Analysis on pp Solar Neutrino in Xenon1t

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Why Solar Neutrino?

Solar Metallicity:

- 3D rotational hydrodynamical simulations suggest high metallicity in Solar core (Asplund et al. 2009)

- Heliosiesmology data suggest low metallicity

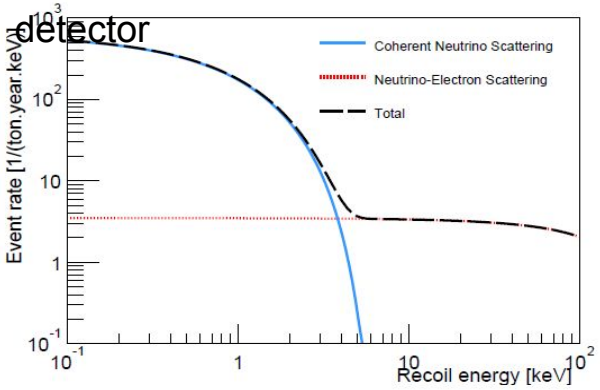
- SNO Neutral Current measurement right in between predictions of low and high metallicity solar standard models

ν flux	E_ν^{max} (MeV)	High Metallicity GS98-SFII	Low Metallicity AGSS09-SFII	Solar	units
$p+p \rightarrow {}^2H+e^+ +\nu$	0.42	$5.98(1 \pm 0.006)$	$6.03(1 \pm 0.006)$	$6.05(1^{+0.003}_{-0.011})$	$10^{10}/cm^2s$
$p+e^- +p \rightarrow {}^2H+\nu$	1.44	$1.44(1 \pm 0.012)$	$1.47(1 \pm 0.012)$	$1.46(1^{+0.010}_{-0.014})$	$10^8/cm^2s$
$^7Be+e^- \rightarrow {}^7Li+\nu$	0.86 (90%)	$5.00(1 \pm 0.07)$	$4.56(1 \pm 0.07)$	$4.82(1^{+0.05}_{-0.04})$	$10^9/cm^2s$
	0.38 (10%)				
$^8B \rightarrow {}^8Be+e^+ +\nu$	~ 15	$5.58(1 \pm 0.14)$	$4.59(1 \pm 0.14)$	$5.00(1 \pm 0.03)$	$10^6/cm^2s$
$^3He+p \rightarrow {}^4He+e^+ +\nu$	18.77	$8.04(1 \pm 0.30)$	$8.31(1 \pm 0.30)$	—	$10^3/cm^2s$
$^{13}N \rightarrow {}^{13}C+e^+ +\nu$	1.20	$2.96(1 \pm 0.14)$	$2.17(1 \pm 0.14)$	≤ 6.7	$10^8/cm^2s$
$^{15}O \rightarrow {}^{15}N+e^+ +\nu$	1.73	$2.23(1 \pm 0.15)$	$1.56(1 \pm 0.15)$	≤ 3.2	$10^8/cm^2s$
$^{17}F \rightarrow {}^{17}O+e^+ +\nu$	1.74	$5.52(1 \pm 0.17)$	$3.40(1 \pm 0.16)$	$\leq 59.$	$10^6/cm^2s$
χ^2/P^{agr}		3.5/90%	3.4/90%		

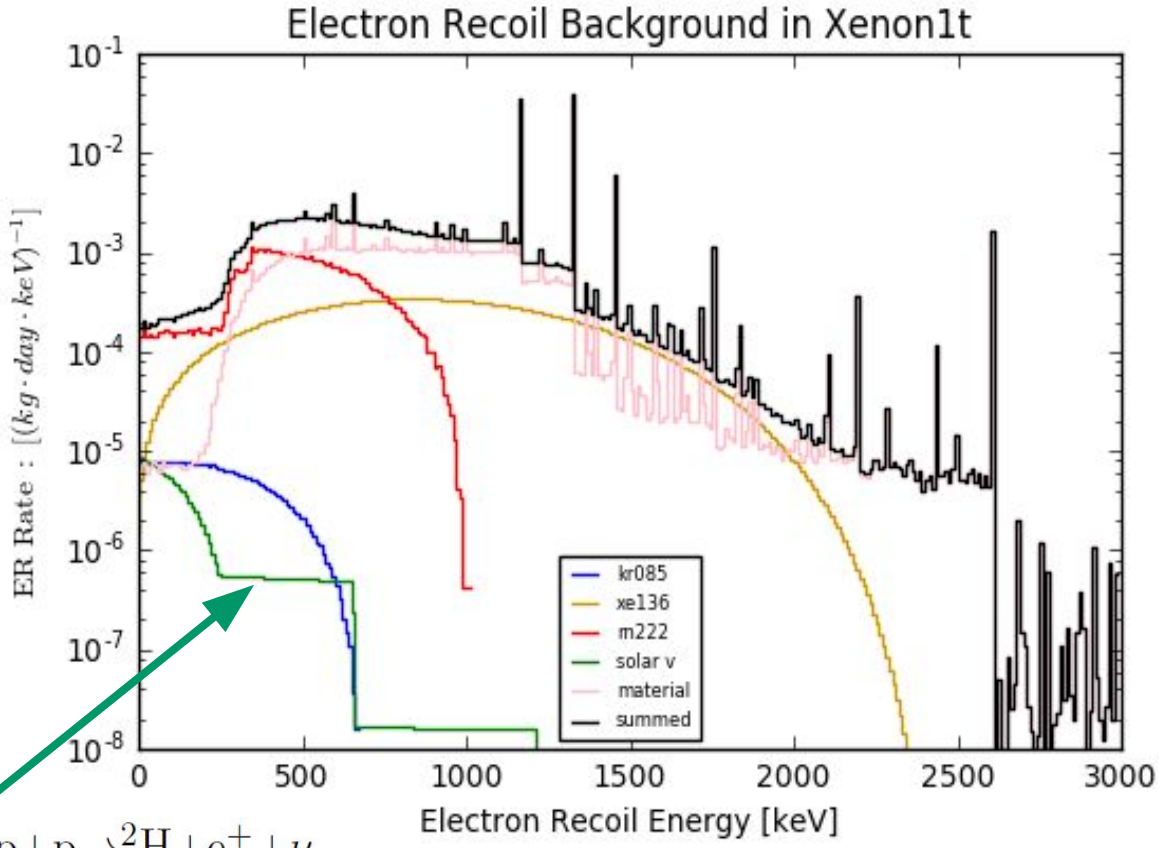
Haxton et al. 2013, arxiv: 1208.5723

Complete Background Distribution

Neutrino background in low-threshold Ge dark matter detector



Louis et al. 2014, arxiv: 1409.0050



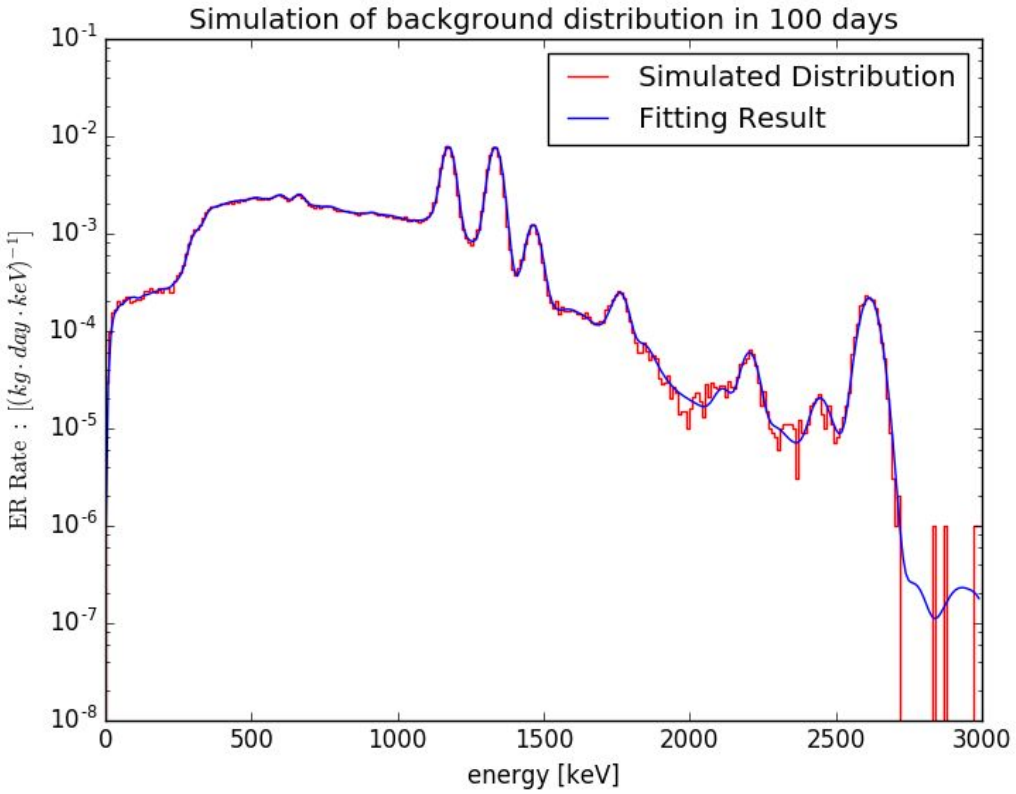
pp solar neutrino: $p+p \rightarrow {}^2H+e^+ +\nu$

Xenon1t collab, arxiv: 1512.07501

Simulation on Needed Duration

Simulation:

- Simulated possible total background distribution within 100 days
- Fit a combination of six source distributions onto the simulated total background
- Figured out the scale factor (normalization) of neutrino distribution
- Result:
- In 100 days, the precision of estimation of pp solar neutrino scale factor is: 1.0023 +- 1.68



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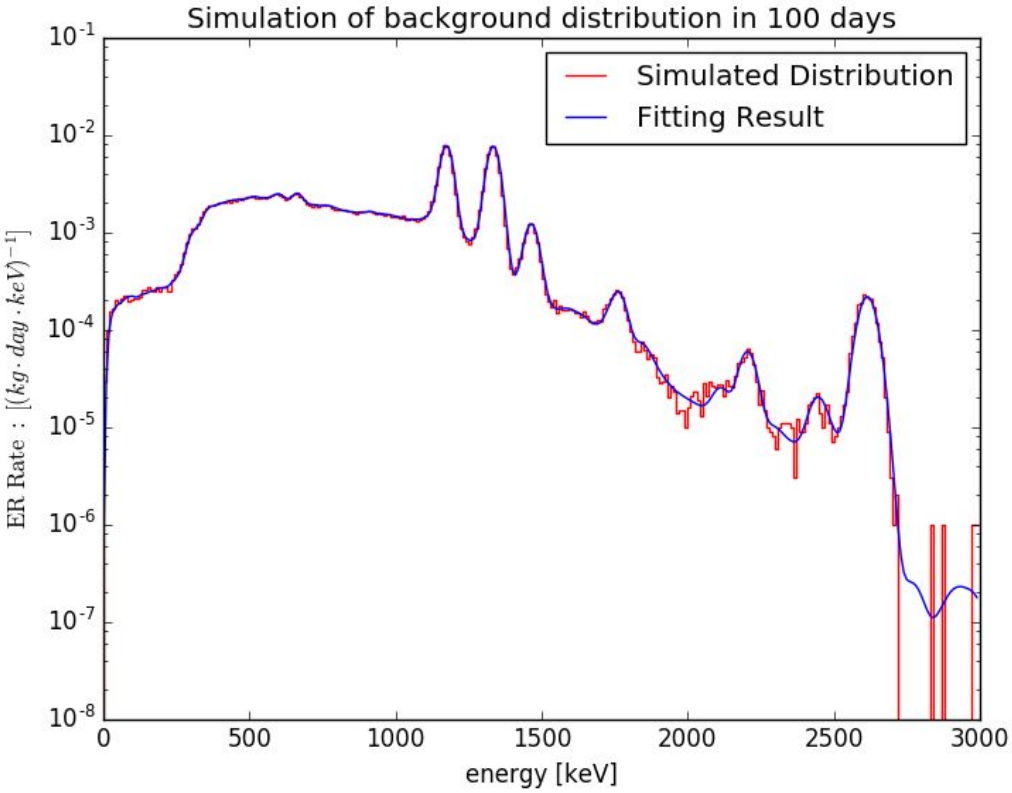
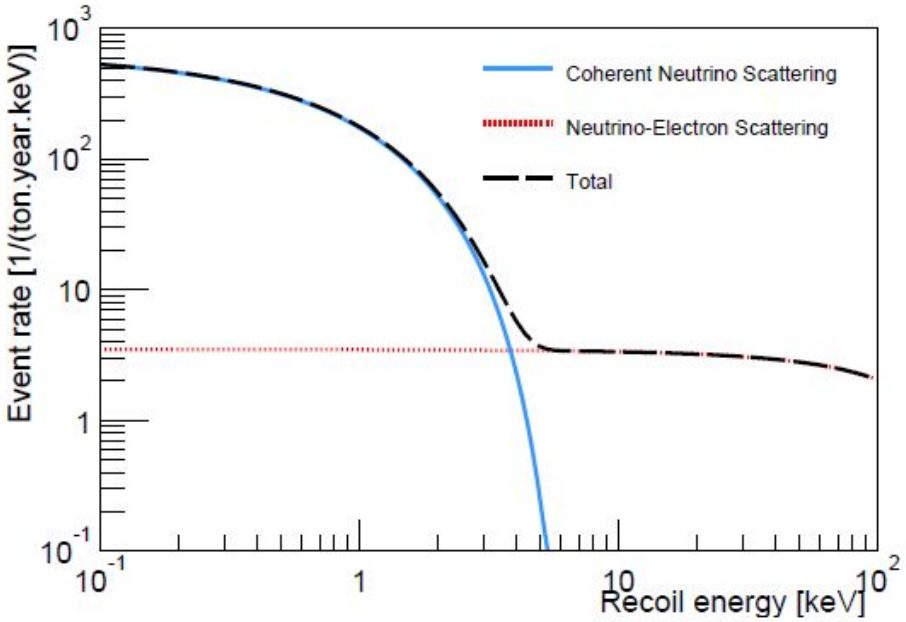


-> Needs 800 days to reach 3sigma
-> S2-only analysis (Darryl's talk)
-> Better algorithm could be applied

(Backup slide)

Neutrino Background Distribution

Neutrino background in low-threshold Ge dark matter detector



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