

Theory Frontier TF09:

Astroparticle Physics and Cosmology

Daniel Green
UCSD

For the TF09 conveners

DG, Josh Ruderman, Ben Safdi, and Jessie Shelton

Theory Frontier

Frontier conveners



Nathaniel Craig
UCSB



Csaba Csaki
Cornell



Aida El-Khadra
UIUC

Spans all of high energy theory, broadly defined

Unifying Goal: highlight the essential role of theory

Theory Frontier

Organization:

Topical Group		Topical Group co-Conveners			
TF01	String theory, quantum gravity, black holes	Daniel Harlow	Shamit Kachru	Juan Maldacena	
TF02	Effective field theory techniques	Patrick Draper	Ira Rothstein		
TF03	CFT and formal QFT	David Poland	Leonardo Rastelli		
TF04	Scattering amplitudes	Zvi Bern	Jaroslav Trnka		
TF05	Lattice gauge theory	Zohreh Davoudi	Taku Izubuchi	Ethan Neil	
TF06	Theory techniques for precision physics	Radja Boughezal	Zoltan Ligeti		
TF07	Collider phenomenology	Fabio Maltoni	Shufang Su	Jesse Thaler	
TF08	BSM model building	Patrick Fox	Hitoshi Murayama		
TF09	Astro-particle physics and cosmology	Dan Green	Joshua Ruderman	Ben Safdi	Jessie Shelton
TF10	Quantum information science	Simon Catterall	Roni Harnik	Veronika Hubeny	
TF11	Theory of Neutrino Physics	André de Gouvêa	Irina Mocioiu	Saori Pastore	Louis Strigari

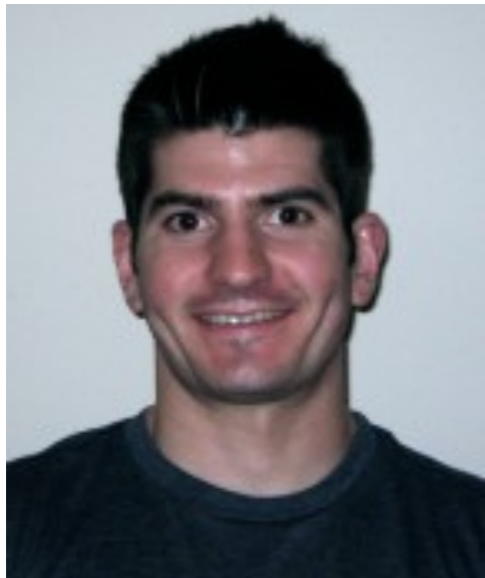
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TF09: Astroparticle Physics & Cosmology

Conveners



Dan Green
UC San Diego



Josh Ruderman
NYU



Ben Safdi
UC Berkeley



Jessie Shelton
UIUC

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Goals: Highlight the roles of theorists

1. Pure theory (e.g. formal aspects of inflation)
 2. Defining theoretically interesting targets
 3. New analyses of existing data
 4. Designing new experiments
 5. Simulations / theory that impacts data analysis
 6. Directly working on projects (likelihoods, pipeline)
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Solicited White Papers:

Inflation and Connections to Formal Theory (with TF01): Liam McAllister and Eva Silverstein

Data Driven Cosmology: Raphael Flauger, Marilena LoVerde, Annika Peter, Mark Vogelsberger, and Risa Wechsler

Early Universe Model-Building (with TF08): David Curtin, Eric Kuflik, Yonit Hochberg, Neal Weiner, and Keisuke Harigaya

Indirect Detection: Mariangela Lisanti, Georg Raffelt, Kim Boddy, Christoph Weniger, Nick Rodd, and Sam McDermott

Theory Meets the Lab: Rouven Essig, Yoni Kahn, Simon Knapen, Peter Graham, Andreas Ringwald, and Natalia Toro

Effective Field Theories for Cosmology (with TF02): Mehrdad Mirbabayi and Marko Simonovic

Cosmological Bootstrap (with TF03/04): TBD

Why is there a Theory Frontier?

Funding for theory is crucial

- Theory is essential, independent of projects
- Theory directly and indirectly supports projects
- A great strength of the US is the theory community

DOE is project-centric, decreasing theory support

In some cases, theoretical work is pro-bono

Hope for a change via Snowmass / P5

Relation to Cosmic Frontier

Theorists are deeply involved in Cosmic Frontier

- A large fraction of conveners are theorists
- Lots of new experiments are proposed by theorists
- Targets and goals are often defined by theory

Members of TF09 directly contribute to these efforts

Theoretical targets/goals is still a CF activity

I.e. the Goal of TF09 is not theory background for CF

Relation to Cosmic Frontier

The goal of the theory frontier is to support theorist

Theorists want vibrant experimental program too

TF09 works with CF to engage theory community

- Co-organized workshops / sessions
 - Most white papers will be cross listed
 - Liaison (Flip Tanado) on all CF & TF calls
 - Help mobilize the theory community
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Relation to CMB-S4

CMB-S4 is a great illustration

- Many theorists involved at all levels
 - This breadth is strength of the CMB community
 - Lots of work falls into gray areas (e.g. Sims)
 - Funding that splits theory/exp gets in the way
 - We should value all these important contributions
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How can CMB-S4 help?

Snowmass is about community input

- Join mailing lists, slack channels
- Come to meetings
- Contribute to white papers
- Send suggestions to the conveners

TF Conference: KITP (tentatively) Feb 23-25, 2022

Check Snowmass website for more events

Thank you

