

London Centre for TeraUniverse Studies

*Informal Brainstorming Meeting on*

**"Interplay and Characterization  
of Dark Matter Searches  
at Colliders and Direct Detection  
Experiments"**

May 29th, 2014, Imperial College London

**Motivation:**

Since the start-up of the LHC in 2010, generic searches for direct Dark Matter (DM) production at colliders, and their comparison with direct-detection experiments such as XENON100 and LUX, have become a focal point for both the experimental and theoretical particle and astroparticle communities.

Today generic searches for DM production at colliders, including missing transverse energy, monojets, monophotons, etc, which go beyond the scope of a dedicated model like SUSY, are often quantitatively compared with results from direct detection experiments. In the past, this comparison was mainly performed in the framework of simplified models or an effective field theory (EFT), which allows for straightforward comparison with the sensitivity of direct detection experiments (e.g., XENON100 and LUX).

However, specific models are often over-simplified, and several independent groups have recently pointed out that the interpretation of DM searches at colliders in the framework of EFT could lead to biased conclusions. Alternative interpretation approaches, e.g., a unified model description of the searches, have been advocated in order to better characterize and constrain the parameter space of generic DM models.

The scope of this brainstorming workshop is to contribute to the development of a consistent and state-of-the-art effort to interpret these searches in order to compare collider and direct detection experiments in a general way. This will be required to establish quantitatively the complementarity of these two search approaches, which will be critical in our quest for Dark Matter in the future.

## Programme:

9:30 Coffee

9:55 Introduction 5'

### 10:00 Session 1: SUSY & Dark Matter

- 10:00: *Overview SUSY & Dark Matter*, 20+5' (John Ellis)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Ellis.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Ellis.pdf)
- 10:25: *DM & pMSSM in MasterCode*, 20+5' (Kees de Vries)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/deVries.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/deVries.pdf)
- 10:50: *short discussion*, 15' (ALL)

### 11:05 Session 4: Mono + X Collider Searches & Dark Matter

- 11:05: *Landscape of Mono + X searches at colliders* 20+5' (Greg Landsberg)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Landsberg.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Landsberg.pdf)
- 11:30: *QCD effects in mono-jet searches for dark matter & POWHEG implementation* 20+5' (Emanuele Re)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Re.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Re.pdf)
- 11:55: *LHC and Tevatron bounds on the dark matter direct detection cross-section for vector mediators* 20+5' (Felix Kahlhoefer)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Kahlhoefer.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Kahlhoefer.pdf)
- 12:20: *Interpretation of results from Mono + X* 20+5' (Sarah Malik)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Malik.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Malik.pdf)
- 12:45: *short discussion*, 15' (ALL)

13:00 Lunch

### 13:45 Session 3: Direct Detection Experiments and Indirect Detection

- 13:45: *Direct Detection Experiments: Today & Future Perspectives* 20+5' (Henrique Araujo)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Araujo.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Araujo.pdf)
- 14:10: *What can we learn from Indirect Detection* 20+5' (Celine Boehm)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Boehm.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Boehm.pdf)
- 14:35: *Interpretation of results from Direct Detection Experiments* 20+5' (Christopher McCabe)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/McCabe.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/McCabe.pdf)
- 15:00: *short discussion*, 15' (ALL)

15:15 Break

### 15:45 Session 2: Invisible Higgs & Dark Matter

- 15:45: *Invisible Higgs searches*, 20+5 (Jim Brook)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Brook.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Brook.pdf)
- 16:10: *Invisible Higgs search interpretation*, 20+5' (Michael Spannowsky/Valentin Khoze)  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/Khose\\_Spannowsky.pdf](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/Khose_Spannowsky.pdf)

- 16:35: *short discussion*, 15' (ALL)

16:50 Break

**17:15 Session 5: Discussion**

17:15: *Round Table Discussion*: Moderators: Greg Landsberg/Albert De Roeck and Henrique Araujo/Malcolm Fairbairn 60' (All)

**18:15 Session 5: Closing**

- 18:15: *What next?* 15' (All)

19:30 **Dinner**

**Note:**

In you have problems to download the talks, all talks can be directly accessed from:  
[http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529\\_Brainstorming/](http://www.hep.ph.ic.ac.uk/TeraUniverse/meetings/20140529_Brainstorming/)

## Confirmed Participants (so far):

Henrique Araujo	(exp)
Alexander Belyaev	(theo)
Celine Boehm	(theo)
Jim Brook	(exp)
Oliver Buchmueller	(exp)
Albert De Roeck	(exp)
Kees de Vries	(theo)
John Ellis	(theo)
Malcolm Fairbairn	(theo)
Henning Flaecher	(exp)
Felix Kahlhoefer	(theo)
Hans Kraus	(exp)
Valentin Khoze	(theo)
Greg Landsberg	(exp)
Sarah Malik	(exp)
Jad Marrouche	(exp)
Christopher McCabe	(theo)
Dave Newbold	(exp)
James Nikkel	(exp)
Michele Papucci	(theo)
Emanuele Re	(theo)
Michael Spannowsky	(theo)
Tim Sumner	(exp)
Marc Thomas	(theo)
Roberto Trotta	(theo)
Steve Worm	(exp)