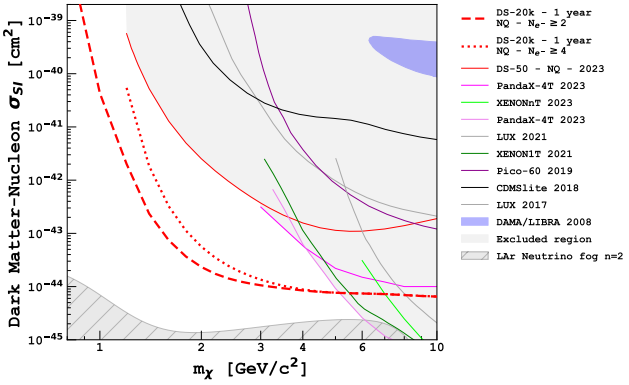
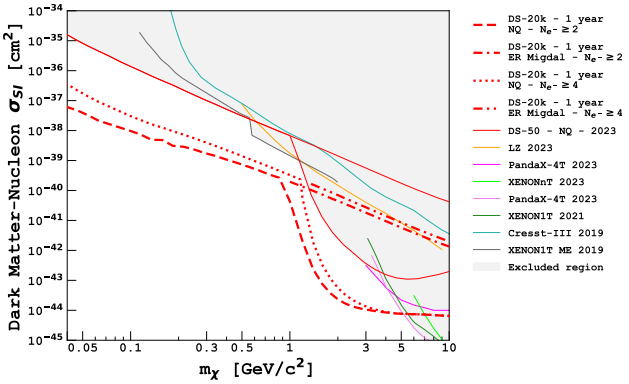
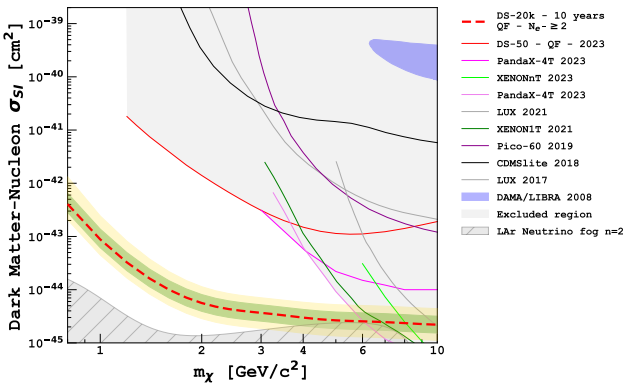
Supplementary material



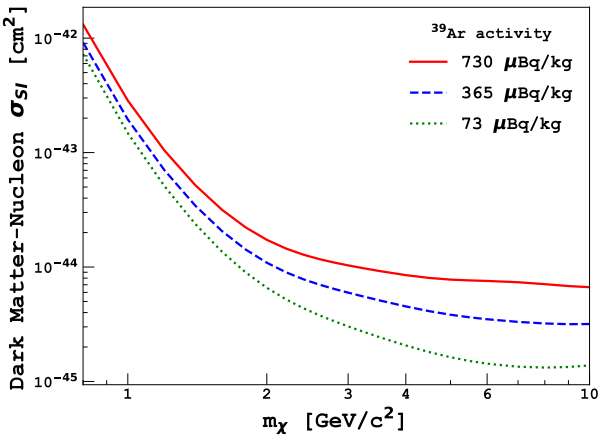
Supplementary FIG. 1. Expected DS-20k 90% C.L. exclusion limits for spin-independent WIMP NR without quenching fluctuations (NQ) are shown as bold red lines (dotted: fit from N_{e^-}=4, dashed: fit from N_{e^-}=2). One year of data is assumed. They are compared to the published 90% C.L. limits from DS-50 [14] and from other experiments [7, 24–30], with currently excluded parameter space shaded in light gray, as well as claimed discovery from Ref.[31]. The neutrino fog in LAr with index $n = 2$ [32] is also shown. A local dark matter density of 0.3 GeV c^{-2} cm^{-3} is assumed.



Supplementary FIG. 2. Expected DS-20k upper limits at 90% C.L. for spin-independent WIMP–nucleon cross-section when considering the Migdal effect and without quenching fluctuations (NQ) for the NR signal (bold red lines, dotted: fit from N_{e^-}=4, dashed: fit from N_{e^-}=2). One year of data is assumed. These results are compared to the published 90% C.L. limits from DS-50 [15] and other experiments [7, 24–26, 34, 35, 41], with currently excluded parameter space shaded in light gray. A local dark matter density of 0.3 GeV c^{-2} cm^{-3} is assumed.



Supplementary FIG. 3. Expected DS-20k 90% C.L. exclusion limits for spin-independent WIMP NR with quenching fluctuations (QF) are shown as bold dashed red line (fit from N_{e^-}=2), with the $\pm$1-σ (green shaded area) and $\pm$2-σ (yellow shaded area) bands. Ten years of data are assumed. They are compared to the published 90% C.L. limits from DS-50 [14] and from other experiments [7, 24–30], with currently excluded parameter space shaded in light gray, as well as claimed discovery from Ref. [31]. The neutrino fog in LAr with index $n = 2$ [32] is also shown. A local dark matter density of 0.3 GeV c^{-2} cm^{-3} is assumed.



Supplementary FIG. 4. Expected DS-20k 90% C.L. exclusion limits for spin-independent WIMP NR with quenching fluctuations (QF) (fit from N_{e^-}=2), for three levels of ^{39}Ar activity: 730 μBq kg^{-1} (nominal, full red line), 365 μBq kg^{-1} (dashed blue line) and 73 μBq kg^{-1} (dotted green line). One year of data and a local dark matter density of 0.3 GeV c^{-2} cm^{-3} are assumed.