WIMP and Dark Matter Searches

OMITTED FROM SUMMARY TABLE

We omit papers on CHAMP's, millicharged particles, and other exotic particles.

GALACTIC WIMP SEARCHES

These limits are for weakly-interacting stable particles that may constitute the invisible mass in the galaxy. Unless otherwise noted, a local mass density of 0.3 GeV/cm^3 is assumed; see each paper for velocity distribution assumptions. In the papers the limit is given as a function of the X^0 mass. Here we list limits only for typical mass values of 20 GeV, 100 GeV, and 1 TeV. Specific limits on supersymmetric dark matter particles may be found in the Supersymmetry section.

Limits for Spin-Independent Cross Section of Dark Matter Particle (X^0) on Nucleon

Isoscalar coupling is assumed to extract the limits from those on X^0–nuclei cross section.

For m_{X^0} = 20 GeV

For limits from X^0 annihilation in the Sun, the assumed annihilation final state is shown in parenthesis in the comment.

VALUE (pb)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5 \times 10^{-6}$	95	[1] AGNESE	18	CDMS	Ge
$<2 \times 10^{-6}$	90	[2] AARTSEN	17	ICCB	ν, earth
$<1 \times 10^{4}$	90	[3] ANGLOHER	17A	CRES	χp
$<1 \times 10^{-3}$	90	[4] BARBOSA-D...	17	ICCB	NaI
$<7.3 \times 10^{-7}$	90	AGNES	16	DS50	Ar
$<1 \times 10^{-5}$	90	[5] AGNESE	16	CDMS	Ge
$<2 \times 10^{-4}$	90	[6] AGUILAR-AR...	16	DMIC	Si CCDs
$<4 \times 10^{-5}$	90	[7] ANGLOHER	16	CRES	$CaWO_4$
$<2 \times 10^{-6}$	90	[8] APRILE	16	X100	Xe
$<9.4 \times 10^{-8}$	90	[9] ARMENGAUD	16	EDE3	Ge
$<1.0 \times 10^{-7}$	90	[10] HEHN	16	EDE3	Ge
$<4 \times 10^{-6}$	90	[11] ZHAO	16	CDEX	Ge
$<1 \times 10^{-5}$	90	AGNES	15	DS50	Ar
$<1.5 \times 10^{-6}$	90	[12] AGNESE	15A	CDM2	Ge
$<1.5 \times 10^{-7}$	90	[13] AGNESE	15B	CDM2	Ge
$<2 \times 10^{-6}$	90	[14] AMOLE	15	PICO	C_3F_8
$<1.2 \times 10^{-5}$	90	CHOI	15	SKAM	H, solar ν ($b\overline{b}$)
$<1.19 \times 10^{-6}$	90	CHOI	15	SKAM	H, solar ν ($\tau^+\tau^-$)
$<2 \times 10^{-8}$	90	[15] XIAO	15	PNDX	Xe
$<2.0 \times 10^{-7}$	90	[16] AGNESE	14	SCDM	Ge
$<3.7 \times 10^{-5}$	90	[17] AGNESE	14A	SCDM	Ge
$<1 \times 10^{-9}$	90	[18] AKERIB	14	LUX	Xe
$<2 \times 10^{-6}$	90	[19] ANGLOHER	14	CRES	$CaWO_4$

$<5 \times 10^{-6}$	90	FELIZARDO	14	SMPL	C_2ClF_5
$<8 \times 10^{-6}$	90	[20] LEE	14A	KIMS	CsI
$<2 \times 10^{-4}$	90	[21] LIU	14A	CDEX	Ge
$<1 \times 10^{-5}$	90	[22] YUE	14	CDEX	Ge
$<1.08 \times 10^{-4}$	90	[23] AARTSEN	13	ICCB	H, solar ν ($\tau^+\tau^-$)
$<1.5 \times 10^{-5}$	90	[24] ABE	13B	XMAS	Xe
$<3.1 \times 10^{-6}$	90	[25] AGNESE	13	CDM2	Si
$<3.4 \times 10^{-6}$	90	[26] AGNESE	13A	CDM2	Si
$<2.2 \times 10^{-6}$	90	[27] AGNESE	13A	CDM2	Si
		[28] BERNABEI	13A	DAMA	NaI modulation
$<5 \times 10^{-5}$	90	[29] LI	13B	TEXO	Ge
		[30] ZHAO	13	CDEX	Ge
$<1.2 \times 10^{-7}$	90	AKIMOV	12	ZEP3	Xe
		[31] ANGLOHER	12	CRES	$CaWO_4$
$<8 \times 10^{-6}$	90	[32] ANGLOHER	12	CRES	$CaWO_4$
$<7 \times 10^{-9}$	90	[33] APRILE	12	X100	Xe
		[34] ARCHAMBAU...	12	PICA	F (C_4F_{10})
$<7 \times 10^{-7}$	90	[35] ARMENGAUD	12	EDE2	Ge
		[36] BARRETO	12	DMIC	CCD
$<2 \times 10^{-6}$	90	BEHNKE	12	COUP	CF_3I
$<7 \times 10^{-6}$		[37] FELIZARDO	12	SMPL	C_2ClF_5
$<1.5 \times 10^{-6}$	90	KIM	12	KIMS	CsI
$<5 \times 10^{-5}$	90	[38] AALSETH	11	CGNT	Ge
		[39] AALSETH	11A	CGNT	Ge
$<5 \times 10^{-7}$	90	[40] AHMED	11	CDM2	Ge, inelastic
$<2.7 \times 10^{-7}$	90	[41] AHMED	11A	RVUE	Ge
		[42] AHMED	11B	CDM2	Ge, low threshold
$<3 \times 10^{-6}$	90	[43] ANGLE	11	XE10	Xe
$<7 \times 10^{-8}$	90	[44] APRILE	11	X100	Xe
		[45] APRILE	11A	X100	Xe, inelastic
$<2 \times 10^{-8}$	90	[33] APRILE	11B	X100	Xe
		[46] HORN	11	ZEP3	Xe
$<2 \times 10^{-7}$	90	AHMED	10	CDM2	Ge
$<1 \times 10^{-5}$	90	[47] AKERIB	10	CDM2	Si, Ge, low threshold
$<1 \times 10^{-7}$	90	APRILE	10	X100	Xe
$<2 \times 10^{-6}$	90	ARMENGAUD	10	EDE2	Ge
$<4 \times 10^{-5}$	90	FELIZARDO	10	SMPL	C_2ClF_3
$<1.5 \times 10^{-7}$	90	[48] AHMED	09	CDM2	Ge
$<2 \times 10^{-4}$	90	[49] LIN	09	TEXO	Ge
		[50] AALSETH	08	CGNT	Ge

[1] AGNESE 18 give limits for $\sigma^{SI}(p\chi)$ for m(WIMP) between 1.5 and 20 GeV using CDMSlite mode data.

[2] AARTSEN 17 obtain σ(SI) $<\ 6 \times 10^{-6}$ pb for m(wimp) = 20 GeV from ν from earth.

[3] ANGLOHER 17A find $\sigma^{SI}(\chi p) <\ 10^4$ pb for m(WIMP) = 0.2 GeV.

[4] BARBOSA-DE-SOUZA 17 search for annual modulation of WIMP scatter on NaI using an exposure of 61 kg yr of DM-Ice17 for recoil energy in the 4–20 keV range (DAMA found modulation for recoil energy < 5 keV). No modulation seen. Sensitivity insufficient to distinguish DAMA signal from null.

[5] AGNESE 16 CDMSlite excludes low mass WIMPs 1.6–5.5 GeV and SI scattering cross section depending on *m*(WIMP); see Fig. 4.

[6] AGUILAR-AREVALO 16 search low mass 1–10 GeV WIMP scatter on Si CCDs; set limits Fig. 11.
[7] ANGLOHER 16 requires SI WIMP-nucleon cross section $< 9 \times 10^{-3}$ pb for m(WIMP) $= 1$ GeV on $CaWO_4$ target.
[8] APRILE 16 search low mass WIMP SI scatter on Xe; exclude $\sigma > 1.4 \times 10^{-5}$ pb for m(WIMP) = 6 GeV.
[9] ARMENGAUD 16 require SI WIMP-p cross section $< 4.3 \times 10^{-4}$ pb for m(WIMP) = 5 GeV on Ge target.
[10] HEHN 16 search for low mass WIMPs via SI scatter on Ge target; σ(SI) $< 5.8 \times 10^{-4}$ pb for m(WIMP) = 5 GeV, Fig. 6.
[11] ZHAO 16 require SI scatter $< 4 \times 10^{-6}$ pb for m(WIMP) = 20 GeV using Ge target; limits also on SD scatter, see Fig. 19.
[12] AGNESE 15A reanalyse AHMED 11B low threshold data. See their Fig. 12 (left) for improved limits extending down to 5 GeV.
[13] AGNESE 15B reanalyse AHMED 10 data.
[14] See their Fig. 7 for limits extending down to 4 GeV.
[15] See their Fig. 13 for limits extending down to 5 GeV.
[16] This limit value is provided by the authors. See their Fig. 4 for limits extending down to $m_{X^0} = 3.5$ GeV.
[17] This limit value is provided by the authors. AGNESE 14A result is from CDMSlite mode operation with enhanced sensitivity to low mass m_{X^0}. See their Fig. 3 for limits extending down to $m_{X^0} = 3.5$ GeV (see also Fig. 4 in AGNESE 14).
[18] See their Fig. 5 for limits extending down to $m_{X^0} = 5.5$ GeV.
[19] See their Fig. 5 for limits extending down to $m_{X^0} = 1$ GeV.
[20] See their Fig. 5 for limits extending down to $m_{X^0} = 5$ GeV.
[21] LIU 14A result is based on prototype CDEX-0 detector. See their Fig. 13 for limits extending down to $m_{X^0} = 2$ GeV.
[22] See their Fig. 4 for limits extending down to $m_{X^0} = 4.5$ GeV.
[23] AARTSEN 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between June 2010 and May 2011.
[24] See their Fig. 8 for limits extending down to $m_{X^0} = 7$ GeV.
[25] This limit value is provided by the authors. AGNESE 13 use data taken between Oct. 2006 and July 2007. See their Fig. 4 for limits extending down to $m_{X^0} = 7$ GeV.
[26] This limit value is provided by the authors. AGNESE 13A use data taken between July 2007 and Sep. 2008. Three candidate events are seen. Assuming these events are real, the best fit parameters are $m_{X^0} = 8.6$ GeV and $\sigma = 1.9 \times 10^{-5}$ pb.
[27] This limit value is provided by the authors. Limit from combined data of AGNESE 13 and AGNESE 13A. See their Fig. 4 for limits extending down to $m_{X^0} = 5.5$ GeV.
[28] BERNABEI 13A search for annual modulation of counting rate in the 2–6 keV recoil energy interval, in a 14 yr live time exposure of 1.33 t yr. Find a modulation of 0.0112 ± 0.0012 counts/(day kg keV) with 9.3 sigma C.L. Find period and phase in agreement with expectations from DM particles.
[29] See their Fig. 4 for limits extending down to $m_{X^0} = 4$ GeV.
[30] See their Fig. 5 for limits for $m_{X^0} = 4$–12 GeV.
[31] ANGLOHER 12 observe excess events above the expected background which are consistent with X^0 with mass $\sim$ 25 GeV (or 12 GeV) and spin-independent X^0-nucleon cross section of 2×10^{-6} pb (or 4×10^{-5} pb).
[32] Reanalysis of ANGLOHER 09 data with all three nuclides. See also BROWN 12.
[33] See also APRILE 14A.
[34] See their Fig. 7 for cross section limits for m_{X^0} between 4 and 12 GeV.

[35] See their Fig. 4 for limits extending down to $m_{X^0} = 7$ GeV.
[36] See their Fig. 13 for cross section limits for m_{X^0} between 1.2 and 10 GeV.
[37] See also DAHL 12 for a criticism.
[38] See their Fig. 4 for limits extending to $m_{X^0} = 3.5$ GeV.
[39] AALSETH 11A find indications of annual modulation of the data, the energy spectrum being compatible with X^0 mass around 8 GeV. See also AALSETH 13.
[40] AHMED 11 search for X^0 inelastic scattering. See their Fig. 8–10 for limits. The inelastic cross section reduces to the elastic cross section at the limit of zero mass splitting (Fig. 8, left).
[41] AHMED 11A combine CDMS II and EDELWEISS data.
[42] AHMED 11B give limits on spin-independent X^0-nucleon cross section for m_{X^0} = 4–12 GeV in the range 10^{-3}–10^{-5} pb. See their Fig. 3.
[43] See their Fig. 3 for limits down to $m_{X^0} = 4$ GeV.
[44] APRILE 11 reanalyze APRILE 10 data.
[45] APRILE 11A search for X^0 inelastic scattering. See their Fig. 2 and 3 for limits. See also APRILE 14A.
[46] HORN 11 perform detector calibration by neutrons. Earlier results are only marginally affected.
[47] See their Fig. 10 and 12 for limits extending to X^0 mass of 1 GeV.
[48] Superseded by AHMED 10.
[49] See their Fig. 6(a) for cross section limits for m_{X^0} extending down to 2 GeV.
[50] See their Fig. 2 for cross section limits for m_{X^0} between 4 and 10 GeV.

For $m_{X^0} = 100$ GeV

For limits from X^0 annihilation in the Sun, the assumed annihilation final state is shown in parenthesis in the comment.

VALUE (pb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1 \times 10^{-8}$	90	[1] AGNESE	18A	CDMS	$\sigma^{SI}(\chi p)$
$<1.7 \times 10^{-10}$	90	[2] AKERIB	17	LUX	Xe
$<1.2 \times 10^{-10}$	90	[3] APRILE	17G	XE1T	Xe
$<1.2 \times 10^{-10}$	90	[4] CUI	17A	PNDX	Xe
$<2.0 \times 10^{-8}$	90	AGNES	16	DS50	Ar
$<1 \times 10^{-9}$	90	[5] AKERIB	16	LUX	Xe
$<1 \times 10^{-9}$	90	[6] APRILE	16B	X100	Xe
$<2 \times 10^{-8}$	90	[7] TAN	16	PNDX	Xe
$<4 \times 10^{-10}$	90	[8] TAN	16B	PNDX	Xe
$<6 \times 10^{-8}$	90	AGNES	15	DS50	Ar
$<4 \times 10^{-8}$	90	[9] AGNESE	15B	CDM2	Ge
$<7.13 \times 10^{-6}$	90	CHOI	15	SKAM	H, solar ν ($b\overline{b}$)
$<6.26 \times 10^{-7}$	90	CHOI	15	SKAM	H, solar ν (W^+W^-)
$<2.76 \times 10^{-7}$	90	CHOI	15	SKAM	H, solar ν ($\tau^+\tau^-$)
$<1.5 \times 10^{-8}$	90	XIAO	15	PNDX	Xe
$<1 \times 10^{-9}$	90	AKERIB	14	LUX	Xe
$<4.0 \times 10^{-6}$	90	[10] AVRORIN	14	BAIK	H, solar ν (W^+W^-)
$<1.0 \times 10^{-4}$	90	[10] AVRORIN	14	BAIK	H, solar ν ($b\overline{b}$)
$<1.6 \times 10^{-6}$	90	[10] AVRORIN	14	BAIK	H, solar ν ($\tau^+\tau^-$)
$<5 \times 10^{-6}$	90	FELIZARDO	14	SMPL	C_2ClF_5
$<6.01 \times 10^{-7}$	90	[11] AARTSEN	13	ICCB	H, solar ν (W^+W^-)
$<3.30 \times 10^{-5}$	90	[11] AARTSEN	13	ICCB	H, solar ν ($b\overline{b}$)

$<1.9 \times 10^{-6}$	90	[12] ADRIAN-MAR..	13	ANTR	H, solar ν ($W^+ W^-$)
$<1.2 \times 10^{-4}$	90	[12] ADRIAN-MAR..	13	ANTR	H, solar ν ($b\overline{b}$)
$<7.6 \times 10^{-7}$	90	[12] ADRIAN-MAR..	13	ANTR	H, solar ν ($\tau^+ \tau^-$)
$<2 \times 10^{-6}$	90	[13] AGNESE	13	CDM2	Si
$<1.6 \times 10^{-6}$	90	[14] BOLIEV	13	BAKS	H, solar ν ($W^+ W^-$)
$<1.9 \times 10^{-5}$	90	[14] BOLIEV	13	BAKS	H, solar ν ($b\overline{b}$)
$<7.1 \times 10^{-7}$	90	[14] BOLIEV	13	BAKS	H, solar ν ($\tau^+ \tau^-$)
$<1.67 \times 10^{-6}$	90	[15] ABBASI	12	ICCB	H, solar ν ($W^+ W^-$)
$<1.07 \times 10^{-4}$	90	[15] ABBASI	12	ICCB	H, solar ν ($b\overline{b}$)
$<4 \times 10^{-8}$	90	AKIMOV	12	ZEP3	Xe
$<1.4 \times 10^{-6}$	90	[16] ANGLOHER	12	CRES	$CaWO_4$
$<3 \times 10^{-9}$	90	[17] APRILE	12	X100	Xe
$<3 \times 10^{-7}$	90	BEHNKE	12	COUP	CF_3I
$<7 \times 10^{-6}$		FELIZARDO	12	SMPL	C_2ClF_5
$<2.5 \times 10^{-7}$	90	[18] KIM	12	KIMS	CsI
$<2 \times 10^{-4}$	90	AALSETH	11	CGNT	Ge
		[19] AHMED	11	CDM2	Ge, inelastic
$<3.3 \times 10^{-8}$	90	[20] AHMED	11A	RVUE	Ge
		[21] AJELLO	11	FLAT	
$<3 \times 10^{-8}$	90	[22] APRILE	11	X100	Xe
		[23] APRILE	11A	X100	Xe, inelastic
$<1 \times 10^{-8}$	90	[17] APRILE	11B	X100	Xe
$<5 \times 10^{-8}$	90	[24] ARMENGAUD	11	EDE2	Ge
		[25] HORN	11	ZEP3	Xe
$<4 \times 10^{-8}$	90	AHMED	10	CDM2	Ge
$<9 \times 10^{-6}$	90	AKERIB	10	CDM2	Si, Ge, low threshold
		[26] AKIMOV	10	ZEP3	Xe, inelastic
$<5 \times 10^{-8}$	90	APRILE	10	X100	Xe
$<1 \times 10^{-7}$	90	ARMENGAUD	10	EDE2	Ge
$<3 \times 10^{-5}$	90	FELIZARDO	10	SMPL	C_2ClF_3
$<5 \times 10^{-8}$	90	[27] AHMED	09	CDM2	Ge
		[28] ANGLE	09	XE10	Xe, inelastic
$<3 \times 10^{-4}$	90	LIN	09	TEXO	Ge
		[29] GIULIANI	05	RVUE	

[1] AGNESE 18A set limit $\sigma^{SI}(\chi p) < 10^{-8}$ pb for m(WIMP) = 100 GeV.

[2] AKERIB 17 exclude SI cross section $> 1.7 \times 10^{-10}$ pb for m(WIMP) = 100 GeV. Uses complete LUX data set.

[3] APRILE 17G set limit $\sigma^{SI}(\chi p) < 1.2\ 10^{-10}$ pb for m(WIMP) = 100 GeV using 1 ton fiducial mass Xe TPC. Exposure is 34.2 live days.

[4] CUI 17A require $\sigma^{SI}(\chi p) < 1.2 \times 10^{-10}$ pb for m(WIMP) = 100 GeV using 54 ton-day exposure of Xe.

[5] AKERIB 16 re-analysis of 2013 data exclude SI cross section $> 1 \times 10^{-9}$ pb for m(WIMP) = 100 GeV on Xe target.

[6] APRILE 16B combined 447 live days using Xe target exclude σ(SI) $> 1.1 \times 10^{-9}$ pb for m(WIMP) = 50 GeV.

[7] TAN 16 search for WIMP scatter off Xe target; see SI exclusion plot Fig. 6.

[8] TAN 16B search for WIMP-p scatter off Xe target; see Fig. 5 for SI exclusion.

[9] AGNESE 15B reanalyse AHMED 10 data.

[10] AVRORIN 14 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun in data taken between 1998 and 2003. See their Table 1 for limits assuming annihilation into neutrino pairs.

[11] AARTSEN 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between June 2010 and May 2011.
[12] ADRIAN-MARTINEZ 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between Jan. 2007 and Dec. 2008.
[13] AGNESE 13 use data taken between Oct. 2006 and July 2007.
[14] BOLIEV 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken from 1978 to 2009. See also SUVOROVA 13 for an older analysis of the same data.
[15] ABBASI 12 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.
[16] Reanalysis of ANGLOHER 09 data with all three nuclides. See also BROWN 12.
[17] See also APRILE 14A.
[18] See their Fig. 6 for a limit on inelastically scattering X^0 for m_{X^0} = 70 GeV.
[19] AHMED 11 search for X^0 inelastic scattering. See their Fig. 8–10 for limits.
[20] AHMED 11A combine CDMS and EDELWEISS data.
[21] AJELLO 11 search for $e^\pm$ flux from X^0 annihilations in the Sun. Models in which X^0 annihilates into an intermediate long-lived weakly interacting particles or X^0 scatters inelastically are constrained. See their Fig. 6–8 for limits.
[22] APRILE 11 reanalyze APRILE 10 data.
[23] APRILE 11A search for X^0 inelastic scattering. See their Fig. 2 and 3 for limits. See also APRILE 14A.
[24] Supersedes ARMENGAUD 10. A limit on inelastic cross section is also given.
[25] HORN 11 perform detector calibration by neutrons. Earlier results are only marginally affected.
[26] AKIMOV 10 give cross section limits for inelastically scattering dark matter. See their Fig. 4.
[27] Superseded by AHMED 10.
[28] ANGLE 09 search for X^0 inelastic scattering. See their Fig. 4 for limits.
[29] GIULIANI 05 analyzes the spin-independent X^0-nucleon cross section limits with both isoscalar and isovector couplings. See their Fig. 3 and 4 for limits on the couplings.

For m_{X^0} = 1 TeV

For limits from X^0 annihilation in the Sun, the assumed annihilation final state is shown in parenthesis in the comment.

VALUE (pb)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<0.3	90	[1] CHEN	17E	PNDX	$\chi N \rightarrow \chi^* \rightarrow \chi\gamma$
$<8.6 \times 10^{-8}$	90	AGNES	16	DS50	Ar
$<2 \times 10^{-7}$	90	AGNES	15	DS50	Ar
$<2 \times 10^{-7}$	90	[2] AGNESE	15B	CDM2	Ge
$<1 \times 10^{-8}$	90	AKERIB	14	LUX	Xe
$<2.2 \times 10^{-6}$	90	[3] AVRORIN	14	BAIK	H, solar ν (W^+W^-)
$<5.5 \times 10^{-5}$	90	[3] AVRORIN	14	BAIK	H, solar ν ($b\overline{b}$)
$<6.8 \times 10^{-7}$	90	[3] AVRORIN	14	BAIK	H, solar ν ($\tau^+\tau^-$)
$<3.46 \times 10^{-7}$	90	[4] AARTSEN	13	ICCB	H, solar ν (W^+W^-)
$<7.75 \times 10^{-6}$	90	[4] AARTSEN	13	ICCB	H, solar ν ($b\overline{b}$)
$<6.9 \times 10^{-7}$	90	[5] ADRIAN-MAR..	13	ANTR	H, solar ν (W^+W^-)
$<1.5 \times 10^{-5}$	90	[5] ADRIAN-MAR..	13	ANTR	H, solar ν ($b\overline{b}$)
$<1.8 \times 10^{-7}$	90	[5] ADRIAN-MAR..	13	ANTR	H, solar ν ($\tau^+\tau^-$)
$<4.3 \times 10^{-6}$	90	[6] BOLIEV	13	BAKS	H, solar ν (W^+W^-)
$<3.4 \times 10^{-5}$	90	[6] BOLIEV	13	BAKS	H, solar ν ($b\overline{b}$)
$<1.2 \times 10^{-6}$	90	[6] BOLIEV	13	BAKS	H, solar ν ($\tau^+\tau^-$)

$<2.12 \times 10^{-7}$	90	[7] ABBASI	12	ICCB	H, solar ν ($W^+ W^-$)
$<6.56 \times 10^{-6}$	90	[7] ABBASI	12	ICCB	H, solar ν ($b\overline{b}$)
$<4 \times 10^{-7}$	90	AKIMOV	12	ZEP3	Xe
$<1.1 \times 10^{-5}$	90	[8] ANGLOHER	12	CRES	$CaWO_4$
$<2 \times 10^{-8}$	90	[9] APRILE	12	X100	Xe
$<2 \times 10^{-6}$	90	BEHNKE	12	COUP	CF_3I
$<4 \times 10^{-6}$		FELIZARDO	12	SMPL	C_2ClF_5
$<1.5 \times 10^{-6}$	90	KIM	12	KIMS	CsI
		[10] AHMED	11	CDM2	Ge, inelastic
$<1.5 \times 10^{-7}$	90	[11] AHMED	11A	RVUE	Ge
$<2 \times 10^{-7}$	90	[12] APRILE	11	X100	Xe
$<8 \times 10^{-8}$	90	[9] APRILE	11B	X100	Xe
$<2 \times 10^{-7}$	90	[13] ARMENGAUD	11	EDE2	Ge
		[14] HORN	11	ZEP3	Xe
$<2 \times 10^{-7}$	90	AHMED	10	CDM2	Ge
$<4 \times 10^{-7}$	90	APRILE	10	X100	Xe
$<6 \times 10^{-7}$	90	ARMENGAUD	10	EDE2	Ge
$<3.5 \times 10^{-7}$	90	[15] AHMED	09	CDM2	Ge

[1] CHEN 17E search for inelastic WIMP scatter on Xe; require $\sigma^{SI}(\chi N) < 0.3$ pb for m(χ) = 1 TeV and (mass difference) = 300 keV.
[2] AGNESE 15B reanalyse AHMED 10 data.
[3] AVRORIN 14 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun in data taken between 1998 and 2003. See their Table 1 for limits assuming annihilation into neutrino pairs.
[4] AARTSEN 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between June 2010 and May 2011.
[5] ADRIAN-MARTINEZ 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between Jan. 2007 and Dec. 2008.
[6] BOLIEV 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken from 1978 to 2009. See also SUVOROVA 13 for an older analysis of the same data.
[7] ABBASI 12 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.
[8] Reanalysis of ANGLOHER 09 data with all three nuclides. See also BROWN 12.
[9] See also APRILE 14A.
[10] AHMED 11 search for X^0 inelastic scattering. See their Fig. 8–10 for limits.
[11] AHMED 11A combine CDMS and EDELWEISS data.
[12] APRILE 11 reanalyze APRILE 10 data.
[13] Supersedes ARMENGAUD 10. A limit on inelastic cross section is also given.
[14] HORN 11 perform detector calibration by neutrons. Earlier results are only marginally affected.
[15] Superseded by AHMED 10.

Limits for Spin-Dependent Cross Section of Dark Matter Particle (X^0) on Proton

For m_{X^0} = 20 GeV

For limits from X^0 annihilation in the Sun, the assumed annihilation final state is shown in parenthesis in the comment.

VALUE (pb)	*CL%*	*DOCUMENT ID*		*TECN*	*COMMENT*
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<30	95	[1] AGNESE	18	CDMS	Ge

$<1.32 \times 10^{-2}$	90	[2] BEHNKE	17	PICA	C_4F_{10}
$<5 \times 10^{-4}$	90	[3] AMOLE	16A	PICO	C_3F_8
$<2 \times 10^{-6}$	90	[4] KHACHATRY...	16AJ	CMS	8 TeV $pp \rightarrow Z + \not{E}_T$; $Z \rightarrow \ell\overline{\ell}$
$<1.2 \times 10^{-3}$	90	AMOLE	15	PICO	C_3F_8
$<1.43 \times 10^{-3}$	90	CHOI	15	SKAM	H, solar ν ($b\overline{b}$)
$<1.42 \times 10^{-4}$	90	CHOI	15	SKAM	H, solar ν ($\tau^+\tau^-$)
$<5 \times 10^{-3}$	90	FELIZARDO	14	SMPL	C_2ClF_5
$<1.29 \times 10^{-2}$	90	[5] AARTSEN	13	ICCB	H, solar ν ($\tau^+\tau^-$)
$<3.17 \times 10^{-2}$	90	[6] APRILE	13	X100	Xe
$<3 \times 10^{-2}$	90	ARCHAMBAU...	12	PICA	F (C_4F_{10})
$<6 \times 10^{-2}$	90	BEHNKE	12	COUP	CF_3I
<20	90	DAW	12	DRFT	F (CF_4)
$<7 \times 10^{-3}$		FELIZARDO	12	SMPL	C_2ClF_5
<0.15	90	KIM	12	KIMS	CsI
$<1 \times 10^{5}$	90	[7] AHLEN	11	DMTP	F (CF_4)
<0.1	90	[7] BEHNKE	11	COUP	CF_3I
$<1.5 \times 10^{-2}$	90	[8] TANAKA	11	SKAM	H, solar ν ($b\overline{b}$)
<0.2	90	ARCHAMBAU...	09	PICA	F
<4	90	LEBEDENKO	09A	ZEP3	Xe
<0.6	90	ANGLE	08A	XE10	Xe
<100	90	ALNER	07	ZEP2	Xe
<1	90	LEE	07A	KIMS	CsI
<20	90	[9] AKERIB	06	CDMS	^{73}Ge, ^{29}Si
<2	90	SHIMIZU	06A	CNTR	F (CaF_2)
<0.5	90	ALNER	05	NAIA	NaI
<1.5	90	BARNABE-HE...	05	PICA	F (C_4F_{10})
<1.5	90	GIRARD	05	SMPL	F (C_2ClF_5)
<35	90	MIUCHI	03	BOLO	LiF
<30	90	TAKEDA	03	BOLO	NaF

[1] AGNESE 18 give limits for $\sigma^{SD}(p\chi)$ for m(WIMP) between 1.5 and 20 GeV using CDMSlite mode data.

[2] BEHNKE 17 show final Picasso results based on 231.4 kg d exposure at SNOLab for WIMP scatter on C_4F_{10} search via superheated droplet; require σ(SD) $< 1.32 \times 10^{-2}$ pb for m(WIMP) = 20 GeV.

[3] AMOLE 16A require SD WIMP-p scattering $< 5 \times 10^{-4}$ pb for m(WIMP) = 20 GeV; bubbles from C_3F_8 target.

[4] KHACHATRYAN 16AJ require SD WIMP-p $< 2 \times 10^{-6}$ pb for m(WIMP) = 20 GeV from $pp \rightarrow Z + \not{E}_T$; $Z \rightarrow \ell\overline{\ell}$ signal.

[5] AARTSEN 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between June 2010 and May 2011.

[6] The value has been provided by the authors. APRILE 13 note that the proton limits on Xe are highly sensitive to the theoretical model used. See also APRILE 14A.

[7] Use a direction-sensitive detector.

[8] TANAKA 11 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.

[9] See also AKERIB 05.

For m_{X^0} = 100 GeV

For limits from X^0 annihilation in the Sun, the assumed annihilation final state is shown in parenthesis in the comment.

VALUE (pb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<5 \times 10^{-5}$	90	[1] AMOLE	17	PICO	C_3F_8
$<3.3 \times 10^{-2}$	90	[2] APRILE	17A	X100	Xe inelastic
$<2.8 \times 10^{-1}$	90	[3] BATTAT	17	DRFT	CS_2
$<2 \times 10^{-3}$	90	[4] FU	17	PNDX	Xe
$<$ 0.553–0.019	95	[5] AABOUD	16D	ATLS	$pp \rightarrow j + \not{E}_T$
$<1 \times 10^{-5}$	90	[6] AABOUD	16F	ATLS	$pp \rightarrow \gamma + \not{E}_T$
$<1 \times 10^{-4}$	90	[7] AARTSEN	16C	ICCB	solar ν (W^+W^-)
$<2 \times 10^{-4}$	90	[8] ADRIAN-MAR..	16	ANTR	solar ν (WW, $b\overline{b}$, $\tau\overline{\tau}$)
$<3 \times 10^{-3}$	90	[9] AKERIB	16A	LUX	Xe
$<5 \times 10^{-4}$	90	[10] AMOLE	16	PICO	CF_3I
$<1.5 \times 10^{-3}$	90	AMOLE	15	PICO	C_3F_8
$<3.19 \times 10^{-3}$	90	CHOI	15	SKAM	H, solar ν ($b\overline{b}$)
$<2.80 \times 10^{-4}$	90	CHOI	15	SKAM	H, solar ν (W^+W^-)
$<1.24 \times 10^{-4}$	90	CHOI	15	SKAM	H, solar ν ($\tau^+\tau^-$)
$<8 \times 10^{2}$	90	[11] NAKAMURA	15	NAGE	CF_4
$<1.7 \times 10^{-3}$	90	[12] AVRORIN	14	BAIK	H, solar ν (W^+W^-)
$<4.5 \times 10^{-2}$	90	[12] AVRORIN	14	BAIK	H, solar ν ($b\overline{b}$)
$<7.1 \times 10^{-4}$	90	[12] AVRORIN	14	BAIK	H, solar ν ($\tau^+\tau^-$)
$<6 \times 10^{-3}$	90	FELIZARDO	14	SMPL	C_2ClF_5
$<2.68 \times 10^{-4}$	90	[13] AARTSEN	13	ICCB	H, solar ν (W^+W^-)
$<1.47 \times 10^{-2}$	90	[13] AARTSEN	13	ICCB	H, solar ν ($b\overline{b}$)
$<8.5 \times 10^{-4}$	90	[14] ADRIAN-MAR..	13	ANTR	H, solar ν (W^+W^-)
$<5.5 \times 10^{-2}$	90	[14] ADRIAN-MAR..	13	ANTR	H, solar ν ($b\overline{b}$)
$<3.4 \times 10^{-4}$	90	[14] ADRIAN-MAR..	13	ANTR	H, solar ν ($\tau^+\tau^-$)
$<1.00 \times 10^{-2}$	90	[15] APRILE	13	X100	Xe
$<7.1 \times 10^{-4}$	90	[16] BOLIEV	13	BAKS	H, solar ν (W^+W^-)
$<8.4 \times 10^{-3}$	90	[16] BOLIEV	13	BAKS	H, solar ν ($b\overline{b}$)
$<3.1 \times 10^{-4}$	90	[16] BOLIEV	13	BAKS	H, solar ν ($\tau^+\tau^-$)
$<7.07 \times 10^{-4}$	90	[17] ABBASI	12	ICCB	H, solar ν (W^+W^-)
$<4.53 \times 10^{-2}$	90	[17] ABBASI	12	ICCB	H, solar ν ($b\overline{b}$)
$<7 \times 10^{-2}$	90	ARCHAMBAU..	12	PICA	F (C_4F_{10})
$<1 \times 10^{-2}$	90	BEHNKE	12	COUP	CF_3I
<1.8	90	DAW	12	DRFT	F (CF_4)
$<9 \times 10^{-3}$		FELIZARDO	12	SMPL	C_2ClF_5
$<2 \times 10^{-2}$	90	KIM	12	KIMS	CsI
$<2 \times 10^{3}$	90	[11] AHLEN	11	DMTP	F (CF_4)
$<7 \times 10^{-2}$	90	BEHNKE	11	COUP	CF_3I
$<2.7 \times 10^{-4}$	90	[18] TANAKA	11	SKAM	H, solar ν (W^+W^-)
$<4.5 \times 10^{-3}$	90	[18] TANAKA	11	SKAM	H, solar ν ($b\overline{b}$)
		[19] FELIZARDO	10	SMPL	C_2ClF_3
$<6 \times 10^{3}$	90	[11] MIUCHI	10	NAGE	CF_4
<0.4	90	ARCHAMBAU..	09	PICA	F
<0.8	90	LEBEDENKO	09A	ZEP3	Xe

$<$ 1.0	90	ANGLE	08A	XE10	Xe
$<$ 15	90	ALNER	07	ZEP2	Xe
$<$ 0.2	90	LEE	07A	KIMS	CsI
$<$ 1 $\times 10^4$	90	[11] MIUCHI	07	NAGE	F (CF_4)
$<$ 5	90	[20] AKERIB	06	CDMS	^{73}Ge, ^{29}Si
$<$ 2	90	SHIMIZU	06A	CNTR	F (CaF_2)
$<$ 0.3	90	ALNER	05	NAIA	NaI
$<$ 2	90	BARNABE-HE...	05	PICA	F (C_4F_{10})
$<$100	90	BENOIT	05	EDEL	^{73}Ge
$<$ 1.5	90	GIRARD	05	SMPL	F (C_2ClF_5)
$<$ 0.7		[21] GIULIANI	05A	RVUE	
		[22] GIULIANI	04	RVUE	
		[23] GIULIANI	04A	RVUE	
$<$ 35	90	MIUCHI	03	BOLO	LiF
$<$ 40	90	TAKEDA	03	BOLO	NaF

[1] AMOLE 17 require σ(WIMP-p)^{SD} $<$ 5×10^{-5} pb for m(WIMP) = 100 GeV using PICO-60 1167 kg-days exposure at SNOLab.

[2] APRILE 17A require require σ(WIMP-p)(inelastic)^{SD} $<$ 3.3×10^{-2} pb for m(WIMP) = 100 GeV, based on 7640 kg day exposure at LNGS.

[3] BATTAT 17 use directional detection of CS_2 ions to require σ(SD) $<$ 2.8×10^{-1} pb for 100 GeV WIMP with a 55 days exposure at the Boulby Underground Science Facility.

[4] FU 17 from a 33000 kg d exposure at CJPL, PANDAX II derive for m(DM) = 100 GeV, σ(WIMP-p)^{SD} $< 2 \times 10^{-3}$ pb and σ(WIMP-n)^{SD} $<$ 6×10^{-5} pb.

[5] AABOUD 16D use ATLAS 13 TeV 3.2 fb^{-1} of data to search for monojet plus missing E_T; agree with SM rates; present limits on large extra dimensions, compressed SUSY spectra and wimp pair production.

[6] AABOUD 16F search for monophoton plus missing E_T events at ATLAS with 13 Tev and 3.2 fb^{-1}; signal agrees with SM background; place limits on SD WIMP-proton scattering vs. mediator mass and large extra dimension models.

[7] AARTSEN 16C search for high energy νs from WIMP annihilation in solar core; limits set on SD WIMP-p scattering (Fig. 8).

[8] ADRIAN-MARTINEZ 16 search for WIMP annihilation into νs from solar core; exclude SD cross section $<$ few 10^{-4} depending on m(WIMP).

[9] AKERIB 16A using 2013 data exclude SD WIMP-proton scattering $>$ 3×10^{-3} pb for m(WIMP) = 100 GeV.

[10] AMOLE 16 use bubble technique on CF_3I target to exclude SD WIMP-p scattering $>$ 5×10^{-4} pb for m(WIMP) = 100 GeV.

[11] Use a direction-sensitive detector.

[12] AVRORIN 14 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun in data taken between 1998 and 2003. See their Table 1 for limits assuming annihilation into neutrino pairs.

[13] AARTSEN 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between June 2010 and May 2011.

[14] ADRIAN-MARTINEZ 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between Jan. 2007 and Dec. 2008.

[15] The value has been provided by the authors. APRILE 13 note that the proton limits on Xe are highly sensitive to the theoretical model used. See also APRILE 14A.

[16] BOLIEV 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken from 1978 to 2009. See also SUVOROVA 13 for an older analysis of the same data.

[17] ABBASI 12 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.

[18] TANAKA 11 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.
[19] See their Fig. 3 for limits on spin-dependent proton couplings for X^0 mass of 50 GeV.
[20] See also AKERIB 05.
[21] GIULIANI 05A analyze available data and give combined limits.
[22] GIULIANI 04 reanalyze COLLAR 00 data and give limits for spin-dependent X^0-proton coupling.
[23] GIULIANI 04A give limits for spin-dependent X^0-proton couplings from existing data.

For $m_{X^0} = 1$ TeV

For limits from X^0 annihilation in the Sun, the assumed annihilation final state is shown in parenthesis in the comment.

VALUE (pb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 2.05 \times 10^{-5}$	90	[1] AARTSEN	17A	ICCB	ν, sun
		[2] ADRIAN-MAR..	16B	ANTR	solar μ from WIMP annih.
$< 1 \times 10^{-2}$	90	AMOLE	15	PICO	C_3F_8
$< 1.5 \times 10^{3}$	90	NAKAMURA	15	NAGE	CF_4
$< 2.7 \times 10^{-3}$	90	[3] AVRORIN	14	BAIK	H, solar ν ($W^+ W^-$)
$< 6.9 \times 10^{-2}$	90	[3] AVRORIN	14	BAIK	H, solar ν ($b\overline{b}$)
$< 8.4 \times 10^{-4}$	90	[3] AVRORIN	14	BAIK	H, solar ν ($\tau^+\tau^-$)
$< 4.48 \times 10^{-4}$	90	[4] AARTSEN	13	ICCB	H, solar ν ($W^+ W^-$)
$< 1.00 \times 10^{-2}$	90	[4] AARTSEN	13	ICCB	H, solar ν ($b\overline{b}$)
$< 8.9 \times 10^{-4}$	90	[5] ADRIAN-MAR..	13	ANTR	H, solar ν ($W^+ W^-$)
$< 2.0 \times 10^{-2}$	90	[5] ADRIAN-MAR..	13	ANTR	H, solar ν ($b\overline{b}$)
$< 2.3 \times 10^{-4}$	90	[5] ADRIAN-MAR..	13	ANTR	H, solar ν ($\tau^+\tau^-$)
$< 7.57 \times 10^{-2}$	90	[6] APRILE	13	X100	Xe
$< 5.4 \times 10^{-3}$	90	[7] BOLIEV	13	BAKS	H, solar ν ($W^+ W^-$)
$< 4.2 \times 10^{-2}$	90	[7] BOLIEV	13	BAKS	H, solar ν ($b\overline{b}$)
$< 1.5 \times 10^{-3}$	90	[7] BOLIEV	13	BAKS	H, solar ν ($\tau^+\tau^-$)
$< 2.50 \times 10^{-4}$	90	[8] ABBASI	12	ICCB	H, solar ν ($W^+ W^-$)
$< 7.86 \times 10^{-3}$	90	[8] ABBASI	12	ICCB	H, solar ν ($b\overline{b}$)
$< 8 \times 10^{-2}$	90	BEHNKE	12	COUP	CF_3I
< 8	90	DAW	12	DRFT	F (CF_4)
$< 6 \times 10^{-2}$		FELIZARDO	12	SMPL	C_2ClF_5
$< 8 \times 10^{-2}$	90	KIM	12	KIMS	CsI
$< 8 \times 10^{3}$	90	[9] AHLEN	11	DMTP	F (CF_4)
< 0.4	90	BEHNKE	11	COUP	CF_3I
$< 2 \times 10^{-3}$	90	[10] TANAKA	11	SKAM	H, solar ν ($b\overline{b}$)
$< 2 \times 10^{-2}$	90	[10] TANAKA	11	SKAM	H, solar ν ($W^+ W^-$)
$< 1 \times 10^{-3}$	90	[11] ABBASI	10	ICCB	KK dark matter
$< 2 \times 10^{4}$	90	[9] MIUCHI	10	NAGE	CF_4
$< 8.7 \times 10^{-4}$	90	ABBASI	09B	ICCB	H, solar ν ($W^+ W^-$)
$< 2.2 \times 10^{-2}$	90	ABBASI	09B	ICCB	H, solar ν ($b\overline{b}$)
< 3	90	ARCHAMBAU..	09	PICA	F
< 6	90	LEBEDENKO	09A	ZEP3	Xe
< 9	90	ANGLE	08A	XE10	Xe
<100	90	ALNER	07	ZEP2	Xe
< 0.8	90	LEE	07A	KIMS	CsI

$<$ 4 $\times 10^{4}$	90	[9] MIUCHI	07	NAGE	F (CF_4)
$<$ 30	90	[12] AKERIB	06	CDMS	^{73}Ge, ^{29}Si
$<$ 1.5	90	ALNER	05	NAIA	NaI
$<$ 15	90	BARNABE-HE...05		PICA	F (C_4F_{10})
$<$600	90	BENOIT	05	EDEL	^{73}Ge
$<$ 10	90	GIRARD	05	SMPL	F (C_2ClF_5)
$<$260	90	MIUCHI	03	BOLO	LiF
$<$150	90	TAKEDA	03	BOLO	NaF

[1] AARTSEN 17A search for neutrinos from solar WIMP annihilation into $\tau^+\tau^-$ in 532 days of live time.

[2] ADRIAN-MARTINEZ 16B search for secluded DM via WIMP annihilation in solar core into light mediator which later decays to μ or νs; limits presented in Figures 3 and 4.

[3] AVRORIN 14 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun in data taken between 1998 and 2003. See their Table 1 for limits assuming annihilation into neutrino pairs.

[4] AARTSEN 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between June 2010 and May 2011.

[5] ADRIAN-MARTINEZ 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken between Jan. 2007 and Dec. 2008.

[6] The value has been provided by the authors. APRILE 13 note that the proton limits on Xe are highly sensitive to the theoretical model used. See also APRILE 14A.

[7] BOLIEV 13 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the sun in data taken from 1978 to 2009. See also SUVOROVA 13 for an older analysis of the same data.

[8] ABBASI 12 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.

[9] Use a direction-sensitive detector.

[10] TANAKA 11 search for neutrinos from the Sun arising from the pair annihilation of X^0 trapped by the Sun. The amount of X^0 depends on the X^0-proton cross section.

[11] ABBASI 10 search for ν_μ from annihilations of Kaluza-Klein photon dark matter in the Sun.

[12] See also AKERIB 05.

Limits for Spin-Dependent Cross Section of Dark Matter Particle (X^0) on Neutron

For m_{X^0} = 20 GeV

VALUE (pb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<$ 1.5	95	[1] AGNESE	18	CDMS	Ge
$<$ 0.09	90	FELIZARDO	14	SMPL	C_2ClF_5
$<$ 8	90	[2] UCHIDA	14	XMAS	^{129}Xe, inelastic
$<$ 1.13×10^{-3}	90	[3] APRILE	13	X100	Xe
$<$ 0.02	90	AKIMOV	12	ZEP3	Xe
		[4] AHMED	11B	CDM2	Ge, low threshold
$<$ 0.06	90	AHMED	09	CDM2	Ge
$<$ 0.04	90	LEBEDENKO	09A	ZEP3	Xe
$<$ 50		[5] LIN	09	TEXO	Ge
$<$ 6 $\times 10^{-3}$	90	ANGLE	08A	XE10	Xe

$<$ 0.5	90		ALNER	07	ZEP2	Xe
$<$ 25	90		LEE	07A	KIMS	CsI
$<$ 0.3	90	[6] AKERIB	06	CDMS	^{73}Ge, ^{29}Si
$<$ 30	90	SHIMIZU	06A	CNTR	F (CaF_2)
$<$ 60	90	ALNER	05	NAIA	NaI
$<$ 20	90	BARNABE-HE...	05	PICA	F (C_4F_{10})
$<$ 10	90	BENOIT	05	EDEL	^{73}Ge
$<$ 4	90	KLAPDOR-K...	05	HDMS	^{73}Ge (enriched)
$<$600	90	TAKEDA	03	BOLO	NaF

[1] AGNESE 18 give limits for $\sigma^{SD}(n\chi)$ for m(WIMP) between 1.5 and 20 GeV using CDMSlite mode data.
[2] Derived limit from search for inelastic scattering $X^0 + {}^{129}\text{Xe} \rightarrow X^0 + {}^{129}\text{Xe}^*$(39.58 keV).
[3] The value has been provided by the authors. See also APRILE 14A.
[4] AHMED 11B give limits on spin-dependent X^0-neutron cross section for m_{X^0} = 4–12 GeV in the range 10^{-3}–10 pb. See their Fig. 3.
[5] See their Fig. 6(b) for cross section limits for m_{X^0} extending down to 2 GeV.
[6] See also AKERIB 05.

For m_{X^0} = 100 GeV

VALUE (pb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$< 2.5 \times 10^{-5}$	90	[1] AKERIB	17A	LUX	Xe
$<$ 0.1	90	FELIZARDO	14	SMPL	C_2ClF_5
$<$ 0.05	90	[2] UCHIDA	14	XMAS	^{129}Xe, inelastic
$< 4.68 \times 10^{-4}$	90	[3] APRILE	13	X100	Xe
$<$ 0.01	90	AKIMOV	12	ZEP3	Xe
		[4] FELIZARDO	10	SMPL	C_2ClF_3
$<$ 0.02	90	AHMED	09	CDM2	Ge
$<$ 0.01	90	LEBEDENKO	09A	ZEP3	Xe
$<$100	90	LIN	09	TEXO	Ge
$<$ 0.01	90	ANGLE	08A	XE10	Xe
$<$ 0.05	90	[5] BEDNYAKOV	08	RVUE	Ge
$<$ 0.08	90	ALNER	07	ZEP2	Xe
$<$ 6	90	LEE	07A	KIMS	CsI
$<$ 0.07	90	[6] AKERIB	06	CDMS	^{73}Ge, ^{29}Si
$<$ 30	90	SHIMIZU	06A	CNTR	F (CaF_2)
$<$ 10	90	ALNER	05	NAIA	NaI
$<$ 30	90	BARNABE-HE...	05	PICA	F (C_4F_{10})
$<$ 0.7	90	BENOIT	05	EDEL	^{73}Ge
$<$ 0.2		[7] GIULIANI	05A	RVUE	
$<$ 1.5	90	KLAPDOR-K...	05	HDMS	^{73}Ge (enriched)
		[8] GIULIANI	04	RVUE	
		[9] GIULIANI	04A	RVUE	
		[10] MIUCHI	03	BOLO	LiF
$<$800	90	TAKEDA	03	BOLO	NaF

[1] AKERIB 17A require $\sigma(\chi p)_{SD} < 7 \times 10^{-4}$ pb for m(χ) = 100 GeV using 129.5 kg yr exposure.
[2] Derived limit from search for inelastic scattering $X^0 + {}^{129}Xe^* \rightarrow X^0 + {}^{129}Xe^*$(39.58 keV).
[3] The value has been provided by the authors. See also APRILE 14A.
[4] See their Fig. 3 for limits on spin-dependent neutron couplings for X^0 mass of 50 GeV.
[5] BEDNYAKOV 08 reanalyze KLAPDOR-KLEINGROTHAUS 05 and BAUDIS 01 data.
[6] See also AKERIB 05.
[7] GIULIANI 05A analyze available data and give combined limits.
[8] GIULIANI 04 reanalyze COLLAR 00 data and give limits for spin-dependent X^0-neutron coupling.
[9] GIULIANI 04A give limits for spin-dependent X^0-neutron couplings from existing data.
[10] MIUCHI 03 give model-independent limit for spin-dependent X^0-proton and neutron cross sections. See their Fig. 5.

For m_{X^0} = 1 TeV

VALUE (pb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.07	90	FELIZARDO	14	SMPL	C_2ClF_5
< 0.2	90	[1] UCHIDA	14	XMAS	^{129}Xe, inelastic
$< 3.64 \times 10^{-3}$	90	[2] APRILE	13	X100	Xe
< 0.08	90	AKIMOV	12	ZEP3	Xe
< 0.2	90	AHMED	09	CDM2	Ge
< 0.1	90	LEBEDENKO	09A	ZEP3	Xe
< 0.1	90	ANGLE	08A	XE10	Xe
< 0.25	90	[3] BEDNYAKOV	08	RVUE	Ge
< 0.6	90	ALNER	07	ZEP2	Xe
< 30	90	LEE	07A	KIMS	CsI
< 0.5	90	[4] AKERIB	06	CDMS	^{73}Ge, ^{29}Si
< 40	90	ALNER	05	NAIA	NaI
< 200	90	BARNABE-HE...	05	PICA	F (C_4F_{10})
< 4	90	BENOIT	05	EDEL	^{73}Ge
< 10	90	KLAPDOR-K...	05	HDMS	^{73}Ge (enriched)
$< 4 \times 10^3$	90	TAKEDA	03	BOLO	NaF

[1] Derived limit from search for inelastic scattering $X^0 + {}^{129}Xe^* \rightarrow X^0 + {}^{129}Xe^*$(39.58 keV).
[2] The value has been provided by the authors. See also APRILE 14A.
[3] BEDNYAKOV 08 reanalyze KLAPDOR-KLEINGROTHAUS 05 and BAUDIS 01 data.
[4] See also AKERIB 05.

Cross-Section Limits for Dark Matter Particles (X^0) on Nuclei

For m_{X^0} = 20 GeV

VALUE (nb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.03	90	[1] UCHIDA	14	XMAS	^{129}Xe, inelastic
< 0.08	90	[2] ANGLOHER	02	CRES	Al
		[3] BENOIT	00	EDEL	Ge
< 0.04	95	[4] KLIMENKO	98	CNTR	^{73}Ge, inel.
< 0.8		ALESSAND...	96	CNTR	O
< 6		ALESSAND...	96	CNTR	Te

$<$ 0.02	90	[5] BELLI	96	CNTR	^{129}Xe, inel.
		[6] BELLI	96C	CNTR	^{129}Xe
$<4 \times 10^{-3}$	90	[7] BERNABEI	96	CNTR	Na
$<$ 0.3	90	[7] BERNABEI	96	CNTR	I
$<$ 0.2	95	[8] SARSA	96	CNTR	Na
$<$ 0.015	90	[9] SMITH	96	CNTR	Na
$<$ 0.05	95	[10] GARCIA	95	CNTR	Natural Ge
$<$ 0.1	95	QUENBY	95	CNTR	Na
$<$90	90	[11] SNOWDEN-...	95	MICA	^{16}O
$<4 \times 10^{3}$	90	[11] SNOWDEN-...	95	MICA	^{39}K
$<$ 0.7	90	BACCI	92	CNTR	Na
$<$ 0.12	90	[12] REUSSER	91	CNTR	Natural Ge
$<$ 0.06	95	CALDWELL	88	CNTR	Natural Ge

[1] UCHIDA 14 limit is for inelastic scattering $X^0 + {}^{129}\text{Xe}^* \rightarrow X^0 + {}^{129}\text{Xe}^*$ (39.58 keV).

[2] ANGLOHER 02 limit is for spin-dependent WIMP-Aluminum cross section.

[3] BENOIT 00 find four event categories in Ge detectors and suggest that low-energy surface nuclear recoils can explain anomalous events reported by UKDMC and Saclay NaI experiments.

[4] KLIMENKO 98 limit is for inelastic scattering $X^0\ {}^{73}\text{Ge} \rightarrow X^0\ {}^{73}\text{Ge}^*$ (13.26 keV).

[5] BELLI 96 limit for inelastic scattering $X^0\ {}^{129}\text{Xe} \rightarrow X^0\ {}^{129}\text{Xe}^*$(39.58 keV).

[6] BELLI 96C use background subtraction and obtain $\sigma <$ 150 pb ($<$ 1.5 fb) (90% CL) for spin-dependent (independent) X^0-proton cross section. The confidence level is from R. Bernabei, private communication, May 20, 1999.

[7] BERNABEI 96 use pulse shape discrimination to enhance the possible signal. The limit here is from R. Bernabei, private communication, September 19, 1997.

[8] SARSA 96 search for annual modulation of WIMP signal. See SARSA 97 for details of the analysis. The limit here is from M.L. Sarsa, private communication, May 26, 1997.

[9] SMITH 96 use pulse shape discrimination to enhance the possible signal. A dark matter density of 0.4 GeV cm^{-3} is assumed.

[10] GARCIA 95 limit is from the event rate. A weaker limit is obtained from searches for diurnal and annual modulation.

[11] SNOWDEN-IFFT 95 look for recoil tracks in an ancient mica crystal. Similar limits are also given for ^{27}Al and ^{28}Si. See COLLAR 96 and SNOWDEN-IFFT 96 for discussion on potential backgrounds.

[12] REUSSER 91 limit here is changed from published (0.04) after reanalysis by authors. J.L. Vuilleumier, private communication, March 29, 1996.

For m_{X^0} = 100 GeV

VALUE (nb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<3 \times 10^{-3}$	90	[1] UCHIDA	14	XMAS	^{129}Xe, inelastic
$<$ 0.3	90	[2] ANGLOHER	02	CRES	Al
		[3] BELLI	02	RVUE	
		[4] BERNABEI	02C	DAMA	
		[5] GREEN	02	RVUE	
		[6] ULLIO	01	RVUE	
		[7] BENOIT	00	EDEL	Ge
$<4 \times 10^{-3}$	90	[8] BERNABEI	00D		^{129}Xe, inel.
		[9] AMBROSIO	99	MCRO	
		[10] BRHLIK	99	RVUE	
$<8 \times 10^{-3}$	95	[11] KLIMENKO	98	CNTR	^{73}Ge, inel.

< 0.08	95	[12] KLIMENKO	98	CNTR	^{73}Ge, inel.
< 4		ALESSAND...	96	CNTR	O
<25		ALESSAND...	96	CNTR	Te
$< 6 \times 10^{-3}$	90	[13] BELLI	96	CNTR	^{129}Xe, inel.
		[14] BELLI	96C	CNTR	^{129}Xe
$< 1 \times 10^{-3}$	90	[15] BERNABEI	96	CNTR	Na
< 0.3	90	[15] BERNABEI	96	CNTR	I
< 0.7	95	[16] SARSA	96	CNTR	Na
< 0.03	90	[17] SMITH	96	CNTR	Na
< 0.8	90	[17] SMITH	96	CNTR	I
< 0.35	95	[18] GARCIA	95	CNTR	Natural Ge
< 0.6	95	QUENBY	95	CNTR	Na
< 3	95	QUENBY	95	CNTR	I
$< 1.5 \times 10^{2}$	90	[19] SNOWDEN-...	95	MICA	^{16}O
$< 4 \times 10^{2}$	90	[19] SNOWDEN-...	95	MICA	^{39}K
< 0.08	90	[20] BECK	94	CNTR	^{76}Ge
< 2.5	90	BACCI	92	CNTR	Na
< 3	90	BACCI	92	CNTR	I
< 0.9	90	[21] REUSSER	91	CNTR	Natural Ge
< 0.7	95	CALDWELL	88	CNTR	Natural Ge

[1] UCHIDA 14 limit is for inelastic scattering $X^0 + {}^{129}\text{Xe}^* \rightarrow X^0 + {}^{129}\text{Xe}^*$(39.58 keV).

[2] ANGLOHER 02 limit is for spin-dependent WIMP-Aluminum cross section.

[3] BELLI 02 discuss dependence of the extracted WIMP cross section on the assumptions of the galactic halo structure.

[4] BERNABEI 02C analyze the DAMA data in the scenario in which X^0 scatters into a slightly heavier state as discussed by SMITH 01.

[5] GREEN 02 discusses dependence of extracted WIMP cross section limits on the assumptions of the galactic halo structure.

[6] ULLIO 01 disfavor the possibility that the BERNABEI 99 signal is due to spin-dependent WIMP coupling.

[7] BENOIT 00 find four event categories in Ge detectors and suggest that low-energy surface nuclear recoils can explain anomalous events reported by UKDMC and Saclay NaI experiments.

[8] BERNABEI 00D limit is for inelastic scattering $X^0\,{}^{129}\text{Xe} \rightarrow X^0\,{}^{129}\text{Xe}$ (39.58 keV).

[9] AMBROSIO 99 search for upgoing muon events induced by neutrinos originating from WIMP annihilations in the Sun and Earth.

[10] BRHLIK 99 discuss the effect of astrophysical uncertainties on the WIMP interpretation of the BERNABEI 99 signal.

[11] KLIMENKO 98 limit is for inelastic scattering $X^0\,{}^{73}\text{Ge} \rightarrow X^0\,{}^{73}\text{Ge}^*$ (13.26 keV).

[12] KLIMENKO 98 limit is for inelastic scattering $X^0\,{}^{73}\text{Ge} \rightarrow X^0\,{}^{73}\text{Ge}^*$ (66.73 keV).

[13] BELLI 96 limit for inelastic scattering $X^0\,{}^{129}\text{Xe} \rightarrow X^0\,{}^{129}\text{Xe}^*$(39.58 keV).

[14] BELLI 96C use background subtraction and obtain $\sigma < 0.35$ pb (< 0.15 fb) (90% CL) for spin-dependent (independent) X^0-proton cross section. The confidence level is from R. Bernabei, private communication, May 20, 1999.

[15] BERNABEI 96 use pulse shape discrimination to enhance the possible signal. The limit here is from R. Bernabei, private communication, September 19, 1997.

[16] SARSA 96 search for annual modulation of WIMP signal. See SARSA 97 for details of the analysis. The limit here is from M.L. Sarsa, private communication, May 26, 1997.

[17] SMITH 96 use pulse shape discrimination to enhance the possible signal. A dark matter density of 0.4 GeV cm^{-3} is assumed.

[18] GARCIA 95 limit is from the event rate. A weaker limit is obtained from searches for diurnal and annual modulation.
[19] SNOWDEN-IFFT 95 look for recoil tracks in an ancient mica crystal. Similar limits are also given for ^{27}Al and ^{28}Si. See COLLAR 96 and SNOWDEN-IFFT 96 for discussion on potential backgrounds.
[20] BECK 94 uses enriched ^{76}Ge (86% purity).
[21] REUSSER 91 limit here is changed from published (0.3) after reanalysis by authors. J.L. Vuilleumier, private communication, March 29, 1996.

For m_{X^0} = 1 TeV

VALUE (nb)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
< 0.03	90	[1] UCHIDA	14	XMAS	^{129}Xe, inelastic
< 3	90	[2] ANGLOHER	02	CRES	Al
		[3] BENOIT	00	EDEL	Ge
		[4] BERNABEI	99D	CNTR	SIMP
		[5] DERBIN	99	CNTR	SIMP
< 0.06	95	[6] KLIMENKO	98	CNTR	^{73}Ge, inel.
< 0.4	95	[7] KLIMENKO	98	CNTR	^{73}Ge, inel.
< 40		ALESSAND...	96	CNTR	O
<700		ALESSAND...	96	CNTR	Te
< 0.05	90	[8] BELLI	96	CNTR	^{129}Xe, inel.
< 1.5	90	[9] BELLI	96	CNTR	^{129}Xe, inel.
		[10] BELLI	96C	CNTR	^{129}Xe
< 0.01	90	[11] BERNABEI	96	CNTR	Na
< 9	90	[11] BERNABEI	96	CNTR	I
< 7	95	[12] SARSA	96	CNTR	Na
< 0.3	90	[13] SMITH	96	CNTR	Na
< 6	90	[13] SMITH	96	CNTR	I
< 6	95	[14] GARCIA	95	CNTR	Natural Ge
< 8	95	QUENBY	95	CNTR	Na
< 50	95	QUENBY	95	CNTR	I
<700	90	[15] SNOWDEN-...	95	MICA	^{16}O
< 1 $\times 10^3$	90	[15] SNOWDEN-...	95	MICA	^{39}K
< 0.8	90	[16] BECK	94	CNTR	^{76}Ge
< 30	90	BACCI	92	CNTR	Na
< 30	90	BACCI	92	CNTR	I
< 15	90	[17] REUSSER	91	CNTR	Natural Ge
< 6	95	CALDWELL	88	CNTR	Natural Ge

[1] UCHIDA 14 limit is for inelastic scattering $X^0 + {}^{129}\text{Xe}^* \rightarrow X^0 + {}^{129}\text{Xe}^*$ (39.58 keV).
[2] ANGLOHER 02 limit is for spin-dependent WIMP-Aluminum cross section.
[3] BENOIT 00 find four event categories in Ge detectors and suggest that low-energy surface nuclear recoils can explain anomalous events reported by UKDMC and Saclay NaI experiments.
[4] BERNABEI 99D search for SIMPs (Strongly Interacting Massive Particles) in the mass range 10^3–10^{16} GeV. See their Fig. 3 for cross-section limits.
[5] DERBIN 99 search for SIMPs (Strongly Interacting Massive Particles) in the mass range 10^2–10^{14} GeV. See their Fig. 3 for cross-section limits.
[6] KLIMENKO 98 limit is for inelastic scattering $X^0\,{}^{73}\text{Ge} \rightarrow X^0\,{}^{73}\text{Ge}^*$ (13.26 keV).
[7] KLIMENKO 98 limit is for inelastic scattering $X^0\,{}^{73}\text{Ge} \rightarrow X^0\,{}^{73}\text{Ge}^*$ (66.73 keV).

[8] BELLI 96 limit for inelastic scattering $X^0\ {}^{129}\mathrm{Xe} \to X^0\ {}^{129}\mathrm{Xe}^*$(39.58 keV).
[9] BELLI 96 limit for inelastic scattering $X^0\ {}^{129}\mathrm{Xe} \to X^0\ {}^{129}\mathrm{Xe}^*$(236.14 keV).
[10] BELLI 96C use background subtraction and obtain $\sigma < 0.7$ pb (< 0.7 fb) (90% CL) for spin-dependent (independent) X^0-proton cross section. The confidence level is from R. Bernabei, private communication, May 20, 1999.
[11] BERNABEI 96 use pulse shape discrimination to enhance the possible signal. The limit here is from R. Bernabei, private communication, September 19, 1997.
[12] SARSA 96 search for annual modulation of WIMP signal. See SARSA 97 for details of the analysis. The limit here is from M.L. Sarsa, private communication, May 26, 1997.
[13] SMITH 96 use pulse shape discrimination to enhance the possible signal. A dark matter density of 0.4 GeV cm^{-3} is assumed.
[14] GARCIA 95 limit is from the event rate. A weaker limit is obtained from searches for diurnal and annual modulation.
[15] SNOWDEN-IFFT 95 look for recoil tracks in an ancient mica crystal. Similar limits are also given for ^{27}Al and ^{28}Si. See COLLAR 96 and SNOWDEN-IFFT 96 for discussion on potential backgrounds.
[16] BECK 94 uses enriched ^{76}Ge (86% purity).
[17] REUSSER 91 limit here is changed from published (5) after reanalysis by authors. J.L. Vuilleumier, private communication, March 29, 1996.

Miscellaneous Results from Underground Dark Matter Searches

VALUE	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1 \times 10^{-12}$	90	[1] AGUILAR-AR...	17	DMIC	γ' on Si
		[2] APRILE	17	X100	Xe
		[3] APRILE	17D	X100	Xe
		[4] APRILE	17H	X100	keV bosonic DM search
		[5] APRILE	17K	X100	$\chi N \to \chi^* \to \chi\gamma$
$<4 \times 10^{-3}$	90	[6] ANGLOHER	16A	CRES	$CaWO_4$
		[7] APRILE	15	X100	Event rate modulation
		[8] APRILE	15A	X100	Electron scattering

[1] AGUILAR-AREVALO 17 search for hidden photon DM scatter on Si target CCD; limit kinetic mixing $\kappa < 1 \times 10^{-12}$ for m = 10 eV.
[2] APRILE 17 search for WIMP-e annual modulation signal for recoil energy in the 2.0–5.8 keV interval using 4 years data with Xe. No significant effect seen.
[3] APRILE 17D set limits on 14 WIMP-nucleon different interaction operators. No deviations found using 225 live days in the 6.6–240 keV recoil energy range.
[4] APRILE 17H search for keV bosonic DM via $e\chi \to e$, looking for electronic recoils with 224.6 live days of data and 34 kg of LXe. Limits set on $\chi e e$ coupling for m(χ) = 8–125 keV.
[5] APRILE 17K search for magnetic inelastic DM via $\chi N \to \chi^* \to \chi\gamma$. Limits set in DM magnetic moment vs. mass splitting plane for two DM masses corresponding to the DAMA/LIBRA best fit values.
[6] ANGLOHER 16A require q^2 dependent scattering $< 8 \times 10^{-3}$ pb for asymmetric DM m(WIMP) = 3 GeV on $CaWO_4$ target. It uses a local dark matter density of 0.38 GeV/cm^3.
[7] APRILE 15 search for periodic variation of electronic recoil event rate in the data between Feb. 2011 and Mar. 2012. No significant modulation is found for periods up to 500 days.
[8] APRILE 15A search for X^0 scattering off electrons. See their Fig. 4 for limits on cross section through axial-vector coupling for m_{X^0} between 0.6 GeV and 1 TeV. For m_{X^0} = 2 GeV, $\sigma < 60$ pb (90%CL) is obtained.

X^0 Annihilation Cross Section

Limits are on σv for X^0 pair annihilation at threshold.

VALUE ($cm^3 s^{-1}$)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
$<1.2 \times 10^{-23}$	95	[1] AARTSEN	17C	ICCB	$\chi\chi \rightarrow$ neutrinos
$<5 \times 10^{-25}$	90	[2] ALBERT	17A	ANTR	ν, Milky Way
$<1.32 \times 10^{-25}$	95	[3] ARCHAMBAU...	17	VRTS	γ dwarf galaxies
$<7 \times 10^{-21}$	90	[4] AVRORIN	17	BAIK	cosmic ν
$<1 \times 10^{-28}$		[5] BOUDAUD	17		MeV DM to $e^+ e^-$
		[6] AARTSEN	16D	ICCB	ν, galactic center
$<6 \times 10^{-26}$	95	[7] ABDALLAH	16	HESS	Central Galactic Halo
$<1 \times 10^{-27}$	95	[8] ABDALLAH	16A	HESS	WIMP+WIMP $\rightarrow \gamma\gamma$; galactic center
$<3 \times 10^{-26}$	95	[9] AHNEN	16	MGFL	Satellite galaxy, m(WIMP)=100 GeV
$<1.9 \times 10^{-21}$	90	[10] AVRORIN	16	BAIK	νs from galactic center
$<3 \times 10^{-26}$	95	[11] CAPUTO	16	FLAT	small Magellanic cloud
$<1 \times 10^{-25}$	95	[12] FORNASA	16	FLAT	Fermi-LAT γ-ray anisotropy
$<5 \times 10^{-27}$		[13] LEITE	16		WIMP, radio
$<2 \times 10^{-26}$	95	[14] LI	16	FLAT	dwarf galaxies
$<1 \times 10^{-25}$	95	[15] LI	16A	FLAT	Fermi-LAT; M31
$<1 \times 10^{-26}$		[16] LIANG	16	FLAT	Fermi-LAT, gamma line
$<1 \times 10^{-25}$	95	[17] LU	16	FLAT	Fermi-LAT and AMS-02
$<1 \times 10^{-23}$	95	[18] SHIRASAKI	16	FLAT	extra galactic
		[19] AARTSEN	15C	ICCB	ν, Galactic halo
		[20] AARTSEN	15E	ICCB	ν, Galactic center
		[21] ABRAMOWSKI	15	HESS	Galactic center
		[22] ACKERMANN	15	FLAT	monochromatic γ
		[23] ACKERMANN	15A	FLAT	isotropic γ background
		[24] ACKERMANN	15B	FLAT	Satellite galaxy
		[25] ADRIAN-MAR...	15	ANTR	ν, Galactic center
$<2.90 \times 10^{-26}$	95	[26,27] ACKERMANN	14	FLAT	Satellite galaxy, m = 10 GeV
$<1.84 \times 10^{-25}$	95	[26,28] ACKERMANN	14	FLAT	Satellite galaxy, m = 100 GeV
$<1.75 \times 10^{-24}$	95	[26,28] ACKERMANN	14	FLAT	Satellite galaxy, m = 1 TeV
$<4.52 \times 10^{-24}$	95	[29] ALEKSIC	14	MGIC	Segue 1, m = 1.35 TeV
		[30] AARTSEN	13C	ICCB	Galaxies
		[31] ABRAMOWSKI	13	HESS	Central Galactic Halo
		[32] ACKERMANN	13A	FLAT	Galaxy
		[33] ABRAMOWSKI	12	HESS	Fornax Cluster
		[34] ACKERMANN	12	FLAT	Galaxy
		[35] ACKERMANN	12	FLAT	Galaxy
		[36] ALIU	12	VRTS	Segue 1
$<1 \times 10^{-22}$	90	[37] ABBASI	11C	ICCB	Galactic halo, m=1 TeV
$<3 \times 10^{-25}$	95	[38] ABRAMOWSKI	11	HESS	Near Galactic center, m=1 TeV
$<1 \times 10^{-26}$	95	[39] ACKERMANN	11	FLAT	Satellite galaxy, m=10 GeV
$<1 \times 10^{-25}$	95	[39] ACKERMANN	11	FLAT	Satellite galaxy, m=100 GeV
$<1 \times 10^{-24}$	95	[39] ACKERMANN	11	FLAT	Satellite galaxy, m=1 TeV

[1] AARTSEN 17C use 1005 days of IceCube data to search for $\chi\chi \rightarrow$ neutrinos via various annihilation channels. Limits set.

[2] ALBERT 17A maximum sensitivity to thermally averaged annihilation cross-section is for m(WIMP) = 10^5 GeV, where they require via $\tau\tau$ channel, $\langle\sigma{\cdot}v\rangle < 5 \times 10^{-25}$ cm^3/s assuming NFW halo profile, $\langle\sigma{\cdot}v\rangle < 2 \times 10^{-24}$ cm^3/s assuming McMillan profile, $\langle\sigma{\cdot}v\rangle < 1.2 \times 10^{-23}$ cm^3/s assuming Burkert profile.

[3] ARCHAMBAULT 17 set limits for WIMP mass between 100 GeV and 1 TeV on $\langle\sigma{\cdot}v\rangle$ for W^+W^-, ZZ, $b\overline{b}$, $s\overline{s}$, $u\overline{u}$, $d\overline{d}$, $t\overline{t}$, e^+e^-, gg, $c\overline{c}$, hh, $\gamma\gamma$, $\mu^+\mu^-$,$\tau^+\tau^-$ annihilation channels.

[4] AVRORIN 17 find upper limits for the annhilation cross section in various channels for DM particle mass between 30 GeV and 10 TeV. Strongest upper limits coming from the two neutrino channel require $\langle\sigma{\cdot}v\rangle < 6 \times 10^{-20}$ cm^3/s in dwarf galaxies and $\langle\sigma{\cdot}v\rangle < 7 \times 10^{-21}$ cm^3/s in LMC for 5 TeV WIMP mass.

[5] BOUDAUD 17 use data from the spacecraft Voyager 1, beyond the heliopause, and from AMS02 on $\chi\chi \rightarrow e^+e^-$ to require $\langle\sigma{\cdot}v\rangle < 1. \times 10^{-28}$ cm^3/s for m(χ) = 10 MeV.

[6] AARTSEN 16D search for GeV νs from WIMP annihilation in galaxy; limits set on $\langle\sigma{\cdot}v\rangle$ in Fig. 6, 7.

[7] ABDALLAH 16 require $\langle\sigma{\cdot}v\rangle < 6 \times 10^{-26}$ cm^3/s for m(WIMP) = 1.5 TeV from 254 hours observation (WW channel) and $< 2 \times 10^{-26}$ cm^3/s for m(WIMP) = 1.0 TeV in $\tau^+\tau^-$ channel.

[8] ABDALLAH 16A search for line spectra from WIMP + WIMP $\rightarrow \gamma\gamma$ in 18 hr HESS data; rule out previous 130 GeV WIMP hint from Fermi-LAT data.

[9] AHNEN 16 require $\langle\sigma{\cdot}v\rangle < 3 \times 10^{-26}$ cm^3/s for m(WIMP) = 100 GeV (WW channel).

[10] AVRORIN 16 require $\langle$s.v$\rangle < 1.91 \times 10^{-21}$ cm^3/s from WIMP annihilation to νs via WW channel for m(WIMP) = 1 TeV.

[11] CAPUTO 16 place limits on WIMPs from annihilation to gamma rays in Small Magellanic Cloud using Fermi-LaT data: $\langle\sigma{\cdot}v\rangle < 3 \times 10^{-26}$cm^3/s for m(WIMP) = 10 GeV.

[12] FORNASA 16 use anisotropies in the γ-ray diffuse emission detected by Fermi-LAT to bound $\langle\sigma{\cdot}v\rangle < 10^{-25}$cm^3/s for m(WIMP) = 100 GeV in $b\overline{b}$ channel: see Fig. 28. The limit is driven by dark-matter subhalos in the Milky Way and it refers to their Most Constraining Scenario.

[13] LEITE 16 constrain WIMP annihilation via search for radio emissions from Smith cloud; $\langle\sigma{\cdot}v\rangle < 5 \times 10^{-27}$cm^3/s in ee channel for m(WIMP) = 5 GeV.

[14] LI 16 re-analyze Fermi-LAT data on 8 dwarf spheroidals; set limit $\langle\sigma{\cdot}v\rangle < 2 \times 10^{-26}$ cm^3/s for m(WIMP) = 100 GeV in $b\overline{b}$ mode with substructures included.

[15] LI 16A constrain $\langle\sigma{\cdot}v\rangle < 10^{-25}$cm^3/s in $b\overline{b}$ channel for m(WIMP) = 100 GeV using Fermi-LAT data from M31; see Fig. 6.

[16] LIANG 16 search dwarf spheroidal galaxies, Large Magellanic Cloud, and Small Magellanic Cloud for γ-line in Fermi-LAT data.

[17] LU 16 re-analyze Fermi-LAT and AMS-02 data; require $\langle\sigma{\cdot}v\rangle < 10^{-25}$cm^3/s for m_m(WIMP) = 1 TeV in $b\overline{b}$ channel .

[18] SHIRASAKI 16 re-anayze Fermi-LAT extra-galactic data; require $\langle\sigma{\cdot}v\rangle < 10^{-23}$cm^3/s for m(WIMP) = 1 TeV in $b\overline{b}$ channel; see Fig. 8.

[19] AARTSEN 15C search for neutrinos from X^0 annihilation in the Galactic halo. See their Figs. 16 and 17, and Table 5 for limits on $\sigma \cdot$ v for X^0 mass between 100 GeV and 100 TeV.

[20] AARTSEN 15E search for neutrinos from X^0 annihilation in the Galactic center. See their Figs. 7 and 9, and Table 3 for limits on $\sigma \cdot$ v for X^0 mass between 30 GeV and 10 TeV.

[21] ABRAMOWSKI 15 search for γ from X^0 annihilation in the Galactic center. See their Fig. 4 for limits on $\sigma \cdot$ v for X^0 mass between 250 GeV and 10 TeV.

[22] ACKERMANN 15 search for monochromatic γ from X^0 annihilation in the Galactic halo. See their Fig. 8 and Tables 2–4 for limits on $\sigma \cdot$ v for X^0 mass between 0.2 GeV and 500 GeV.

[23] ACKERMANN 15A search for γ from X^0 annihilation (both Galactic and extragalactic) in the isotropic γ background. See their Fig. 7 for limits on $\sigma \cdot$ v for X^0 mass between 10 GeV and 30 TeV.

[24] ACKERMANN 15B search for γ from X^0 annihilation in 15 dwarf spheroidal satellite galaxies of the Milky Way. See their Figs. 1 and 2 for limits on $\sigma \cdot$ v for X^0 mass between 2 GeV and 10 TeV.

[25] ADRIAN-MARTINEZ 15 search for neutrinos from X^0 annihilation in the Galactic center. See their Figs. 10 and 11 and Tables 1 and 2 for limits on $\sigma \cdot$ v for X^0 mass between 25 GeV and 10 TeV.

[26] ACKERMANN 14 search for γ from X^0 annihilation in 25 dwarf spheroidal satellite galaxies of the Milky Way. See their Tables II–VII for limits assuming annihilation into $e^+ e^-$, $\mu^+ \mu^-$, $\tau^+ \tau^-$, $u \overline{u}$, $b \overline{b}$, and $W^+ W^-$, for X^0 mass ranging from 2 GeV to 10 TeV.

[27] Limit assuming X^0 pair annihilation into $b \overline{b}$.

[28] Limit assuming X^0 pair annihilation into $W^+ W^-$.

[29] ALEKSIC 14 search for γ from X^0 annihilation in the dwarf spheroidal galaxy Segue 1. The listed limit assumes annihilation into $W^+ W^-$. See their Figs. 6, 7, and 16 for limits on $\sigma \cdot$ v for annihilation channels $\mu^+ \mu^-$, $\tau^+ \tau^-$, $b \overline{b}$, $t \overline{t}$, $\gamma\gamma$, γZ, $W^+ W^-$, $Z Z$ for X^0 mass between 10^2 and 10^4 GeV.

[30] AARTSEN 13C search for neutrinos from X^0 annihilation in nearby galaxies and galaxy clusters. See their Figs. 5–7 for limits on $\sigma \cdot$ v for $X^0 X^0 \rightarrow \nu \overline{\nu}$, $\mu^+ \mu^-$, $\tau^+ \tau^-$, and $W^+ W^-$ for X^0 mass between 300 GeV and 100 TeV.

[31] ABRAMOWSKI 13 search for monochromatic γ from X^0 annihilation in the Milky Way halo in the central region. Limit on $\sigma \cdot$ v between 10^{-28} and 10^{-25} cm^3 s^{-1} (95% CL) is obtained for X^0 mass between 500 GeV and 20 TeV for $X^0 X^0 \rightarrow \gamma\gamma$. X^0 density distribution in the Galaxy by Einasto is assumed. See their Fig. 4.

[32] ACKERMANN 13A search for monochromatic γ from X^0 annihilation in the Milky Way. Limit on $\sigma \cdot$ v for the process $X^0 X^0 \rightarrow \gamma\gamma$ in the range 10^{-29}–10^{-27} cm^3 s^{-1} (95% CL) is obtained for X^0 mass between 5 and 300 GeV. The limit depends slightly on the assumed density profile of X^0 in the Galaxy. See their Tables VII−X and Fig.10. Supersedes ACKERMANN 12.

[33] ABRAMOWSKI 12 search for γ's from X^0 annihilation in the Fornax galaxy cluster. See their Fig. 7 for limits on $\sigma \cdot$ v for X^0 mass between 0.1 and 100 TeV for the annihilation channels $\tau^+ \tau^-$, $b \overline{b}$, and $W^+ W^-$.

[34] ACKERMANN 12 search for monochromatic γ from X^0 annihilation in the Milky Way. Limit on $\sigma \cdot$ v in the range 10^{-28}–10^{-26} cm^{3}s^{-1} (95% CL) is obtained for X^0 mass between 7 and 200 GeV if X^0 annihilates into $\gamma\gamma$. The limit depends slightly on the assumed density profile of X^0 in the Galaxy. See their Table III and Fig. 15.

[35] ACKERMANN 12 search for γ from X^0 annihilation in the Milky Way in the diffuse γ background. Limit on $\sigma \cdot$ v of 10^{-24} cm^{3}s^{-1} or larger is obtained for X^0 mass between 5 GeV and 10 TeV for various annihilation channels including $W^+ W^-$, $b \overline{b}$, $g g$, $e^+ e^-$, $\mu^+ \mu^-$, $\tau^+ \tau^-$. The limit depends slightly on the assumed density profile of X^0 in the Galaxy. See their Figs. 17–20.

[36] ALIU 12 search for γ's from X^0 annihilation in the dwarf spheroidal galaxy Segue 1. Limit on $\sigma \cdot$ v in the range 10^{-24}–10^{-20} cm^{3}s^{-1} (95% CL) is obtained for X^0 mass between 10 GeV and 2 TeV for annihilation channels $e^+ e^-$, $\mu^+ \mu^-$, $\tau^+ \tau^-$, $b \overline{b}$, and $W^+ W^-$. See their Fig. 3.

[37] ABBASI 11C search for ν_μ from X^0 annihilation in the outer halo of the Milky Way. The limit assumes annihilation into $\nu \nu$. See their Fig. 9 for limits with other annihilation channels.

[38] ABRAMOWSKI 11 search for γ from X^0 annihilation near the Galactic center. The limit assumes Einasto DM density profile.

[39] ACKERMANN 11 search for γ from X^0 annihilation in ten dwarf spheroidal satellite galaxies of the Milky Way. The limit for $m = 10$ GeV assumes annihilation into $b\overline{b}$, the others $W^+ W^-$. See their Fig. 2 for limits with other final states. See also GERINGER-SAMETH 11 for a different analysis of the same data.

Dark Matter Particle (X^0) Production in Hadron Collisions

Searches for X^0 production in asociation with observable particles (γ, jets, ...) in high energy hadron collisions. If a specific form of effective interaction Lagrangian is assumed, the limits may be translated into limits on X^0-nucleon scattering cross section.

VALUE	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
	[1] AABOUD	18	ATLS	$pp \to Z\chi\chi$; $Z \to \ell\ell$
	[2] AABOUD	18A	ATLS	$pp \to t\overline{t}\,\not{E}_T$; $pp \to b\overline{b}\,\not{E}_T$
	[3] AABOUD	18I	ATLS	jet(s) + $\not{E}_T$
	[4] SIRUNYAN	18C	CMS	$pp \to t\overline{t}\,\not{E}_T$
	[5] AABOUD	17A	ATLS	pp ($H \to b\overline{b}$ + WIMP pair)
	[6] AABOUD	17AM	ATLS	$pp \to Z' \to Ah \to h(b\overline{b}) + \not{E}_T$
	[7] AABOUD	17AQ	ATLS	$pp \to h(\gamma\gamma) + \not{E}_T$
	[8] AABOUD	17BD	ATLS	$pp \to$ jet(s) + $\not{E}_T$
	[9] AABOUD	17R	ATLS	$pp \to \gamma\not{E}_T$
	[10] AGUILAR-AR...	17A	MBNE	$pN \to \chi\chi X$; $\chi N \to \chi N$
	[11] BANERJEE	17	NA64	$eN \to eN\gamma'$
	[12] KHACHATRY...	17A	CMS	forward jets + $\not{E}_T$
	[13] KHACHATRY...	17F	CMS	$H \to$ invisibles
	[14] SIRUNYAN	17	CMS	$Z + \not{E}_T$
	[15] SIRUNYAN	17AP	CMS	$pp \to Z' \to Ah \to h$+MET
	[16] SIRUNYAN	17AQ	CMS	$pp \to \gamma$+MET
	[17] SIRUNYAN	17BB	CMS	$pp \to t\overline{t}+\not{E}_T$; $pp \to b\overline{b}+\not{E}_T$
	[18] SIRUNYAN	17G	CMS	$pp \to j + \not{E}_T$
	[19] SIRUNYAN	17U	CMS	$pp \to Z\chi\chi$; $Z \to \ell\overline{\ell}$
	[20] AABOUD	16AD	ATLS	(W or $Z \to$ jets) + $\not{E}_T$
	[21] AAD	16AF	ATLS	$VV \to$ forward jets +$\not{E}_T$
	[22] AAD	16AG	ATLS	ℓ + jets
	[23] AAD	16M	ATLS	$pp \to H + \not{E}_T$, $H \to b\overline{b}$
	[24] KHACHATRY...	16BZ	CMS	jet(s) + $\not{E}_T$
	[25] KHACHATRY...	16CA	CMS	jets + $\not{E}_T$
	[26] KHACHATRY...	16N	CMS	$pp \to \gamma + \not{E}_T$
	[27] AAD	15AS	ATLS	b ($\overline{b}$) + $\not{E}_T$, $t\overline{t} + \not{E}_T$
	[28] AAD	15BH	ATLS	jet + $\not{E}_T$
	[29] AAD	15CF	ATLS	$H^0 + \not{E}_T$
	[30] AAD	15CS	ATLS	$\gamma + \not{E}_T$
	[31] KHACHATRY...	15AG	CMS	$t\overline{t} + \not{E}_T$
	[32] KHACHATRY...	15AL	CMS	jet + $\not{E}_T$
	[33] KHACHATRY...	15T	CMS	$\ell + \not{E}_T$
	[34] AAD	14AI	ATLS	$W + \not{E}_T$

[35] AAD	14BK	ATLS	W, $Z + \not{E}_T$
[36] AAD	14K	ATLS	$Z + \not{E}_T$
[37] AAD	14O	ATLS	$Z + \not{E}_T$
[38] AAD	13AD	ATLS	jet $+ \not{E}_T$
[39] AAD	13C	ATLS	$\gamma + \not{E}_T$
[40] AALTONEN	12K	CDF	$t + \not{E}_T$
[41] AALTONEN	12M	CDF	jet $+ \not{E}_T$
[42] CHATRCHYAN	12AP	CMS	jet $+ \not{E}_T$
[43] CHATRCHYAN	12T	CMS	$\gamma + \not{E}_T$

[1] AABOUD 18 search for $pp \rightarrow Z + \not{E}_T$ with $Z \rightarrow \ell\ell$ at 13 TeV with 36.1 fb^{-1} of data. Limits set for simplified models.

[2] AABOUD 18A search for $pp \rightarrow t\overline{t}\,\not{E}_T$ or $pp \rightarrow b\overline{b}\,\not{E}_T$ at 13 TeV, 36.1 fb^{-1} of data. Limits set for simplified models.

[3] AABOUD 18I search for $pp \rightarrow j + \not{E}_T$ at 13 TeV with 36.1 fb^{-1} of data. Limits set for simplified models with pair-produced weakly interacting dark-matter candidates.

[4] SIRUNYAN 18C search for new physics in $pp \rightarrow$ final states with two oppositely charged leptons at 13 TeV with 35.9 fb^{-1}. Limits placed on m(mediator) and top squark for various simplified models.

[5] AABOUD 17A search for $H \rightarrow b\overline{b} + \not{E}_T$. See Fig. 4b for limits set on VB mediator vs WIMP mass.

[6] AABOUD 17AM search for $pp \rightarrow Z' \rightarrow Ah \rightarrow h(b\overline{b}) + \not{E}_T$ at 13 TeV. Limits set in m(Z') vs. m(A) plane and on the visible cross section of $h(b\overline{b}) + \not{E}_T$ events in bins of $\not{E}_T$.

[7] AABOUD 17AQ search for WIMP in $pp \rightarrow h(\gamma\gamma) + \not{E}_T$ in 36.1 fb^{-1} of data. Limits on the visible cross section are also provided. Model dependent limits on spin independent DM - Nucleon cross-section are also presented, which are more stringent than those from direct searches for DM mass smaller than 2.5 GeV .

[8] AABOUD 17BD search for $pp \rightarrow$ jet(s) $+ \not{E}_T$ at 13 TeV with 3.2 fb^{-1} of data. Limits set for simplified models. Observables corrected for detector effects can be used to constrain other models.

[9] AABOUD 17R, for an axial vector mediator in the s-channel, excludes m(mediator) $<$ 750–1200 GeV for m(DM) $<$ 230–480 GeV, depending on the couplings.

[10] AGUILAR-AREVALO 17A search for DM produced in 8 GeV proton collisions with steel beam dump followed by DM-nucleon scattering in MiniBooNE detector. Limit placed on DM cross section parameter $Y < 2 \times 10^{-8}$ for $\alpha_D = 0.5$ and for $0.01 < m(\text{DM}) <$ 0.3 GeV.

[11] BANERJEE 17 search for dark photon invisible decay via eN scattering; exclude m(γ') $<$ 100 MeV as an explanation of $(g_\mu - 2)$ muon anomaly.

[12] KHACHATRYAN 17A search for WIMPs in forward jets $+ \not{E}_T$ channel with 18.5 fb^{-1} at 8 TeV; limits set in effective theory model, Fig. 3.

[13] KHACHATRYAN 17F search for $H \rightarrow$ invisibles in pp collisions at 7, 8, and 13 TeV; place limits on Higgs portal DM.

[14] SIRUNYAN 17 search for $pp \rightarrow Z + \not{E}_T$ with 2.3 fb^{-1} at 13 TeV; no signal seen; limits placed on WIMPs and unparticles.

[15] SIRUNYAN 17AP search for $pp \rightarrow Z' \rightarrow Ah \rightarrow h$+MET with $h \rightarrow b\overline{b}$ or $\gamma\gamma$ and $A \rightarrow \chi\chi$ with 2.3 fb^{-1} at 13 TeV. Limits set in m(Z') vs. m(A) plane.

[16] SIRUNYAN 17AQ search for $pp \rightarrow \gamma$+MET at 13 TeV with 12.9 fb^{-1}. Limits derived for simplified DM models, effective electroweak-DM interaction and Extra Dimensions models.

[17] SIRUNYAN 17BB search for WIMPs via $pp \rightarrow t\overline{t}+\not{E}_T$, $pp \rightarrow b\overline{b}+\not{E}_T$ at 13 TeV with 2.2 fb^{-1}. Limits derived for various simplified models.

[18] SIRUNYAN 17G search for $pp \rightarrow j + \not{E}_T$ with 12.9 fb^{-1} at 13 TeV; limits placed on WIMP mass/mediators in DM simplified models.

[19] SIRUNYAN 17U search for WIMPs/unparticles via $pp \rightarrow Z\chi\chi$, $Z \rightarrow \ell\overline{\ell}$ at 13 TeV with 2.3 fb^{-1}. Limits derived for various simplified models.

[20] AABOUD 16AD place limits on $VVXX$ effective theory via search for hadronic W or Z plus WIMP pair production. See Fig. 5.

[21] AAD 16AF search for $VV \rightarrow$ ($H \rightarrow$ WIMP pair) + forward jets with 20.3 fb^{-1} at 8 TeV; set limits in Higgs portal model, Fig. 8 .

[22] AAD 16AG search for lepton jets with 20.3 fb^{-1} of data at 8 TeV; Fig. 13 excludes dark photons around 0.1–1 GeV for kinetic mixing 10^{-6}–10^{-2}.

[23] AAD 16M search with 20.3 fb^{-1} of data at 8 TeV pp collisions; limits placed on EFT model (Fig. 7) and simplified Z' model (Fig. 6).

[24] KHACHATRYAN 16BZ search for jet(s) + $\not{E}_T$ in 19.7 fb^{-1} at 8 TeV; limits set for variety of simplified models.

[25] KHACHATRYAN 16CA search for WIMPs via jet(s) + $\not{E}_T$ using razor variable; require mediator scale > 1 TeV for various effective theories.

[26] KHACHATRYAN 16N search for γ + WIMPs in 19.6 fb^{-1} at 8 TeV; limits set on SI and SD WIMP-p scattering in Fig. 3.

[27] AAD 15AS search for events with one or more bottom quark and missing E_T, and also events with a top quark pair and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 20.3 fb^{-1}. See their Figs. 5 and 6 for translated limits on X^0-nucleon cross section for m = 1–700 GeV.

[28] AAD 15BH search for events with a jet and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 20.3 fb^{-1}. See their Fig. 12 for translated limits on X^0-nucleon cross section for m = 1–1200 GeV.

[29] AAD 15CF search for events with a H^0 ($\rightarrow \gamma\gamma$) and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 20.3 fb^{-1}. See paper for limits on the strength of some contact interactions containing X^0 and the Higgs fields.

[30] AAD 15CS search for events with a photon and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 20.3 fb^{-1}. See their Fig. 13 (see also erratum) for translated limits on X^0-nucleon cross section for m = 1–1000 GeV.

[31] KHACHATRYAN 15AG search for events with a top quark pair and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 19.7 fb^{-1}. See their Fig. 8 for translated limits on X^0-nucleon cross section for m = 1–200 GeV.

[32] KHACHATRYAN 15AL search for events with a jet and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 19.7 fb^{-1}. See their Fig. 5 and Tables 4–6 for translated limits on X^0-nucleon cross section for m = 1–1000 GeV.

[33] KHACHATRYAN 15T search for events with a lepton and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 19.7 fb^{-1}. See their Fig. 17 for translated limits on X^0-proton cross section for m = 1–1000 GeV.

[34] AAD 14AI search for events with a W and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 20.3 fb^{-1}. See their Fig. 4 for translated limits on X^0–nucleon cross section for m = 1–1500 GeV.

[35] AAD 14BK search for hadronically decaying W, Z in association with $\not{E}_T$ in 20.3 fb^{-1} at 8 TeV pp collisions. Fig. 5 presents exclusion results for SI and SD scattering cross section. In addition, cross section limits on the anomalous production of W or Z bosons with large missing transverse momentum are also set in two fiducial regions.

[36] AAD 14K search for events with a Z and missing E_T in pp collisions at E_{cm} = 8 TeV with L = 20.3 fb^{-1}. See their Fig. 5 and 6 for translated limits on X^0–nucleon cross section for m = 1–10^3 GeV.

[37] AAD 14O search for ZH^0 production with H^0 decaying to invisible final states. See their Fig. 4 for translated limits on X^0–nucleon cross section for m = 1–60 GeV in Higgs-portal X^0 scenario.

[38] AAD 13AD search for events with a jet and missing E_T in pp collisions at $E_{cm} = 7$ TeV with $L = 4.7$ fb^{-1}. See their Figs. 5 and 6 for translated limits on X^0-nucleon cross section for $m = 1$–1300 GeV.

[39] AAD 13C search for events with a photon and missing E_T in pp collisions at $E_{cm} =$ 7 TeV with $L = 4.6$ fb^{-1}. See their Fig. 3 for translated limits on X^0-nucleon cross section for $m = 1$–1000 GeV.

[40] AALTONEN 12K search for events with a top quark and missing E_T in $p\overline{p}$ collisions at $E_{cm} = 1.96$ TeV with $L = 7.7$ fb^{-1}. Upper limits on $\sigma(t X^0)$ in the range 0.4–2 pb (95% CL) is given for $m_{X^0} = 0$–150 GeV.

[41] AALTONEN 12M search for events with a jet and missing E_T in $p\overline{p}$ collisions at E_{cm} $= 1.96$ TeV with $L = 6.7$ fb^{-1}. Upper limits on the cross section in the range 2–10 pb (90% CL) is given for $m_{X^0} = 1$–300 GeV. See their Fig. 2 for translated limits on X^0-nucleon cross section.

[42] CHATRCHYAN 12AP search for events with a jet and missing E_T in pp collisions at $E_{cm} = 7$ TeV with $L = 5.0$ fb^{-1}. See their Fig. 4 for translated limits on X^0-nucleon cross section for $m_{X^0} = 0.1$–1000 GeV.

[43] CHATRCHYAN 12T search for events with a photon and missing E_T in pp collisions at $E_{cm} = 7$ TeV with $L = 5.0$ fb^{-1}. Upper limits on the cross section in the range 13–15 fb (90% CL) is given for $m_{X^0} = 1$–1000 GeV. See their Fig. 2 for translated limits on X^0-nucleon cross section.

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HEHN	16	EPJ C76 548	L. Hehn *et al.*	(EDELWEISS-III Collab.)
KHACHATRY...	16AJ	PR D93 052011	V. Khachatryan *et al.*	(CMS Collab.)
KHACHATRY...	16BZ	JHEP 1612 083	V. Khachatryan *et al.*	(CMS Collab.)
Also		JHEP 1708 035 (errat.)	V. Khachatryan *et al.*	(CMS Collab.)
KHACHATRY...	16CA	JHEP 1612 088	V. Khachatryan *et al.*	(CMS Collab.)
KHACHATRY...	16N	PL B755 102	V. Khachatryan *et al.*	(CMS Collab.)
LEITE	16	JCAP 1611 021	N. Leite *et al.*	
LI	16	PR D93 043518	S. Li *et al.*	
LI	16A	JCAP 1612 028	Z. Li *et al.*	
LIANG	16	PR D94 103502	Y.-F. Liang *et al.*	
LU	16	PR D93 103517	B-Q. Lu, H-S. Zong	
SHIRASAKI	16	PR D94 063522	M. Shirasaki *et al.*	
TAN	16	PR D93 122009	T.H. Tan *et al.*	(PandaX Collab.)
TAN	16B	PRL 117 121303	A. Tan *et al.*	(PandaX Collab.)
ZHAO	16	PR D93 092003	W. Zhao *et al.*	(CDEX Collab.)
AAD	15AS	EPJ C75 92	G. Aad *et al.*	(ATLAS Collab.)
AAD	15BH	EPJ C75 299	G. Aad *et al.*	(ATLAS Collab.)
Also		EPJ C75 408 (errat.)	G. Aad *et al.*	(ATLAS Collab.)
AAD	15CF	PRL 115 131801	G. Aad *et al.*	(ATLAS Collab.)
AAD	15CS	PR D91 012008	G. Aad *et al.*	(ATLAS Collab.)
Also		PR D92 059903 (errat.)	G. Aad *et al.*	(ATLAS Collab.)
AARTSEN	15C	EPJ C75 20	M.G. Aartsen *et al.*	(IceCube Collab.)
AARTSEN	15E	EPJ C75 492	M.G. Aartsen *et al.*	(IceCube Collab.)
ABRAMOWSKI	15	PRL 114 081301	A. Abramowski *et al.*	(H.E.S.S. Collab.)
ACKERMANN	15	PR D91 122002	M. Ackermann *et al.*	(Fermi-LAT Collab.)
ACKERMANN	15A	JCAP 1509 008	M. Ackermann *et al.*	(Fermi-LAT Collab.)
ACKERMANN	15B	PRL 115 231301	M. Ackermann *et al.*	(Fermi-LAT Collab.)
ADRIAN-MAR...	15	JCAP 1510 068	S. Adrian-Martinez *et al.*	(ANTARES Collab.)
AGNES	15	PL B743 456	P. Agnes *et al.*	(DarkSide-50 Collab.)
AGNESE	15A	PR D91 052021	R. Agnese *et al.*	(SuperCDMS Collab.)
AGNESE	15B	PR D92 072003	R. Agnese *et al.*	(SuperCDMS Collab.)
AMOLE	15	PRL 114 231302	C. Amole *et al.*	(PICO Collab.)
APRILE	15	PRL 115 091302	E. Aprile *et al.*	(XENON Collab.)
APRILE	15A	SCI 349 851	E. Aprile *et al.*	(XENON Collab.)
CHOI	15	PRL 114 141301	K. Choi *et al.*	(Super-Kamiokande Collab.)
KHACHATRY...	15AG	JHEP 1506 121	V. Khachatryan *et al.*	(CMS Collab.)
KHACHATRY...	15AL	EPJ C75 235	V. Khachatryan *et al.*	(CMS Collab.)

KHACHATRY...	15T	PR D91 092005	V. Khachatryan *et al.*	(CMS Collab.)
NAKAMURA	15	PTEP 2015 4 043F01	K. Nakamura *et al.*	(NEWAGE Collab.)
XIAO	15	PR D92 052004	X. Xiao *et al.*	(PandaX Collab.)
AAD	14AI	JHEP 1409 037	G. Aad *et al.*	(ATLAS Collab.)
AAD	14BK	PRL 112 041802	G. Aad *et al.*	(ATLAS Collab.)
AAD	14K	PR D90 012004	G. Aad *et al.*	(ATLAS Collab.)
AAD	14O	PRL 112 201802	G. Aad *et al.*	(ATLAS Collab.)
ACKERMANN	14	PR D89 042001	M. Ackermann *et al.*	(Fermi-LAT Collab.)
AGNESE	14	PRL 112 241302	R. Agnese *et al.*	(SuperCDMS Collab.)
AGNESE	14A	PRL 112 041302	R. Agnese *et al.*	(SuperCDMS Collab.)
AKERIB	14	PRL 112 091303	D.S. Akerib *et al.*	(LUX Collab.)
ALEKSIC	14	JCAP 1402 008	J. Aleksic *et al.*	(MAGIC Collab.)
ANGLOHER	14	EPJ C74 3184	G. Angloher *et al.*	(CRESST-II Collab.)
APRILE	14A	ASP 54 11	E. Aprile *et al.*	(XENON100 Collab.)
AVRORIN	14	ASP 62 12	A.D. Avrorin *et al.*	(BAIKAL Collab.)
FELIZARDO	14	PR D89 072013	M. Felizardo *et al.*	(SIMPLE Collab.)
LEE	14A	PR D90 052006	H.S. Lee *et al.*	(KIMS Collab.)
LIU	14A	PR D90 032003	S.K. Liu *et al.*	(CDEX Collab.)
UCHIDA	14	PTEP 2014 063C01	H. Uchida *et al.*	(XMASS Collab.)
YUE	14	PR D90 091701	Q. Yue *et al.*	(CDEX Collab.)
AAD	13AD	JHEP 1304 075	G. Aad *et al.*	(ATLAS Collab.)
AAD	13C	PRL 110 011802	G. Aad *et al.*	(ATLAS Collab.)
AALSETH	13	PR D88 012002	C.E. Aalseth *et al.*	(CoGeNT Collab.)
AARTSEN	13	PRL 110 131302	M.G. Aartsen *et al.*	(IceCube Collab.)
AARTSEN	13C	PR D88 122001	M.G. Aartsen *et al.*	(IceCube Collab.)
ABE	13B	PL B719 78	K. Abe *et al.*	(XMASS Collab.)
ABRAMOWSKI	13	PRL 110 041301	A. Abramowski *et al.*	(H.E.S.S. Collab.)
ACKERMANN	13A	PR D88 082002	M. Ackermann *et al.*	(Fermi-LAT Collab.)
ADRIAN-MAR...	13	JCAP 1311 032	S. Adrian-Martinez *et al.*	(ANTARES Collab.)
AGNESE	13	PR D88 031104	R. Agnese *et al.*	(CDMS Collab.)
AGNESE	13A	PRL 111 251301	R. Agnese *et al.*	(CDMS Collab.)
APRILE	13	PRL 111 021301	E. Aprile *et al.*	(XENON100 Collab.)
BERNABEI	13A	EPJ C73 2648	R. Bernabei *et al.*	(DAMA Collab.)
BOLIEV	13	JCAP 1309 019	M. Boliev *et al.*	
LI	13B	PRL 110 261301	H.B. Li *et al.*	(TEXONO Collab.)
SUVOROVA	13	PAN 76 1367	O.V. Suvorova *et al.*	(INRM)
		Translated from YAF 76 1433.		
ZHAO	13	PR D88 052004	W. Zhao *et al.*	(CDEX Collab.)
AALTONEN	12K	PRL 108 201802	T. Aaltonen *et al.*	(CDF Collab.)
AALTONEN	12M	PRL 108 211804	T. Aaltonen *et al.*	(CDF Collab.)
ABBASI	12	PR D85 042002	R. Abbasi *et al.*	(IceCube Collab.)
ABRAMOWSKI	12	APJ 750 123	A. Abramowski *et al.*	(H.E.S.S. Collab.)
ACKERMANN	12	PR D86 022002	M. Ackermann *et al.*	(Fermi-LAT Collab.)
AKIMOV	12	PL B709 14	D.Yu. Akimov *et al.*	(ZEPLIN-III Collab.)
ALIU	12	PR D85 062001	E. Aliu *et al.*	(VERITAS Collab.)
ANGLOHER	12	EPJ C72 1971	G. Angloher *et al.*	(CRESST-II Collab.)
APRILE	12	PRL 109 181301	E. Aprile *et al.*	(XENON100 Collab.)
ARCHAMBAU...	12	PL B711 153	S. Archambault *et al.*	(PICASSO Collab.)
ARMENGAUD	12	PR D86 051701	E. Armengaud *et al.*	(EDELWEISS Collab.)
BARRETO	12	PL B711 264	J. Barreto *et al.*	(DAMIC Collab.)
BEHNKE	12	PR D86 052001	E. Behnke *et al.*	(COUPP Collab.)
Also		PR D90 079902 (errat.)	E. Behnke *et al.*	(COUPP Collab.)
BROWN	12	PR D85 021301	A. Brown *et al.*	(OXF)
CHATRCHYAN	12AP	JHEP 1209 094	S. Chatrchyan *et al.*	(CMS Collab.)
CHATRCHYAN	12T	PRL 108 261803	S. Chatrchyan *et al.*	(CMS Collab.)
DAHL	12	PRL 108 259001	C.E. Dahl, J. Hall, W.H. Lippincott	(CHIC, FNAL)
DAW	12	ASP 35 397	E. Daw *et al.*	(DRIFT-IId Collab.)
FELIZARDO	12	PRL 108 201302	M. Felizardo *et al.*	(SIMPLE Collab.)
KIM	12	PRL 108 181301	S.C. Kim *et al.*	(KIMS Collab.)
AALSETH	11	PRL 106 131301	C.E. Aalseth *et al.*	(CoGeNT Collab.)
AALSETH	11A	PRL 107 141301	C.E. Aalseth *et al.*	(CoGeNT Collab.)
ABBASI	11C	PR D84 022004	R. Abbasi *et al.*	(IceCube Collab.)
ABRAMOWSKI	11	PRL 106 161301	A. Abramowski *et al.*	(H.E.S.S. Collab.)
ACKERMANN	11	PRL 107 241302	M. Ackermann *et al.*	(Fermi-LAT Collab.)
AHLEN	11	PL B695 124	S. Ahlen *et al.*	(DMTPC Collab.)
AHMED	11	PR D83 112002	Z. Ahmed *et al.*	(CDMS Collab.)
AHMED	11A	PR D84 011102	Z. Ahmed *et al.*	(CDMS and EDELWEISS Collabs.)
AHMED	11B	PRL 106 131302	Z. Ahmed *et al.*	(CDMS Collab.)
AJELLO	11	PR D84 032007	M. Ajello *et al.*	(Fermi-LAT Collab.)
ANGLE	11	PRL 107 051301	J. Angle *et al.*	(XENON10 Collab.)
Also		PRL 110 249901 (errat.)	J. Angle *et al.*	(XENON10 Collab.)

APRILE	11	PR D84 052003	E. Aprile *et al.*	(XENON100 Collab.)
APRILE	11A	PR D84 061101	E. Aprile *et al.*	(XENON100 Collab.)
APRILE	11B	PRL 107 131302	E. Aprile *et al.*	(XENON100 Collab.)
ARMENGAUD	11	PL B702 329	E. Armengaud *et al.*	(EDELWEISS II Collab.)
BEHNKE	11	PRL 106 021303	E. Behnke *et al.*	(COUPP Collab.)
GERINGER-SA...	11	PRL 107 241303	A. Geringer-Sameth, S.M. Koushiappas	
HORN	11	PL B705 471	M. Horn *et al.*	(ZEPLIN-III Collab.)
TANAKA	11	APJ 742 78	T. Tanaka *et al.*	(Super-Kamiokande Collab.)
ABBASI	10	PR D81 057101	R. Abbasi *et al.*	(IceCube Collab.)
AHMED	10	SCI 327 1619	Z. Ahmed *et al.*	(CDMS II Collab.)
AKERIB	10	PR D82 122004	D.S. Akerib *et al.*	(CDMS-II Collab.)
AKIMOV	10	PL B692 180	D.Yu. Akimov *et al.*	(ZEPLIN-III Collab.)
APRILE	10	PRL 105 131302	E. Aprile *et al.*	(XENON100 Collab.)
ARMENGAUD	10	PL B687 294	E. Armengaud *et al.*	(EDELWEISS II Collab.)
FELIZARDO	10	PRL 105 211301	M. Felizardo *et al.*	(The SIMPLE Collab.)
MIUCHI	10	PL B686 11	K. Miuchi *et al.*	(NEWAGE Collab.)
ABBASI	09B	PRL 102 201302	R. Abbasi *et al.*	(IceCube Collab.)
AHMED	09	PRL 102 011301	Z. Ahmed *et al.*	(CDMS Collab.)
ANGLE	09	PR D80 115005	J. Angle *et al.*	(XENON10 Collab.)
ANGLOHER	09	ASP 31 270	G. Angloher *et al.*	(CRESST Collab.)
ARCHAMBAU...	09	PL B682 185	S. Archambault *et al.*	(PICASSO Collab.)
LEBEDENKO	09A	PRL 103 151302	V.N. Lebedenko *et al.*	(ZEPLIN-III Collab.)
LIN	09	PR D79 061101	S.T. Lin *et al.*	(TEXONO Collab.)
AALSETH	08	PRL 101 251301	C.E. Aalseth *et al.*	(CoGeNT Collab.)
Also		PRL 102 109903 (errat.)	C.E. Aalseth *et al.*	(CoGeNT Collab.)
ANGLE	08A	PRL 101 091301	J. Angle *et al.*	(XENON10 Collab.)
BEDNYAKOV	08	PAN 71 111	V.A. Bednyakov, H.P. Klapdor-Kleingrothaus, I.V. Krivosheina	
		Translated from YAF 71 112.		
ALNER	07	PL B653 161	G.J. Alner *et al.*	(ZEPLIN-II Collab.)
LEE	07A	PRL 99 091301	H.S. Lee *et al.*	(KIMS Collab.)
MIUCHI	07	PL B654 58	K. Miuchi *et al.*	
AKERIB	06	PR D73 011102	D.S. Akerib *et al.*	(CDMS Collab.)
SHIMIZU	06A	PL B633 195	Y. Shimizu *et al.*	
AKERIB	05	PR D72 052009	D.S. Akerib *et al.*	(CDMS Collab.)
ALNER	05	PL B616 17	G.J. Alner *et al.*	(UK Dark Matter Collab.)
BARNABE-HE...	05	PL B624 186	M. Barnabe-Heider *et al.*	(PICASSO Collab.)
BENOIT	05	PL B616 25	A. Benoit *et al.*	(EDELWEISS Collab.)
GIRARD	05	PL B621 233	T.A. Girard *et al.*	(SIMPLE Collab.)
GIULIANI	05	PRL 95 101301	F. Giuliani	
GIULIANI	05A	PR D71 123503	F. Giuliani, T.A. Girard	
KLAPDOR-K...	05	PL B609 226	H.V. Klapdor-Kleingrothaus, I.V. Krivosheina, C. Tomei	
GIULIANI	04	PL B588 151	F. Giuliani, T.A. Girard	
GIULIANI	04A	PRL 93 161301	F. Giuliani	
MIUCHI	03	ASP 19 135	K. Miuchi *et al.*	
TAKEDA	03	PL B572 145	A. Takeda *et al.*	
ANGLOHER	02	ASP 18 43	G. Angloher *et al.*	(CRESST Collab.)
BELLI	02	PR D66 043503	P. Belli *et al.*	
BERNABEI	02C	EPJ C23 61	R. Bernabei *et al.*	(DAMA Collab.)
GREEN	02	PR D66 083003	A.M. Green	
BAUDIS	01	PR D63 022001	L. Baudis *et al.*	(Heidelberg-Moscow Collab.)
SMITH	01	PR D64 043502	D. Smith, N. Weiner	
ULLIO	01	JHEP 0107 044	P. Ullio, M. Kamionkowski, P. Vogel	
BENOIT	00	PL B479 8	A. Benoit *et al.*	(EDELWEISS Collab.)
BERNABEI	00D	NJP 2 15	R. Bernabei *et al.*	(DAMA Collab.)
COLLAR	00	PRL 85 3083	J.I. Collar *et al.*	(SIMPLE Collab.)
AMBROSIO	99	PR D60 082002	M. Ambrosio *et al.*	(Macro Collab.)
BERNABEI	99	PL B450 448	R. Bernabei *et al.*	(DAMA Collab.)
BERNABEI	99D	PRL 83 4918	R. Bernabei *et al.*	(DAMA Collab.)
BRHLIK	99	PL B464 303	M. Brhlik, L. Roszkowski	
DERBIN	99	PAN 62 1886	A.V. Derbin *et al.*	
		Translated from YAF 62 2034.		
KLIMENKO	98	JETPL 67 875	A.A. Klimenko *et al.*	
		Translated from ZETFP 67 835.		
SARSA	97	PR D56 1856	M.L. Sarsa *et al.*	(ZARA)
ALESSAND...	96	PL B384 316	A. Alessandrello *et al.*	(MILA, MILAI, SASSO)
BELLI	96	PL B387 222	P. Belli *et al.*	(DAMA Collab.)
Also		PL B389 783 (erratum)	P. Belli *et al.*	(DAMA Collab.)
BELLI	96C	NC C19 537	P. Belli *et al.*	(DAMA Collab.)
BERNABEI	96	PL B389 757	R. Bernabei *et al.*	(DAMA Collab.)
COLLAR	96	PRL 76 331	J.I. Collar	(SCUC)
SARSA	96	PL B386 458	M.L. Sarsa *et al.*	(ZARA)
Also		PR D56 1856	M.L. Sarsa *et al.*	(ZARA)

SMITH	96	PL B379 299	P.F. Smith *et al.*	(RAL, SHEF, LOIC+)
SNOWDEN-...	96	PRL 76 332	D.P. Snowden-Ifft, E.S. Freeman, P.B. Price	(UCB)
GARCIA	95	PR D51 1458	E. Garcia *et al.*	(ZARA, SCUC, PNL)
QUENBY	95	PL B351 70	J.J. Quenby *et al.*	(LOIC, RAL, SHEF+)
SNOWDEN-...	95	PRL 74 4133	D.P. Snowden-Ifft, E.S. Freeman, P.B. Price	(UCB)
Also		PRL 76 331	J.I. Collar	(SCUC)
Also		PRL 76 332	D.P. Snowden-Ifft, E.S. Freeman, P.B. Price	(UCB)
BECK	94	PL B336 141	M. Beck *et al.*	(MPIH, KIAE, SASSO)
BACCI	92	PL B293 460	C. Bacci *et al.*	(Beijing-Roma-Saclay Collab.)
REUSSER	91	PL B255 143	D. Reusser *et al.*	(NEUC, CIT, PSI)
CALDWELL	88	PRL 61 510	D.O. Caldwell *et al.*	(UCSB, UCB, LBL)