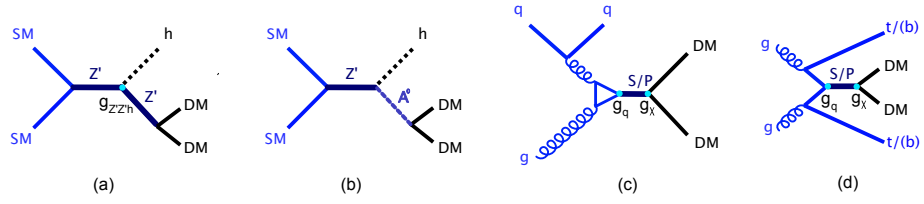


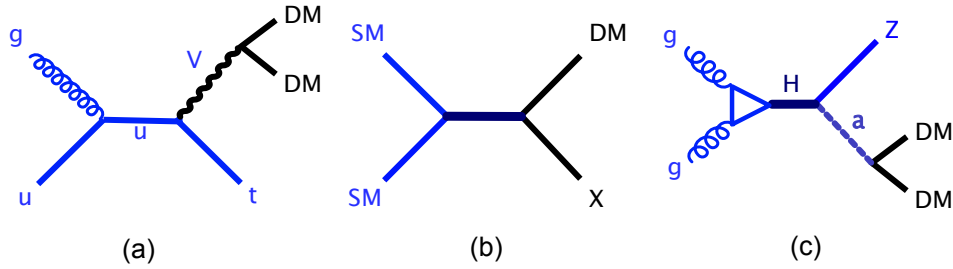
**Figure 1**

(a) The interaction between DM and Standard Model particles via an unspecified interaction (e.g., an EFT). (b) Examples of simplified model processes where the interaction is mediated by an intermediate particle (with additional radiation off one of the initial-state quarks). (c) The same model, in which the mediator decays back into Standard Model particles, with coupling constant  $g_q$  for the mediator–quark–quark vertex and constant  $g_\chi$  for the mediator–DM vertex. Abbreviations: BSM, beyond the Standard Model; DM, dark matter; EFT, effective field theory; SM, Standard Model.



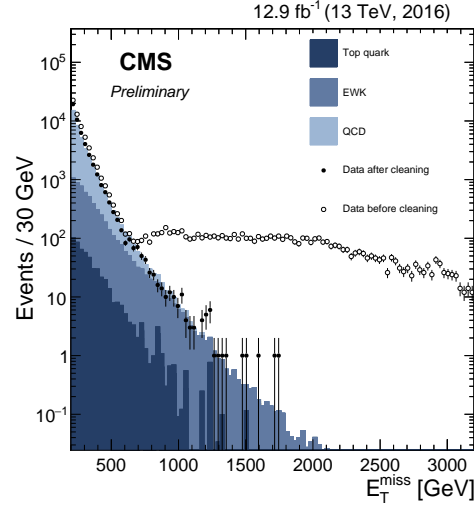
**Figure 2**

(a) Example of a process including baryonic coupling between a vector mediator  $Z'$  and an SM Higgs boson. The  $Z'$ -Higgs coupling is denoted  $g_{hZ'Z'}$ . (b) Example of a process from a  $U(1)$   $Z'$  boson embedded in a 2HDM, where a vector  $Z'$  decays to a pseudoscalar  $A^0$  that in turn decays to DM particles. (c,d) Examples of a simplified model process where the interaction is mediated by an intermediate scalar or pseudoscalar particle. In panel c, the SM-scalar interaction proceeds through a gluon loop (87), whereas in panel d, the pseudo(scalar) is produced in association with a pair of heavy-flavor quarks. The coupling constants that are prefactors to the Yukawa couplings in the model are denoted  $g_q$  for the mediator-quark-quark vertex and  $g_\chi$  for the mediator-DM vertex. Abbreviations:  $A^0/a$ , pseudoscalar bosons;  $b$ , bottom quark; DM, dark matter;  $g$ , gluon;  $h$ , SM Higgs boson;  $S$ , heavy scalar boson; SM, Standard Model;  $t$ , top quark;  $Z'$ , vector mediator; 2HDM, two-Higgs doublet model.



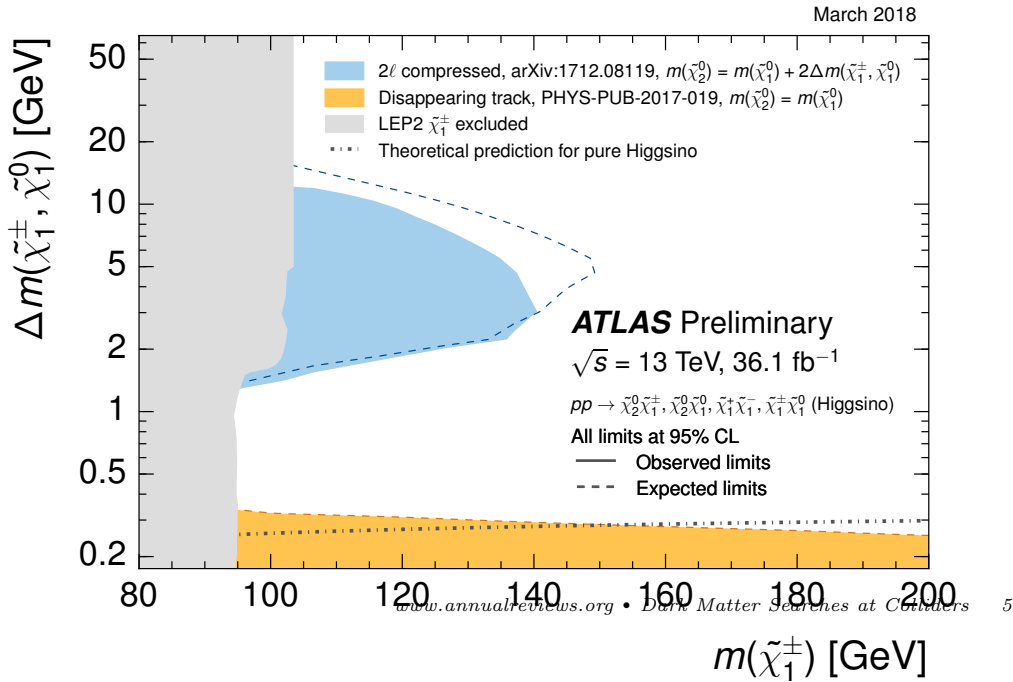
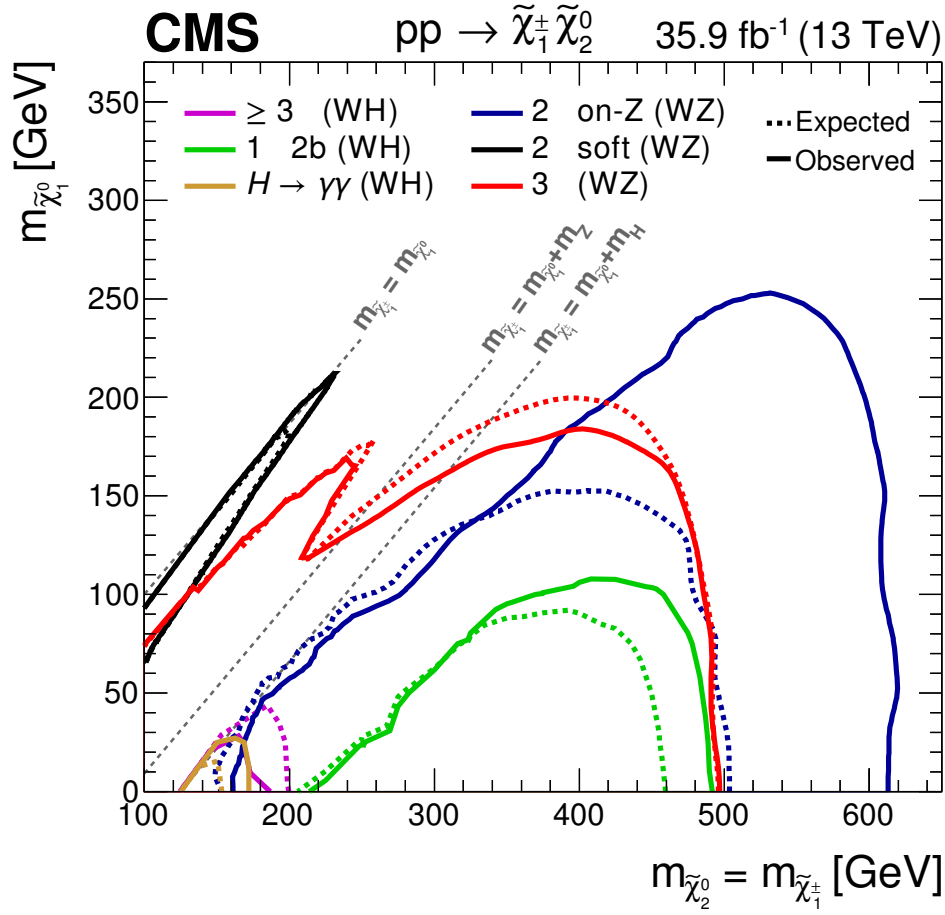
**Figure 3**

(a) Example of a process leading to a single top signature, proceeding through the coupling of a  $u$  and a  $t$  with a new vector boson, decaying to DM particles. (b) Example of a collider diagram from a coannihilation model, where two DM particles are present in the final state (one denoted DM and the other  $X$ ). (c) Example of a diagram from a 2HDM process, with an interaction between an  $H$ , an SM  $Z$  boson, and an  $a$  mediating the SM–DM interaction. Abbreviations:  $a$ , pseudoscalar boson; DM, dark matter;  $g$ , gluon;  $H$ , heavy Higgs boson; SM, Standard Model;  $t$ , top quark;  $u$ , up quark;  $V$ , vector mediator;  $X$ , coannihilating DM partner, 2HDM, two-Higgs doublet model.



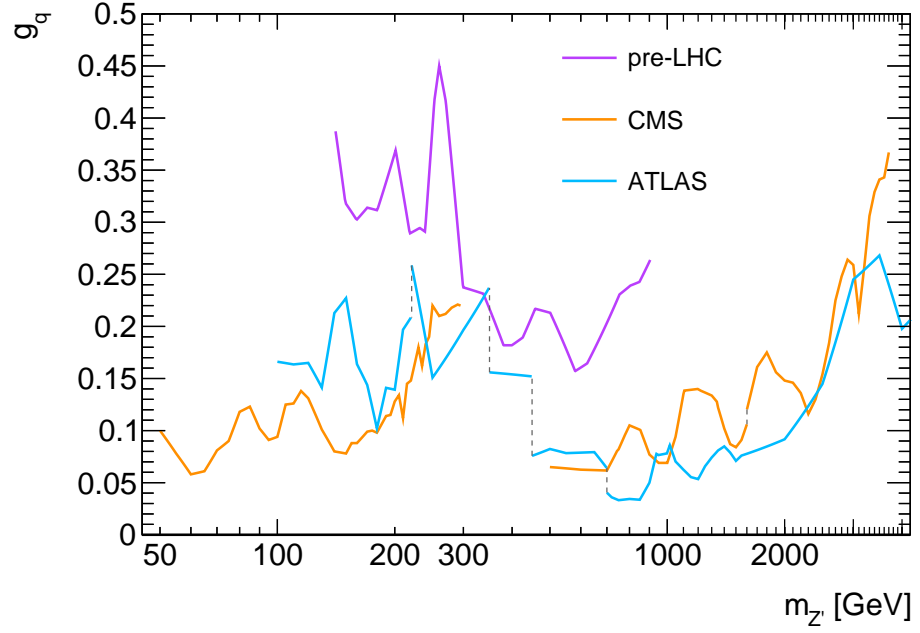
**Figure 4**

The  $\cancel{E}_T$  distribution of events, termed as  $E_T^{miss}$  in the x axis, selected for high total hadronic energy and at least two jets with  $p_T > 400$  and  $200$  GeV, before (*open circles*) and after (*filled circles*) rejection of spurious  $\cancel{E}_T$  backgrounds (83). The predictions of Monte Carlo simulations (*shaded areas*) are also shown. Strong noncollision background suppression is vital to  $X + \cancel{E}_T$  analyses.



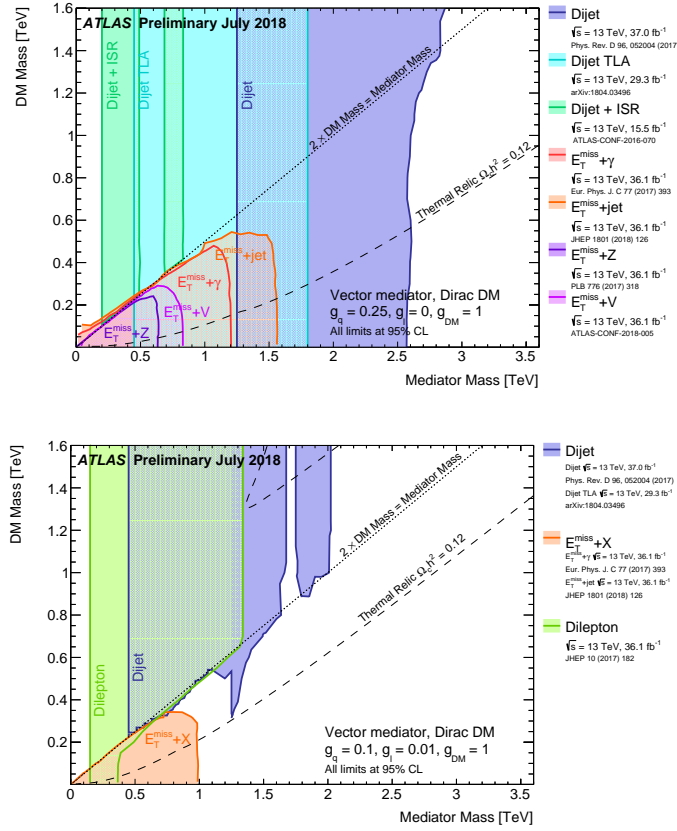
**Figure 5**

Mass reach of (a) CMS and (b) ATLAS searches for a selection of results targeting electroweak supersymmetry production, available as of July 2018. Panel a adapted from Reference 126. Panel b adapted from Reference 130.



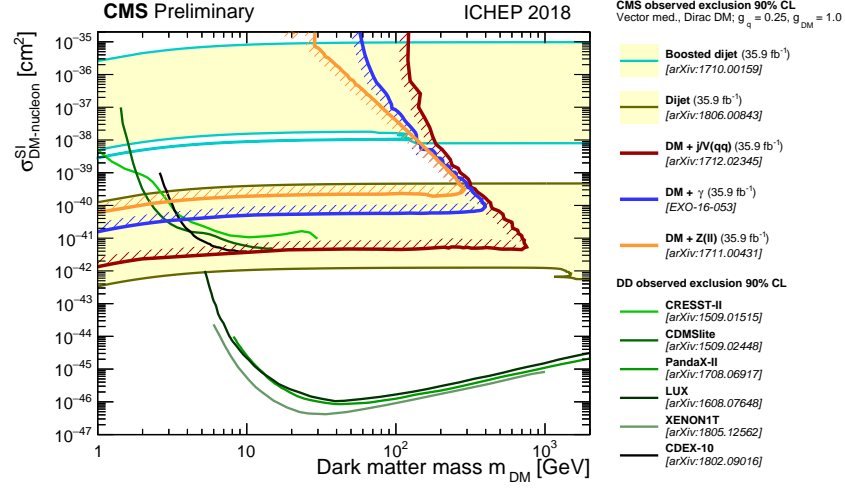
**Figure 6**

Summary of constraints from searches for narrow, light dijet resonances from ATLAS and CMS available as of July 2018, where discrete points are taken from the coupling-mass limits on a simplified model mediated by an axial-vector  $Z'$  coupling exclusively to quarks from the searches mentioned in the text, and interpolated at the crossings. Couplings above the lines are excluded at 95% CL, up to the values where larger couplings yield a resonance width larger than 10-15% (roughly  $g_q > 0.5$ ). Abbreviation: DM, dark matter. Pre-LHC constraints are extracted from Reference 152, while LHC constraints are taken from References (96, 148, 149, 153, 154, 154, 155).



**Figure 7**

Regions in DM mass– $Z'$  mediator mass excluded at 95% CL by a selection of ATLAS searches (from References (90,96,104,107,109,148,153,159)) available as of July 2018, for two coupling scenarios. Dashed curves labeled “thermal relic” indicate combinations of DM and mediator mass that are consistent with a DM density of  $\omega_c = 0.12h^2$  and a standard thermal history, as computed in MadDM for this model (161). The dotted curve indicates the kinematic threshold where the mediator can decay on-shell into DM. In panel (a), the couplings of the mediator particle to each generation of quarks ( $g_q$ ) are set to 0.25, the couplings to leptons ( $g_l$ ) are set to zero and the coupling to DM is set to unity. In panel (b),  $g_q$  is set to 0.1,  $g_l$  is set to 0.01 and the coupling to DM  $g_\chi$  is set to unity and marked as  $g_{DM}$  in this plot. Abbreviations: DM, dark matter; ISR, initial-state radiation; TLA, trigger-object level analysis. Adapted from Reference 162.



**Figure 8**

The 90%-CL constraints from the CMS experiment from References (91, 103, 108, 149, 154) in the  $m_{\chi}$ -spin-independent DM–nucleon plane for a vector mediator, Dirac DM, and benchmark couplings  $g_q = 0.25$  and  $g_{\chi} = 1.0$  (marked as  $g_{\text{DM}}$  in this plot) chosen as an example of what early LHC searches would be sensitive to, compared with direct detection experiments from References (172–176). It is important to note that this comparison is only valid for this particular combination of model and parameter choices. Abbreviation: DM, dark matter. Adapted from Reference 177.

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