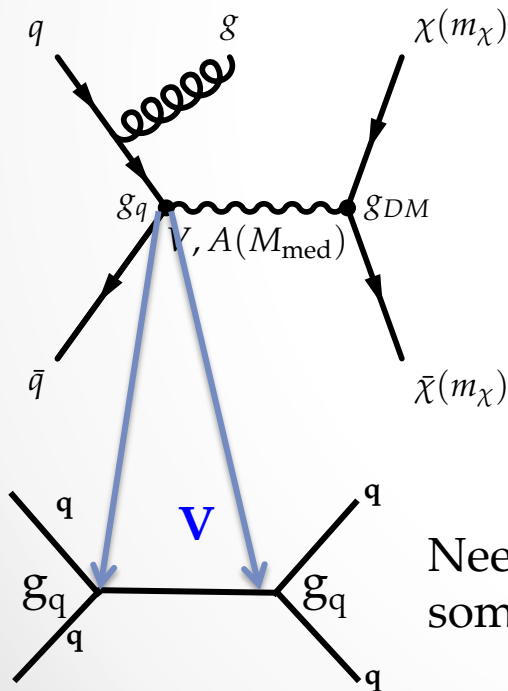


Complementarity: mono-Higgs Exotic Higgs Decays

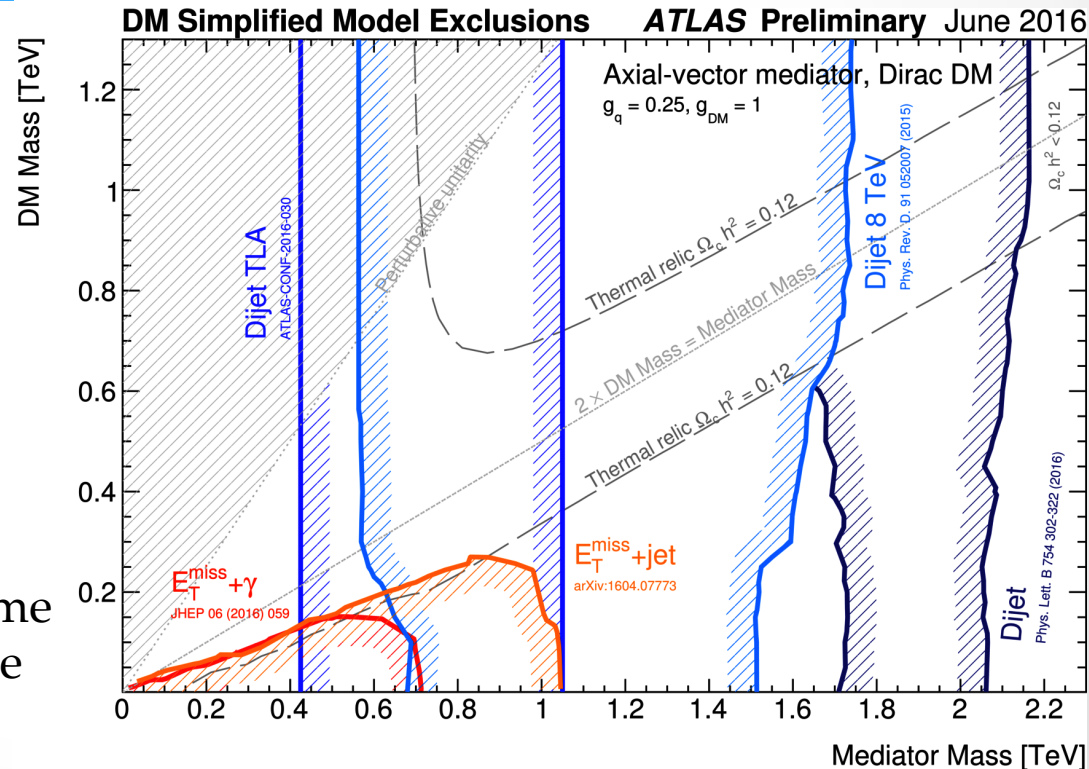
Sam Meehan
LHC Dark Matter WG Meeting
22 June 2016

Starting Point

- Inspired by DM summary plot
 - Described initially here : <https://arxiv.org/abs/1409.2893>
- Contextualize in one simplified model
 - Fix some parameters \rightarrow scan others
 - Exercised for axial vector model only
- Nice talk last week at reinterpretations workshop
 - https://indico.cern.ch/event/525142/contributions/2173688/attachments/1292747/1926191/Kahlhoefer_DM_Reinterpretation.pdf



Need to assume some g_{DM} here



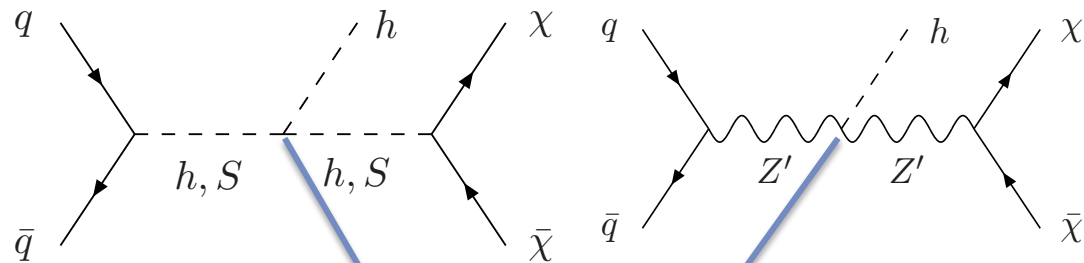
Scalar Models

Are the models compatible?
Does Z' mean Z' ?

- Can we do something similar for scalar models?
 - Connect models via [med-h] coupling : g_{ssh}
- Would need to specify
 - g_{DM} couplings in both models
 - Mixing angle of h - s for scalar model
- Mass range of interest is not directly overlapping
 - Similar case as for the monojet/dijet case

Mono-Higgs

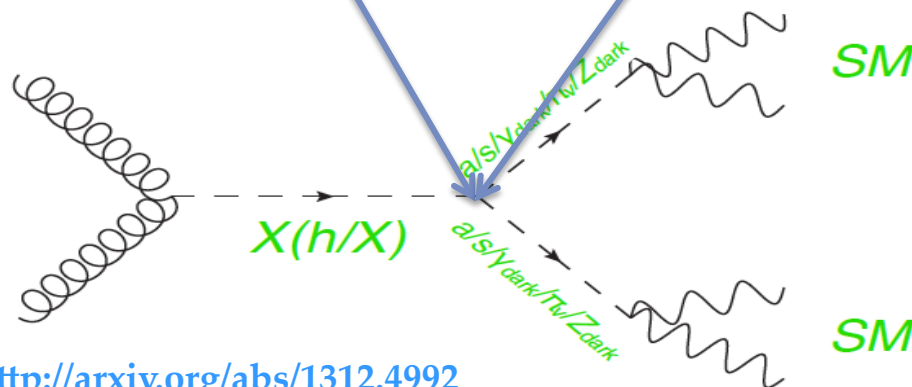
$M_{med} \sim [1, 1000]$ GeV



Need to assume g_{DM}

Exotic Higgs Decays

$M_{med} \sim [1, 60]$ GeV



These g_{DM} 's are not the same!

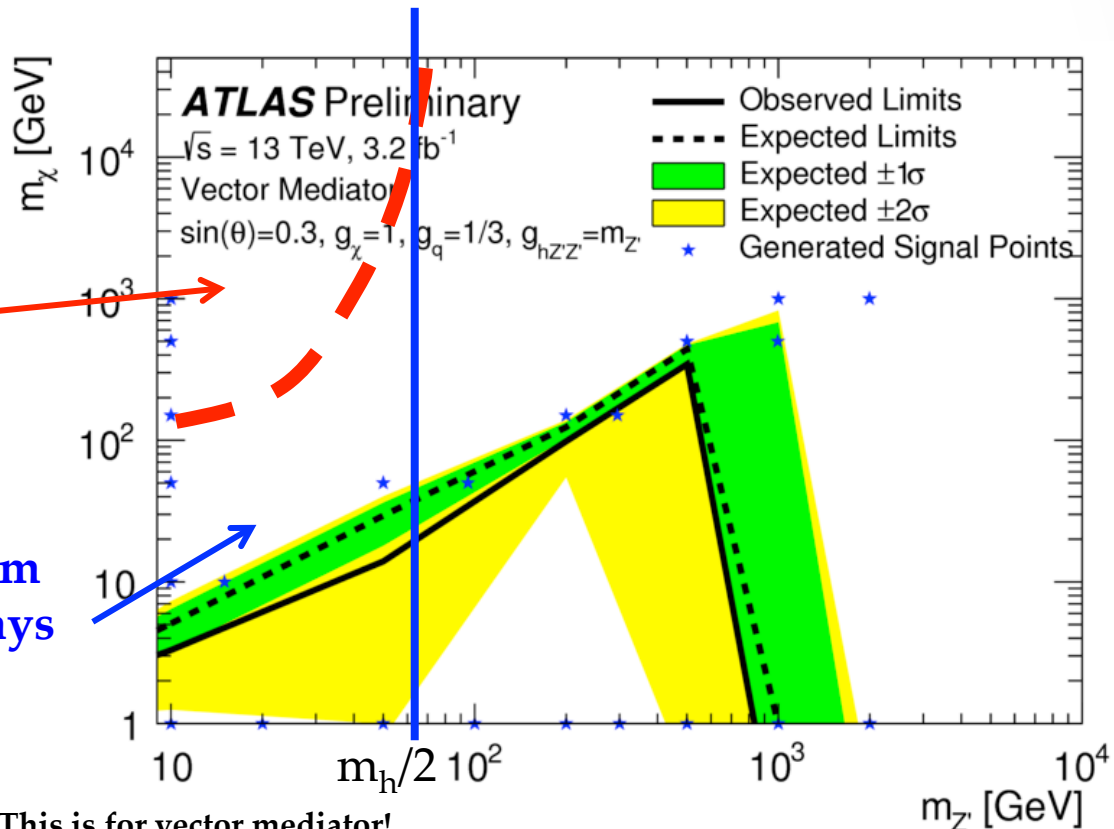
Need to assume g_{DM}

Parameter Space (1)

- How are they complementary?
- The mass ranges are very different
 - Exotic decays could “close the gap” depending on perturbativity bound
 - Would exotic decays care about m_{DM} ?

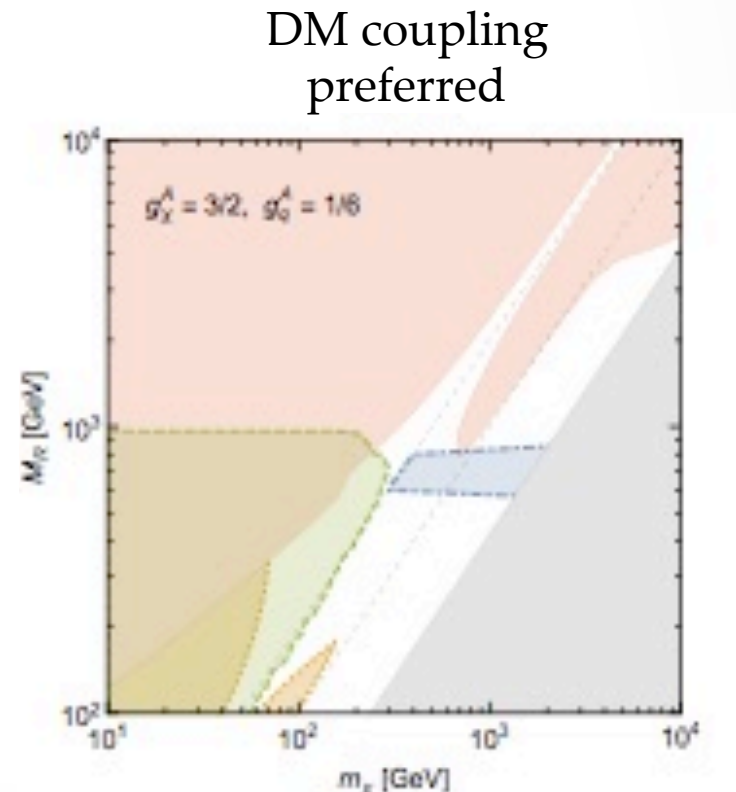
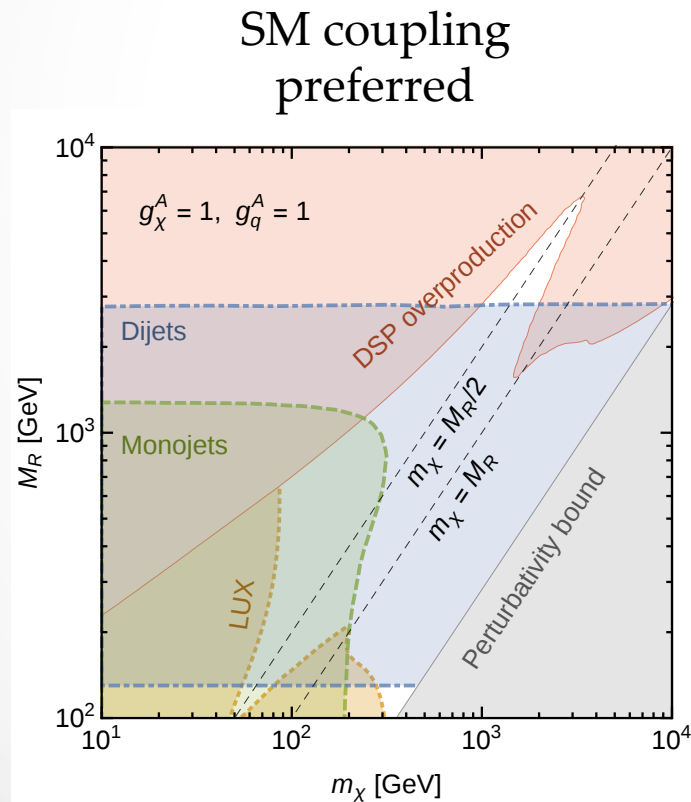
Ruled out by perturbativity?

Exclusions here from
(1) Exotic higgs decays
(2) Higgs width



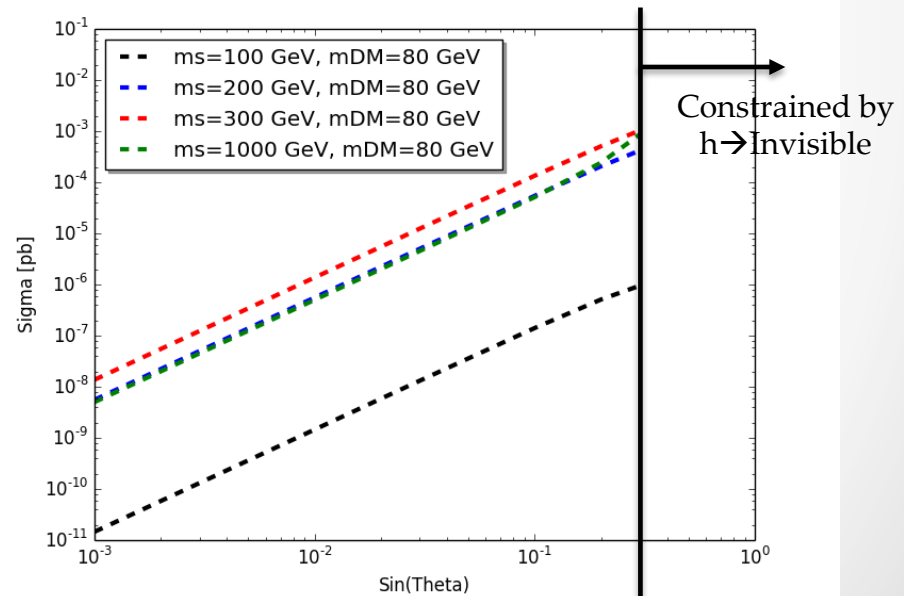
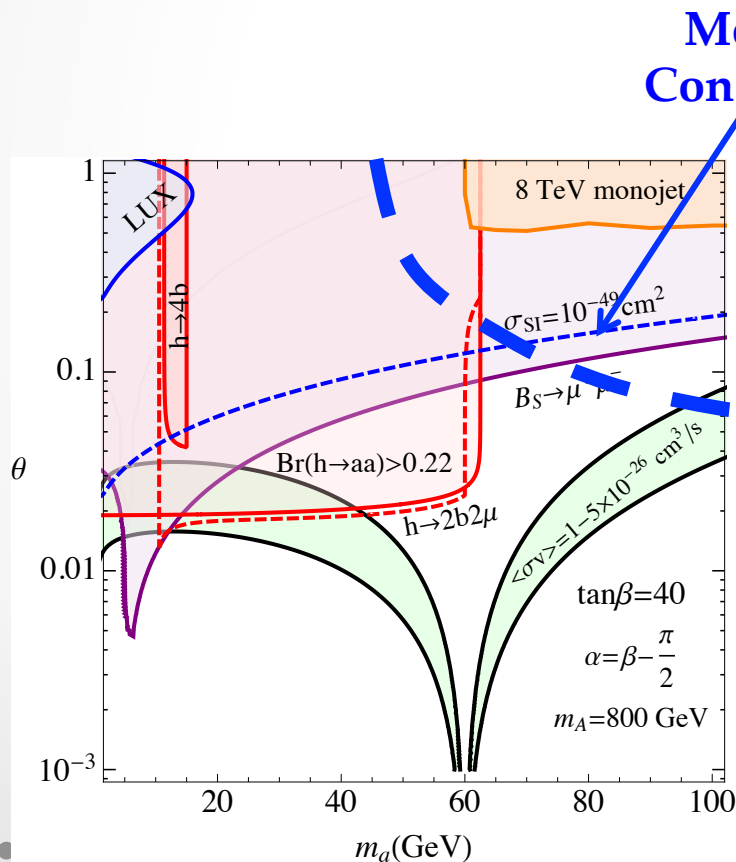
Parameter Space (2)

- Coupling scan is important for (mono-jet/dijet)
 - <http://arxiv.org/abs/1503.05916v2>
- (Left) For scalar models we must also consider mixing with higgs
 - <http://arxiv.org/abs/1404.3716v2>



Parameter Space (2)

- For **scalar models** we must also consider mixing with higgs
 - <http://arxiv.org/abs/1404.3716v2>
- Sigma(mixing) varies strongly



Open Points

- Are there large issues with perturbativity in models involving scalar mediator?
 - Some experts seem to say yes, some say no
 - Repeat <http://arxiv.org/abs/1510.02110> for scalar mediators
- Are the exotic higgs decay models equivalent to mono-H simplified models? (i.e. 2HDM proliferation)
 - Exotic Higgs : <http://arxiv.org/abs/1312.4992>
 - Mono-H : <http://arxiv.org/abs/1312.2592>
 - Should consider this as ATLAS/CMS are aligning on signal models for mono-H → in contact with CMS – Fang-Ying Tsai and Shi-Shan Tsu
- What regions are ruled out
 - Carry through the exercise on the previous slide to the end
 - Requires that (2) be sorted out ... help requested