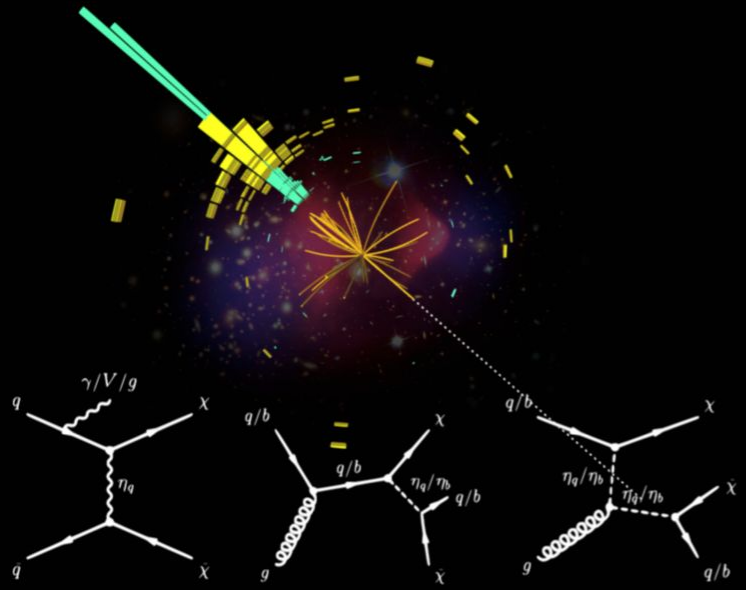
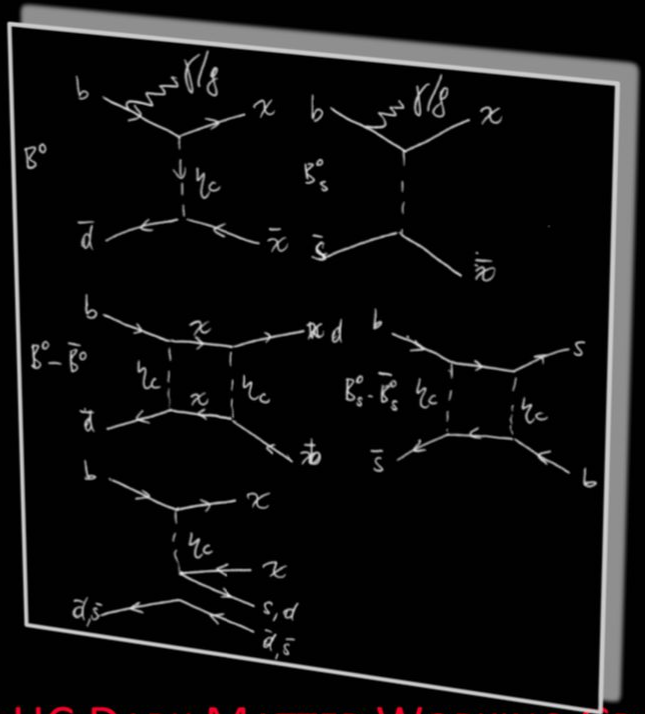
Dark Matter Models with t-Channel Mediators | @LHC & B-factories

26 April 2019 ● 13:00-18:00 ● CERN 40-S2-C01 (Salle Curie) ● Vidyo

& Going Beyond?





Consolidating Existing Work

Experimental + Theory Workshop
https://indico.cern.ch/e/tChannelDM

LHC Dark Matter Working Group
Organisers: Oleg Brandt ● Ulrich Haisch ● Philipp Harris ● Christian Ohm ● Tim Tait ● Xabier Cid Vidal

LHC Dark Matter WG

- **LHC DM WG instrumental for:**
  - Defining benchmark models and interpretations for DM searches
  - Facilitate comparison and collaboration across the LHC experiments and theorists
  - Develop higher-precision calcula for backgrounds
- So far focused on simplified DM and 2HDM+*a* models
- Past White Papers currently being prepared for journal submission
- **Next project:**
  - *t*-channel DM models!

Dark Matter Benchmark Models for Early LHC Run-2 Searches: Report of the ATLAS/CMS Dark Matter Forum

August 8, 2016

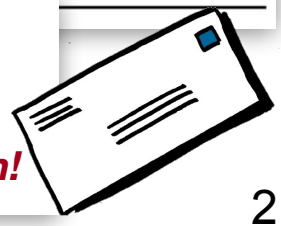
Recommendations on presenting LHC searches for missing transverse energy signals using simplified s-channel models of dark matter

Recommendations of the LHC Dark Matter Working Group: Comparing LHC searches for heavy mediators of dark matter production in visible and invisible decay channels

LHC Dark Matter Working Group: Next-generation spin-0 dark matter models

The next White Paper

Interested? Even mildly? → Get in touch!



LHC Dark Matter WG

- **LHC DM WG mailing lists:**
  - General mailing list used for announcements: subscribe here
  - Contributors mailing list used for discussions among LHC DM WG participants: subscribe here
- **LHC DM WG web page here**

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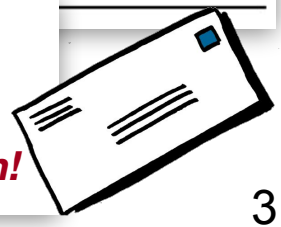
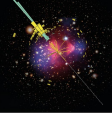


Goals of today's workshop



- **Consolidating existing work:**
  - Converge on a set of models
  - Agree on well-motivated sets of coupling values
  - Map final states to parameter space regions
- **Going Beyond:**
  - Look for uncovered regions of parameter space
  - Can LHCb (+ *b*-factories) cover unique parts of parameter space using *B*-mesons as a probe?
  - *B*-oscillations to constrain DM models?
  - Opportunities at Run 3 of the LHC?
- **Final goal:**
  - White Paper of the LHC DM WG on DM models with *t*-channel mediators providing recommendations for interpreting DM searches at the LHC

Today's agenda: *t*-channel Dark Matter

13:00 → 13:40 **Introduction**

- 13:00 **Welcome: the LHC DM WG & goals of this meeting** — 10m
- 13:10 **History and overview of t-channel models** — 20m
  Speaker: Tim M.P. Tait (University of California, Irvine)

13:40 → 15:15 **Consolidating Existing Work**

- 13:40 **t-channel interpretations @ CMS** — 10m
  Speaker: Andreas Albert (Rheinisch Westfaelische Tech. Hoch. (DE))
- 13:55 **t-channel interpretations @ ATLAS** — 10m
  Speaker: Millie McDonald (University of Melbourne (AU))
- 14:10 **Dark matter with t-channel mediator: a simple step beyond contact interaction** — 10m
  Speakers: Mr HAO ZHANG (Theoretical Division, Institute of High Energy Physics, Chinese Academy of Sciences), Haipeng An (Perimeter Institute), Dr Haipeng An (Caltech), Haipeng An (University of Maryland), LianTao Wang (University of Chicago), Liantao Wang (University of Chicago (US)), Liantao Wang (Princeton University)
- 14:25 **Signatures of Majorana dark matter with t-channel mediators** — 10m
  Speakers: Stefan Vogl (Max Planck Institute for Nuclear Physics), Stefan Vogl (Max Planck Institute for Nuclear Physics), et al
  t-channel.pdf

Today's agenda: *t*-channel Dark Matter

14:40 **Simplified DM models with the full SM gauge symmetry** 10m

Speaker: pyungwon ko (Korea Inst. for Advanced Study (KIAS))

dm@LHC_ko_2019...

14:55 **Direct Detection and LHC constraints on a t-Channel Simplified Model of Majorana Dark Matter at One Loop** 10m

Speakers: Kirtimaan Mohan (Michigan State University), et al

simdm.pdf

15:15 → 15:45 **Rest your brains!** 30m

15:45 → 16:45 **Consolidating Existing Work**

15:45 **Brief review on the vector-like portal to scalar dark matter** 10m

Speakers: Jerome Vandecasteele, Michel Tytgat (Université Libre de Bruxelles)

16:00 **Flavored dark matter beyond Minimal Flavor Violation** 10m

Speakers: Monika Blanke, Monika Blanke (Karlsruhe Institute of Technology), Monika Blanke

Blanke-LHCDMWG...

16:15 **A flavoured dark sector** 10m

Speakers: Pedro Klaus Schwaller (Mainz University), Sophie Renner (University of Mainz), Sophie Renner (CERN)

Today's agenda: *t*-channel Dark Matter

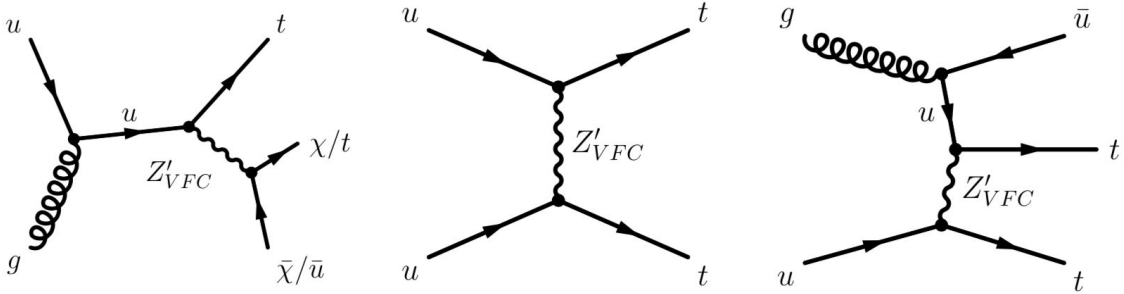
16:30	**Leptonic WIMP Coannihilation and the Current Dark Matter Search Strategy** **Speakers**: Michael Baker (Universitaet Zuerich (CH)), Michael James Baker (Universitaet Zuerich (CH)) Baker.pdf	10m	
16:45 → 18:00	**Going Beyond**		
16:45	**The scope of this session**	5m	
16:50	**Direct (à la semileptonic b-decays) DM searches in B-sector [topic we'd like to discuss]**	1m	
16:50	**Indirect (e.g. B0 - ~B0 oscillations) DM searches in B-sector [topic we'd like to discuss]** ¶	1m	
16:50	**What can we do at B-factories that we can't at the LHC in terms of DM searches?** **Speakers**: Enrico Graziani (INFN - National Institute for Nuclear Physics), Enrico Graziani (Universita e INFN Roma Tre (IT))	15m	
16:50	**Your new ideas!**	1m	

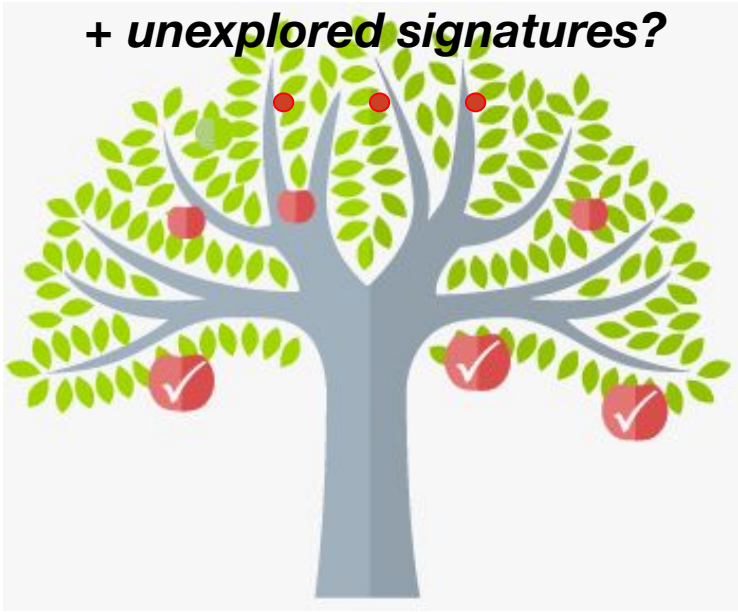
Let’s get started!

Back-up

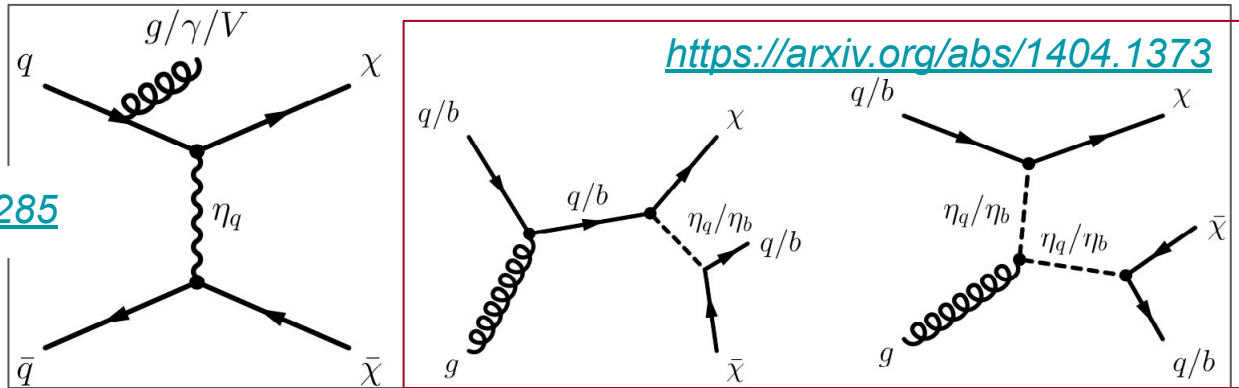
LHC DM WG activities

- **Models with t-channel mediators:**
  - little explored
  - not more or less motivated than s-channel
- → More close investigation → White Paper
- **Previously explored signatures:**
  - https://arxiv.org/abs/1407.7529





https://arxiv.org/abs/1402.2285



LHC DM WG activities

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- → More close in
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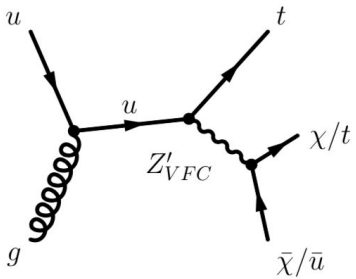

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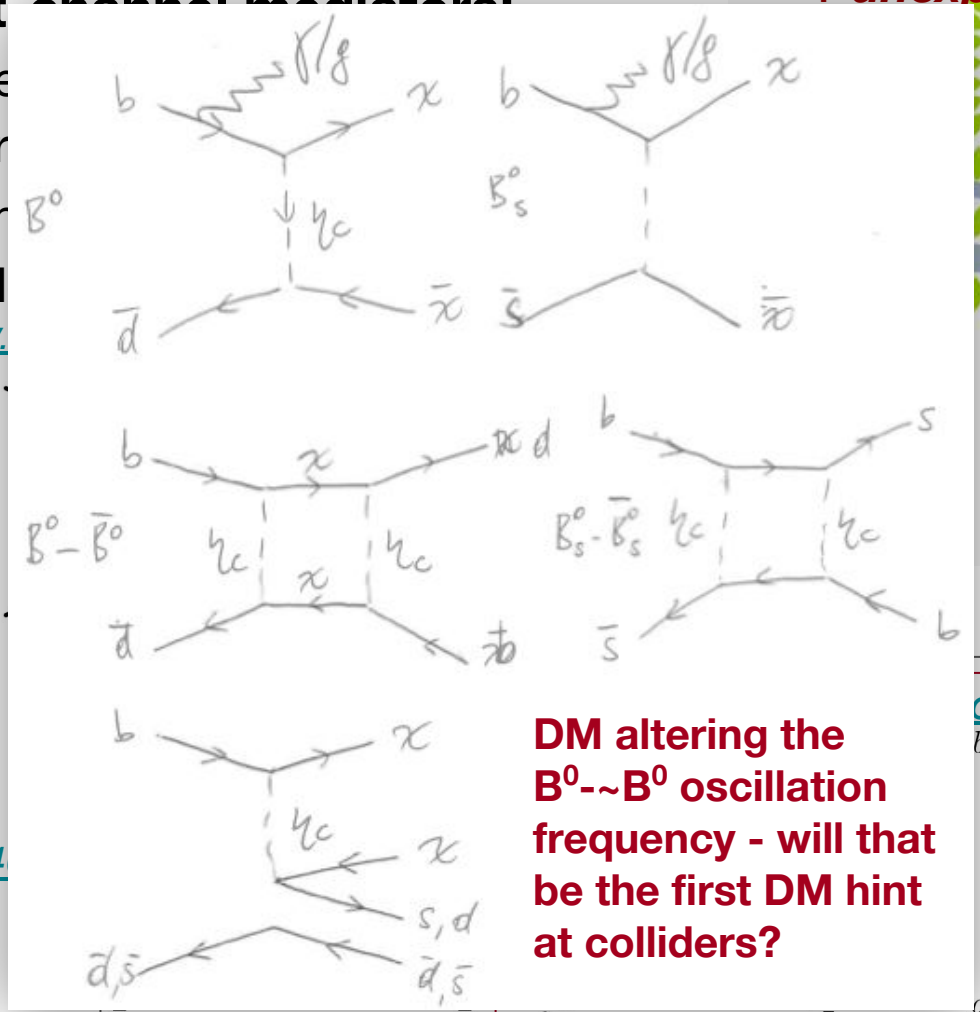
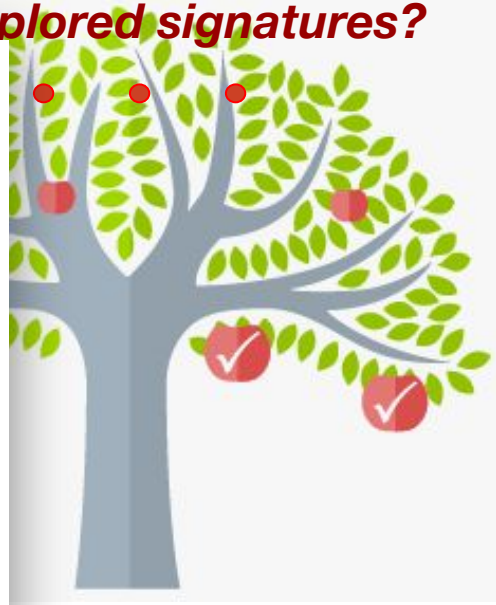
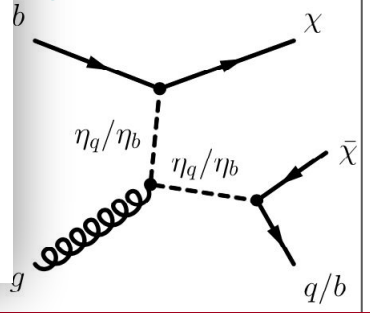


DM altering the B^0-~B^0 oscillation frequency - will that be the first DM hint at colliders?

+ unexplored signatures?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