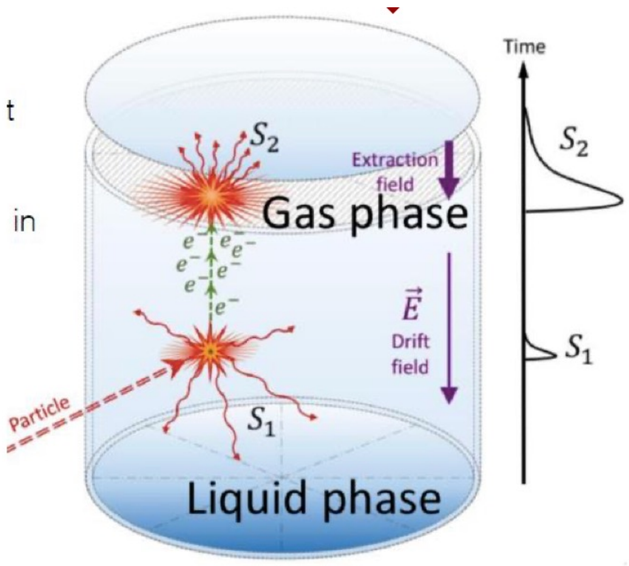
On Behalf of DS-20k collaboration

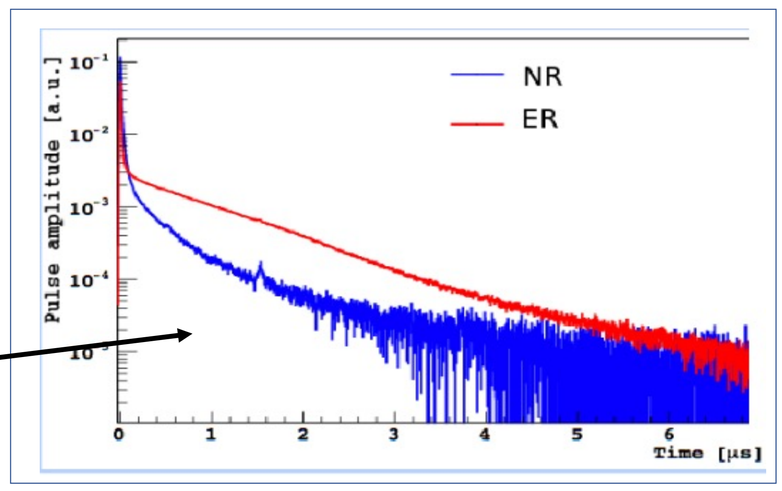
Darkside-20k experiment: Global Argon Dark matter collaboration

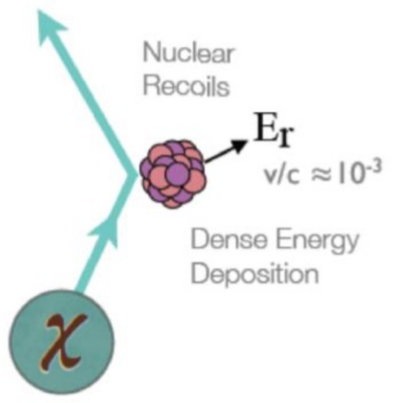


Dual phase liquid Argon TPC:
50 tons of Underground Argon



Detection of scintillation light in liquid Argon with Silicon Photomultipliers [SiPMs]

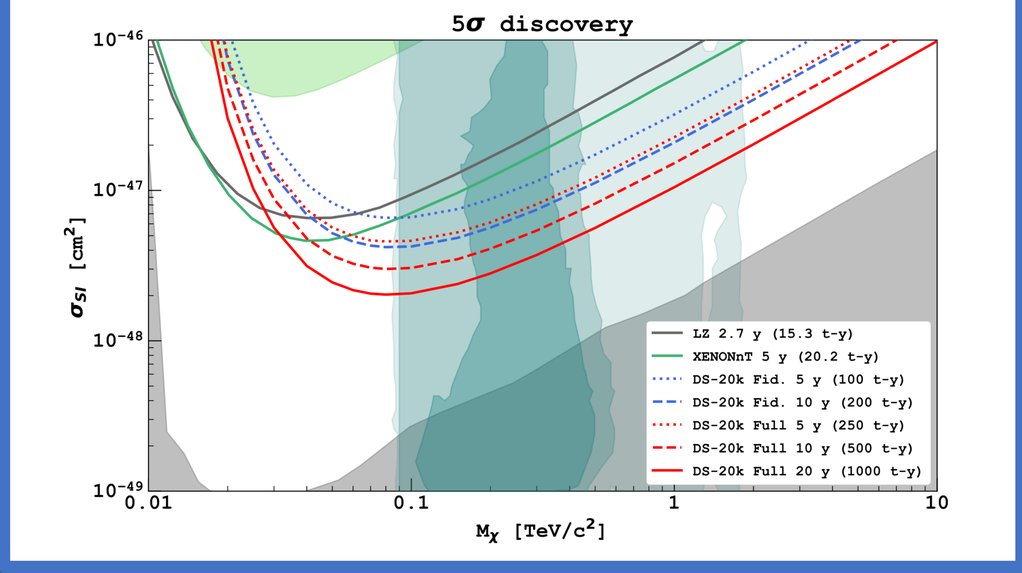




WIMP signal:

- Single nuclear recoil
- Recoil energy: 1 to 100 keV

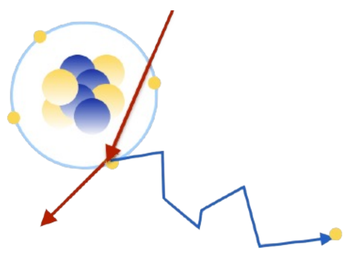
Darkside-20k is expected to lead the field for high mass WIMPs search in the liquid argon experiment [running between 2024-2034]



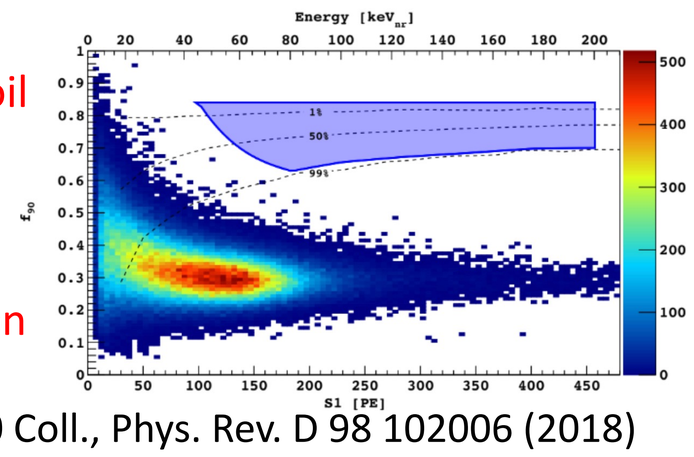
Electron recoil

Coming from **gammas & electrons**:

- Radioactive contamination (U-238/Th-232 chain)
- Ar-39, Kr-85 beta decay
- K-40 decay
- Solar neutrino



Electron recoil is rejected thanks to pulse shape discrimination



DS50 Coll., Phys. Rev. D 98 102006 (2018)

Nuclear recoil

Coming from **neutron & alphas**:

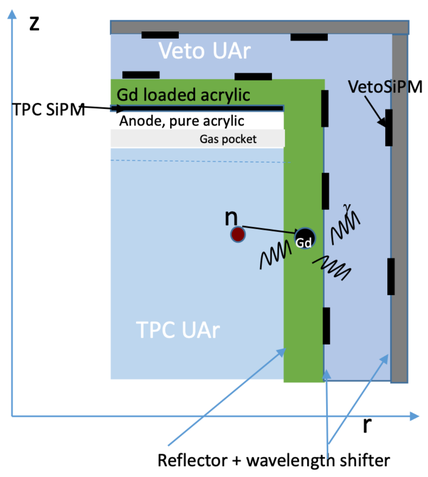
- Radioactive contamination (U-238/Th-232 chain)
- Cosmogenic activation due cosmic ray
- (alphas, n) reaction in detector material
- Spontaneous fission decay

Same recoils as WIMP

Nuclear recoil reduction:

- Stringent radio-purity control and material selection
- Cuts on multi-scatter events, 20 ton of fiducial volume
- **Neutron veto** to identify a neutron in a TPC-veto coincidence window of 800 μs

How does a neutron capture?



- Neutron is captured on Gadolinium producing a gamma cascade (8 MeV)
- Event which energy deposit more than 50 keVee in the TPC **OR** more than 200 keVee in the veto are tagged as neutron

The expected background is 0.091 event for a total exposure of 200 ton x years given a fiducial volume of 20 tons, after the veto cuts. Darkside-20k is able to reach a leading role for high mass search using liquid Argon TPC