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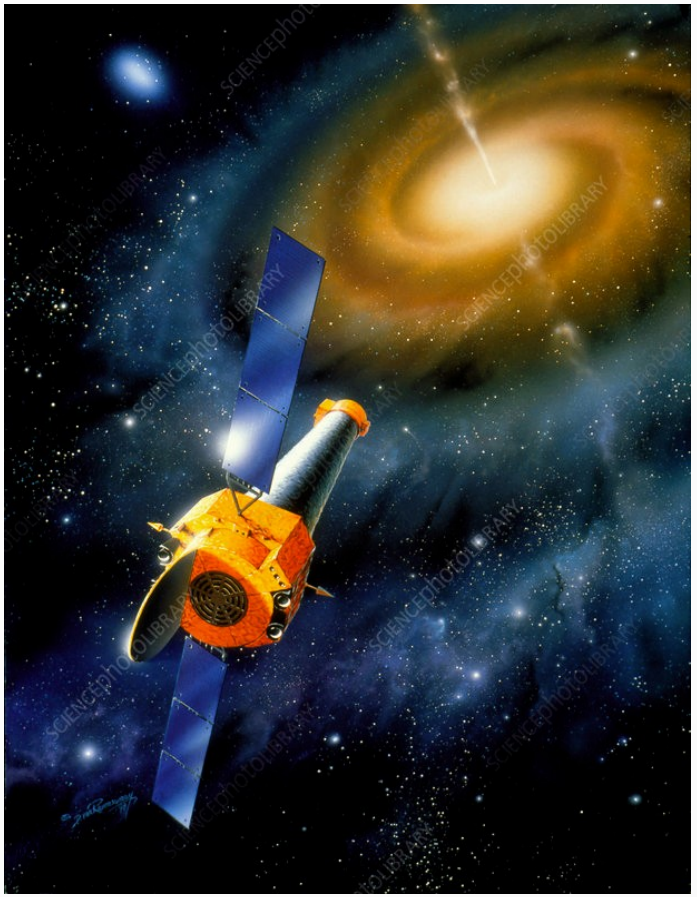


31.01-1.02.2024

European Union
European Regional Development Fund

Dark Wave

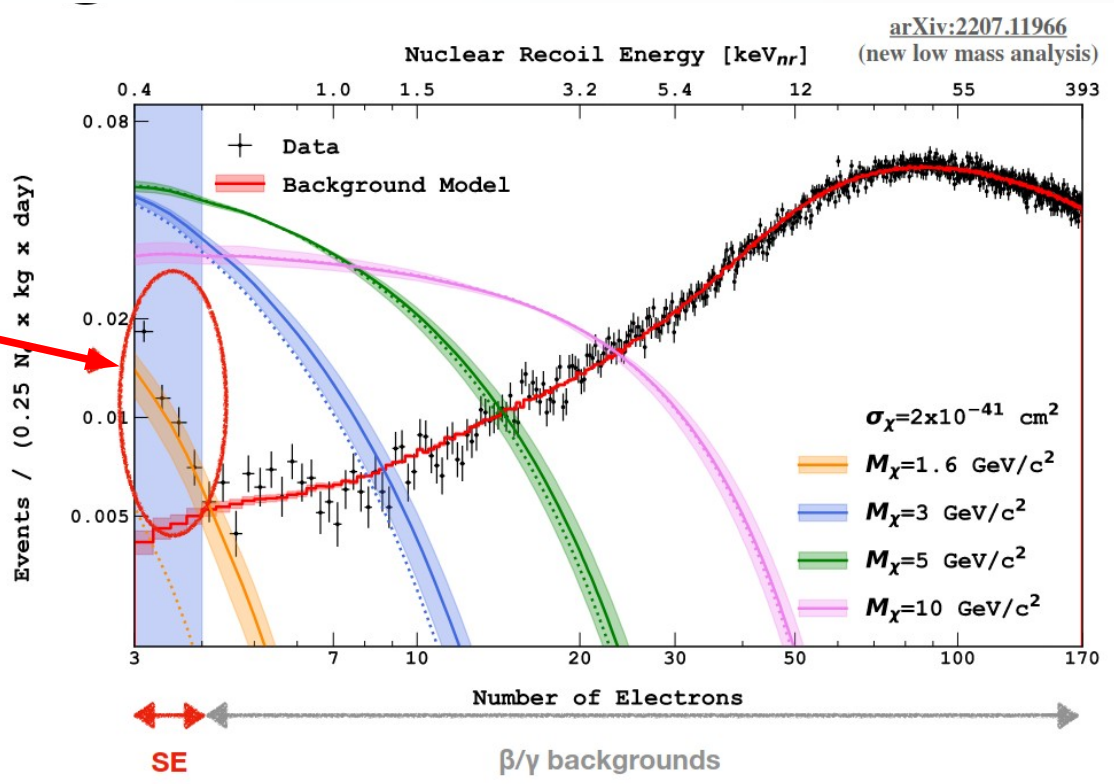
FNP Foundation for Polish Science

National Science Centre Poland

DarkSide-50: Spurious electron drift dependency

Spurious electron events (SE):

Impurities in argon interacting with drifting electrons from ionization (under investigation)

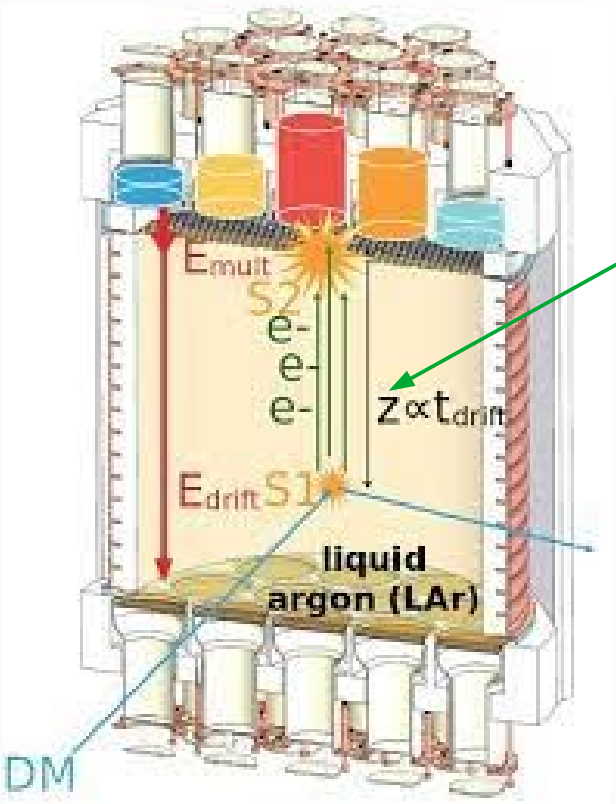


- origin not completely understood
- presence limit sensitivity of WIMP masses below 1.8 GeV

Drift dependency:

- checking level of SE events for 3 different drift fields 50, 100, 200 V/cm
- cut selection dependence on rate of events
- adjusting rate of events based on different inhibit times (when no data is recorded, prevents DAQ on triggering on S2 echo)
- analysis of SE events and their parents (within 10 s)

Processes that influence drift of electrons



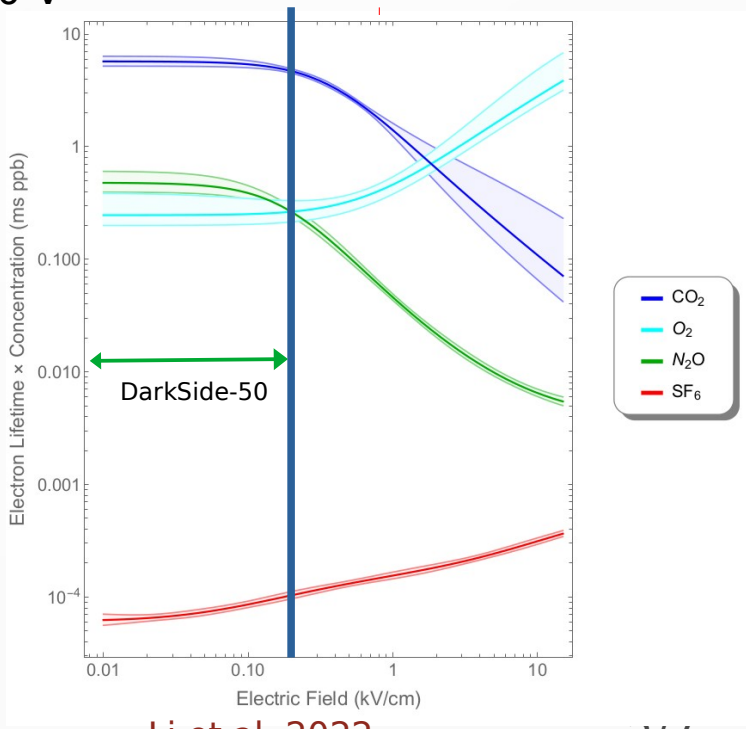
Drifting electrons need to travel distance to TPC anode and reach grid. Limited by 2 factors:

1) recombination of electrons inside TPC
2) attachment to impurities :

Ad 2) different impurities → different attachment coefficients. After concentration correction

→ weak dependence in the range of drift fields DarkSide-50 campaigns (i.e. 50 - 200 V

Effect neglible in 50-200 V



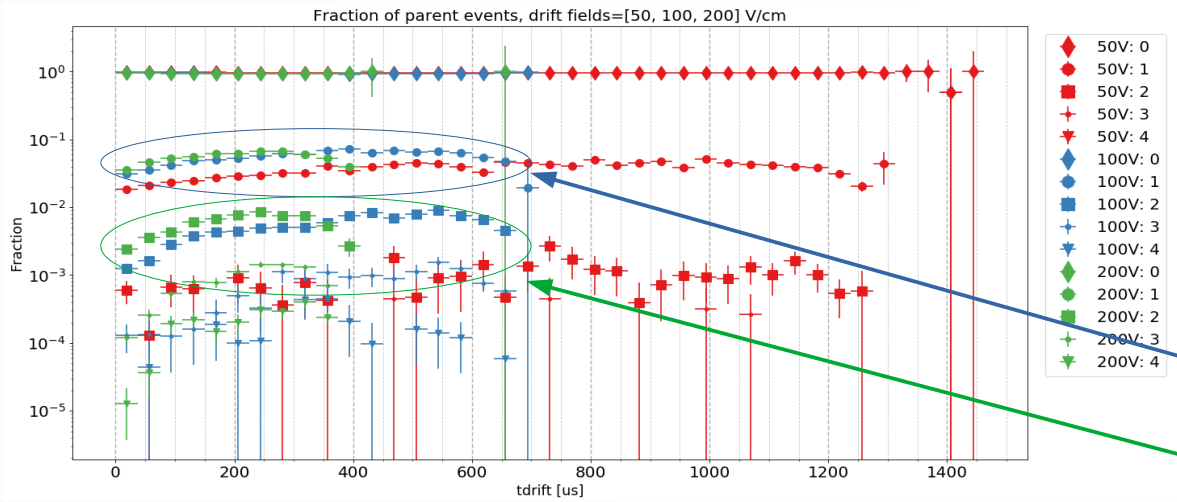
Li et al. 2022

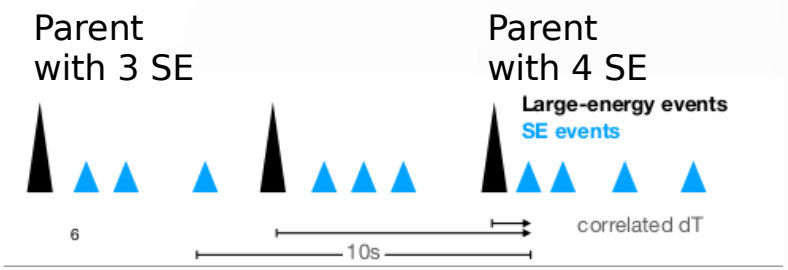
Ad 1) Different drift field → different drift length (376, 665, 1250 us – 200,100,50 V)

Stronger drift field → recombination reduced (more electrons reach gas phase)
→ stronger S2 signal → more asociated SE events
Argon – DarkSide
Xenon – Aprile et al. 2022

This is what is observed before S2 corrections.

Fraction of parents events in tdrift dependence and its S2 size.

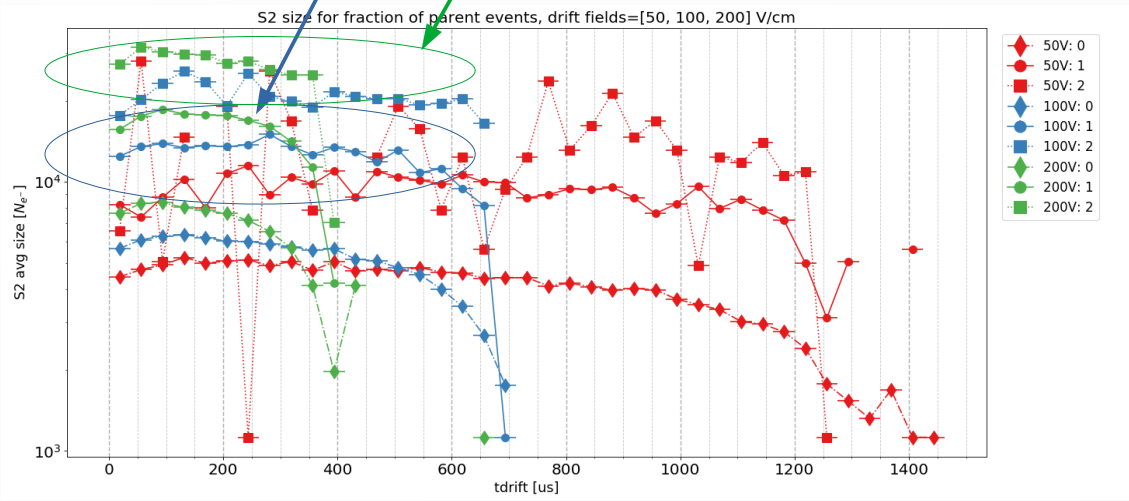




Fraction of parents with 1 SE

Fraction of parents with 2 SE

For every fraction, difference in drift fields (left top) can be explained (partially) by S2 size (recombination efficiency) (bottom right).



Drift field [V]	Old rate [evt/s]	Corrected rate [evt/s]	% of SE rate that can be explained with S2 correction
50	0.0288	-	-
100	0,0616	0,0425 +/- 0,0023	**58 %**
200	0,0655	0,0353 +/- 0,0018	**82 %**

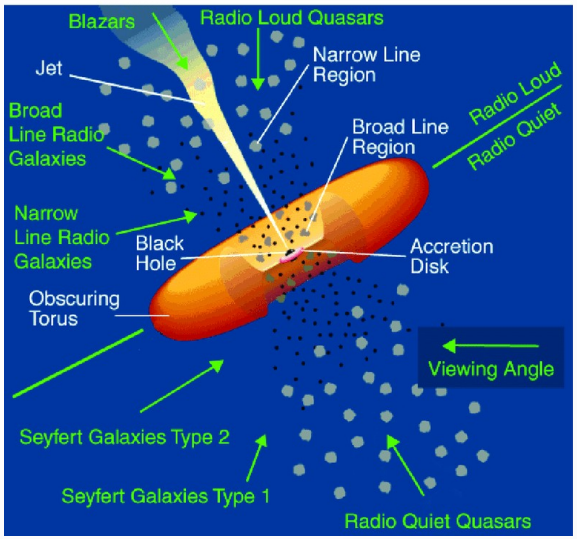
When S2 size correction factors are included (from different recombination) they change significantly SE rate

X-ray fingerprints of accreting objects

Goals:

develop a new code for radiative transfer

- cover 5 characteristic X-ray fingerprints of accreting objects
- towards common model of accretion (agn vs bhb)
  - **the same physical processes in central parts of accretion flows**
  - **strong X-ray radiation**



ALI method of radiative transfer (TITAN)

non-LTE equation of state (TITAN), Dumont 2003

Atomic data:
- TITAN db (4100 transitions)
- atomdb.org atomic data for astrophysicists

NEW CODE

Compton scattering: Compton redistribution functions – (ATM24), Madej 2017

Thermal instability in the warm corona (Gronkiewicz & Różańska 2020)

SIXTE simulation for future missions

GYOTO code (Vincent et al. 2011)

Angle dependent spectra

New code witch changes tracked, stored on git repo, and open to public.

Publication update & summary

Publications:

→ Sensitivity projections for a dual-phase argon TPC optimized for light dark matter searches through the ionization channel.
Agnes et al. (DarkSide Collaboration)
Phys. Rev. D 107, 112006 (2023)

→ Study of cosmogenic activation above ground for the DarkSide-20k experiment.
Elersich et al. (DarkSide-20k Collaboration)
APh, 152, 102878 (2023)

→ Measurement of isotopic separation of argon with the prototype of the cryogenic distillation plant Aria for dark matter searches.
Agnes et al. (DarkSide-20k Collaboration)
EPJC, 83, 453 (2023)

→ Hot accretion flows in low-luminosity active galactic nuclei in NGC 4258 and NGC 7213
Michał Szanecki, Andrzej Niedźwiecki, Rafał Wojaczyński
MNRAS, 521, 2215 (2023)

Conferences:

→ Talk: 'DarkSide-20k and the Liquid Argon Dark Matter Program'
at Cosmology 2023 in Miramare, Trieste 2023-08-27

Other:

→ Participation in DarkSide Collaboration Meeting 2023, 12-16 June 2023, L'Aquila, Italy

The End

Thank you !