

# ALEX: COMPLEMENTARITY (7 CATS)

16 OCT '13

RELATE DM SEARCHES W/ EACH OTHER

(PARTICLE)  
DM OVERVIEW: 1305.1605  
SNOW MASS SUMMARY  
SEE REFS WITH FOR DETAILS

## DIRECT DET.

DM INTERACTS W/ NUCLEI w/ SOME RATE

NUCLEAR RECOIL; three options

1. SCINTILLATION (SEE PHOTON)
2. PRESSURE WAVE (SEE PHONON)
3. IONIZATION (SEE ION IN DETECTOR)

MOST EXPTS USE 2/3 TO REDUCE BG.  
(notable exception: DAMA)

### CURRENT EXPTS:

SIGNAL?	[	• SUPERCDMS	9 kg Ge	
		• CRESST	10 kg $CaWO_4$	(CALCIUM TUNGSTATE)
		• COGENT	440g Ge	
		• LUX (DATA STOP)	350 kg LXe	(LIQUID XENON)
		• XENON100	62 kg LXe	

Not 100 kg, this is the FIDUCIAL VOLUME, SUITABLE TARGET W/ NO EDGE EFFECTS

SIGNAL? → • DAMA/Libra NBI

See: XENON100 BOUNDS  
CDMS POSSIBLE SIGNAL?

note: XENON10 BOUNDS HAD BUG ORIGINALLY  
IT HAS SINCE MOVED

### ASSUMPTIONS (model dependence)

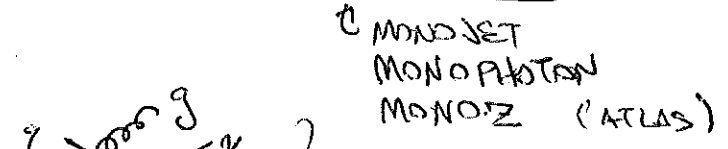
- MOSTLY ASTRO → LOCAL DM DENSITY & VELOCITY DIST
- WIMP-NUCLEAR  $\sigma$

SO USUAL D.D. EXCLUSION PLOT IS: SPIN-INDEP (SIMILAR BE SO)  
TYPICALLY NORMALIZED TO WIMP-PROTON CROSS SECTION  
(ASSUMES  $n=pt$ )

# COLLIDER SEARCHES

SUPPOSE DM INT. w/  $\gamma$   $\beta$   $g$  (NRE FOR DIR. DET.)

@ LHC: LOOK FOR MONO-SOMETHINGS (INIT-STATE RAD.)

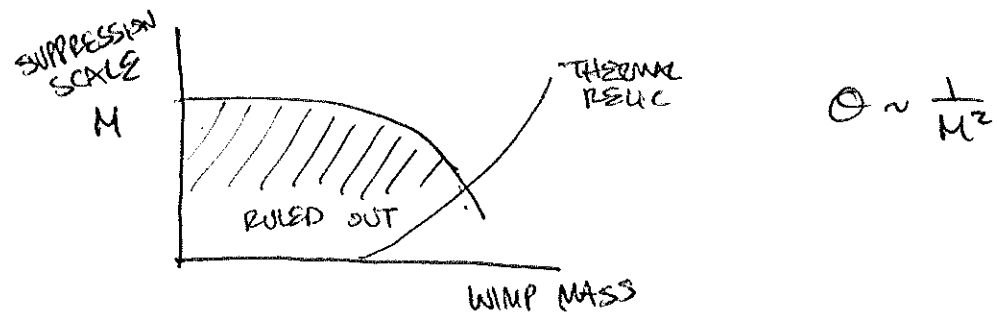


MONOJET  
 MONOPHOTON  
 MONOZ (ATLAS)

} tag the mono summin'  
 use momentum cons.  
 to imply invisibles.

COUNTING EXPTS. BIGGEST BG:  $Z \rightarrow \nu\nu$

GIVES BOUND ON  $\sigma$ , PUTS IN A DIFFERENT LANGUAGE



COLLIDERS DO BETTER ~~FOR~~ <sup>THAN</sup> DIRECT DETECTION FOR LIGHT WIMPS

## INDIRECT DETECTION $\rightarrow$ SHUNSAKU NEXT WK.

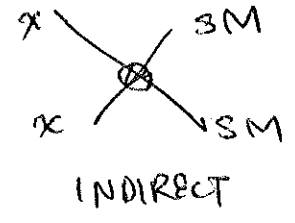
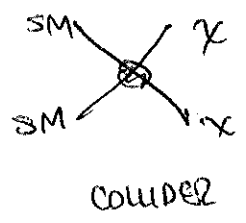
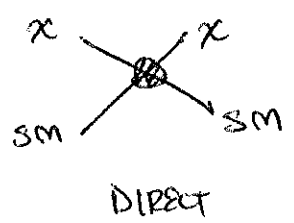
LOOK IN ~~THE~~ GALACTIC CENTER  $\rightarrow$  LOTS OF UNKNOWN BG

$\nwarrow$  BUT GUARANTEED TO HAVE LOTS OF DM THERE

PULSARS?!

COSMOLOGICAL UNCERTAINTIES: eg. ADM won't have signal

# COMPLEMENTARITY



# CROSSING SYM

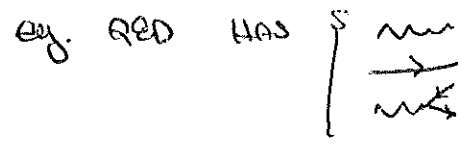
$$\langle \text{out} | iT | \text{in} \rangle = (2\pi)^4 \delta^{(4)}(\sum P_{\text{out}} - \sum P_{\text{in}}) \mathcal{M}$$

↑ CROSSING SYM PROPERTIES

(SUSYMASS COSMIC FRONTIER)

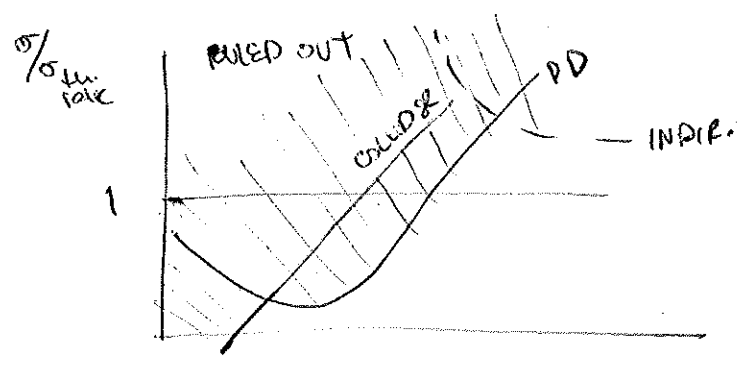
PMSSM	1305.6921	} model dependent
125 H <sub>125</sub>	1307.1758	
AXION/N	1306.2986	

# Model independent approach: EFFECTIVE OPERATORS



EFF OPS: ASSUME INT. W/ WIMPS  
 ANY THY OR PM SHOULD MAP ONTO THESE OPS  
 (PERHAPS w/ SOME SUPPRESSION)

eg. D5 :  $\frac{1}{M^2} (\bar{\chi} \gamma^\mu \chi) (\bar{e} \gamma_\mu e)$



eg. ~~ISSUE~~ SPIN : how to resolve inconsistencies  
in possible signals.

JONATHAN, JASON, } DAVID

$\sigma_{\text{PROTON}} \neq \sigma_{\text{NEUTRON}}$

CAN KILL KENON BOUND

↳ ALSO MAKES DAMA + COGENT OVERLAP!

more recently: still fight D.D. BOUNDS

EFF @ : STRONG BOUNDS FROM CONSIDERS

↳ DON'T CARE ABOUT P VS. V

WCT KILLS COGENT/DAMA OVERLAP

eg of COMPLEMENTARITY