



Particle Theory Group

Zoltan Ligeti

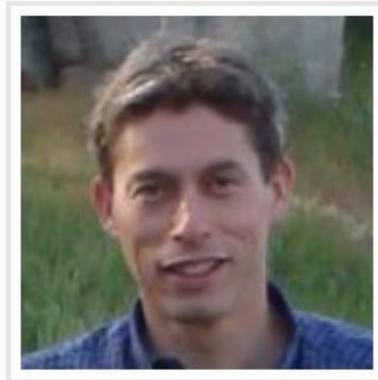
(`ligeti@berkeley.edu`)

March 16, 2018

Who we are



Christian Bauer



Zoltan Ligeti

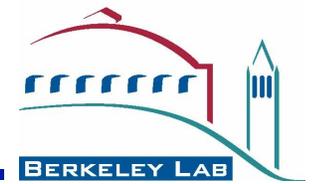


Michele Papucci



Kathryn Zurek

Who we really are: BCTP



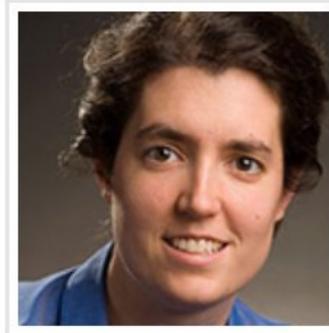
Christian Bauer



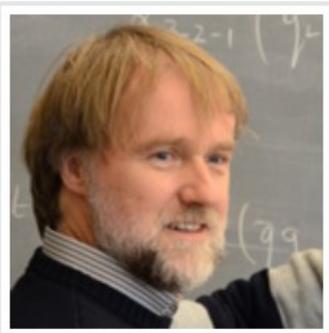
Zoltan Ligeti



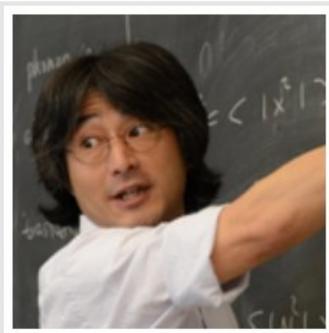
Michele Papucci



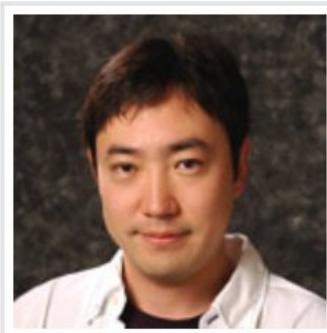
Kathryn Zurek



Lawrence Hall



Hitoshi Murayama



Yasunori Nomura



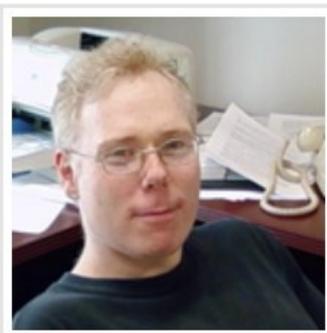
Surjeet Rajendran



Mina Aganagic



Raphael Bousso



Ori Ganor



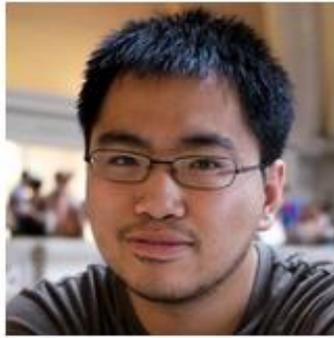
Petr Hořava

+ postdocs

+ students

+ visitors

BCTP postdocs



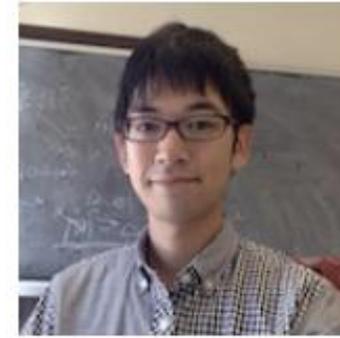
Bao



Dror



Fedderke



Harigaya



Galakhov



Grabowska



Knapen



Kos



Lou



Moul



Ramani



Remmen

- One of the largest and best groups of postdocs in the country, many work with graduate students

The particle theory side

QCD, collider physics, Higgs:

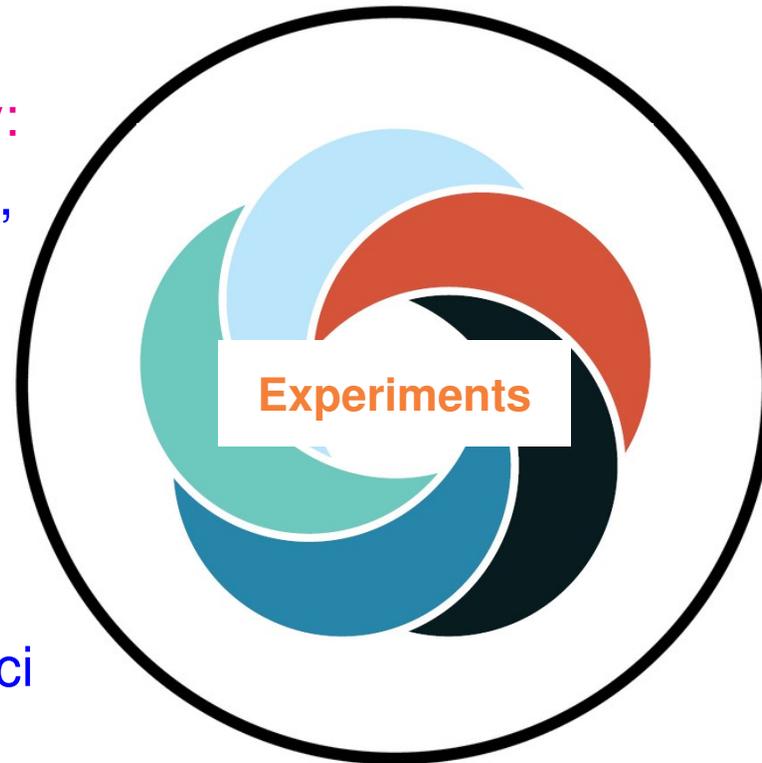
Bauer, Ligeti, Papucci, Zurek, Murayama

BSM Phenomenology:

Ligeti, Papucci, Zurek,

Hall, Murayama

Nomura, Rajendran



Model building:

Papucci, Zurek,

Hall, Murayama

Nomura, Rajendran

Flavor physics:

Bauer, Ligeti, Papucci

Dark matter, cosmic rays:

Papucci, Zurek, Nomura

Hall, Murayama, Rajendran

Neutrinos:

Zurek, Murayama

What and how...



- Those of you who attended the BCTP open house yesterday heard already a lot
- We are leaders in many areas of particle theory
- Research interests evolve depending on what are the most relevant questions to address at the moment — “What’s most exciting?”
- Each of us has his/her own way to approach problems — Important for you to be exposed to many different ways of doing physics in a large and diverse group
- Students and postdocs are free to collaborate with anyone (encouraged!)
(Most doors open, exciting & lively discussions all the time, yearly retreats at Lake Tahoe)

Some research interests (random order)



Develop effective field theories, apply to various problems (flavor, jets, DM, cosmology, ...)

Precision SM calculations, Monte Carlo methods / tools

Collider physics: SM measurements and BSM searches

Flavor physics, CP violation, low-energy searches for NP

Electroweak scale BSM model building / Higgs phenomenology

Dark matter model building, new techniques for DM detection

Dark matter searches (direct detection + indirectly with particle astrophysics)

Proposals for new detectors, new analysis techniques

Early universe particle cosmology

Neutrino physics, leptogenesis models

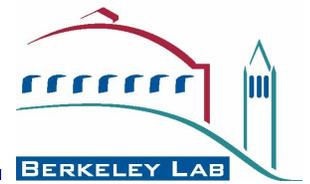
Inflationary models

Connections to experiments



- LBNL has the strongest university connection among the national labs (more so than, e.g., SLAC–Stanford)
- In BCTP we operate as a single group (Mon/Tue on campus, Wed/Thu at LBL, seminars split between campus and LBL accordingly)
- Closeness to extensive experimental programs, many interactions (joint seminars & workshops, etc.)
- Particle theory graduate students exposed to broad spectrum of experimental research at LBL, can become important in shaping careers
- Experimental graduate students have easy access to the theory group for advice on theoretical aspects of their research (just walk down the corridor or catch someone at the espresso machine...)

Theory – experiment connections



- Logistics at LBL makes it extremely easy for theorists and experimentalists to interact on a daily basis
- Regular ATLAS–Theory lunches (informal talks → discussions, collaborations)
- Many of us provide theoretical advice to experiments: ATLAS, DM detection, neutrinos, flavor physics, PDG
Even propose new experiments / techniques
- In the past some of these resulted in direct involvement in experiments (Cahn, Hinchliffe, Murayama)



Hitoshi taking shifts in KamLAND →

My personal views



- After Higgs discovery, situation may resemble around 1900 — we don't understand a "few" things (a lot left for you!) \Rightarrow may see revolutions, but no guarantees

(Michelson 1894: "... it seems probable that most of the grand underlying principles have been firmly established ...")

Dark energy — cosmological constant?

Dark matter — vast parameter space; only interact gravitationally?

Baryon asymmetry — originates at very high scales?

Neutrino mass — Majorana or Dirac? (lepton number viol.?)

Strong CP problem — axion?

Flavor parameters and hierarchies — very high scales?

Leave no stone unturned — explore fully what technologies allow

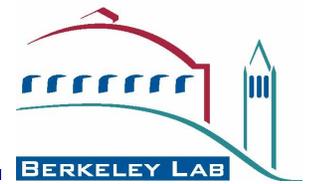


- Move the lamp post: e.g., new LHC searches, new DM or axion param' space
- Search better under the lamp post: e.g., Higgs couplings, B decays & CP violation

- Historically, the combination of both approaches proved most fruitful

Most of us work on both type of questions

And an apology...



- In past years we always had a breakout with theory postdocs, parallel to lab tours

BAY AREA PARTICLE THEORY SEMINAR

The Bay Area Particle Theory Seminar aims to bring together particle theorists in the Bay Area, including UC Santa Cruz, SLAC, Stanford, San Francisco State, Berkeley, LBNL, Livermore, U. of Pacific, and UC Davis to get together for an afternoon, hear a few talks, and discuss physics.

The first (in the 21st century) was held in the Nob Hill Room at the Seven Hills Conference Center of San Francisco State University, on October 4, 2013, and for now it is planned as a biannual event.

Jump to bottom for [location, directions, etc.](#)

Next event: March 16, 2018

1:00 - 1:50	Ann Nelson (Seattle), Baryogenesis and Belle II
2:00	break
2:40 - 3:10	Veronika Hubeny (Davis), Holographic Entanglement
3:20	break
3:50 - 4:20	Keisuke Harigaya (Berkeley), A new aspect of the strong CP problem

- See <http://www-theory.lbl.gov/> and <http://ctp.berkeley.edu/>
All of us (present or not) would be happy to talk to you!

Thank you, and...

Congratulations!!!

