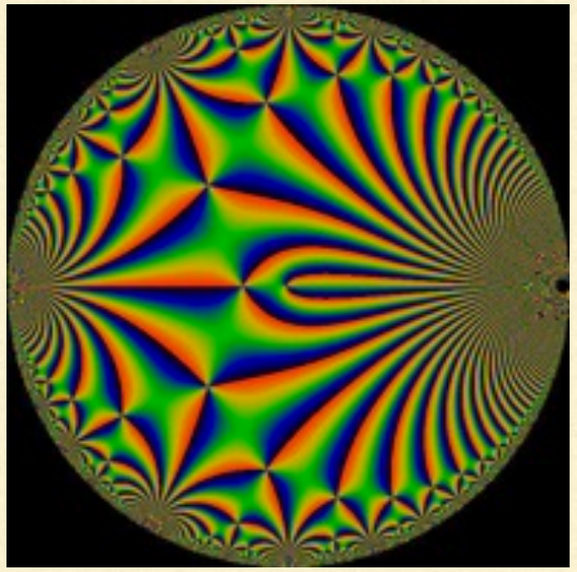


WELCOME TO…
"MODULARITY IN QUANTUM SYSTEMS"

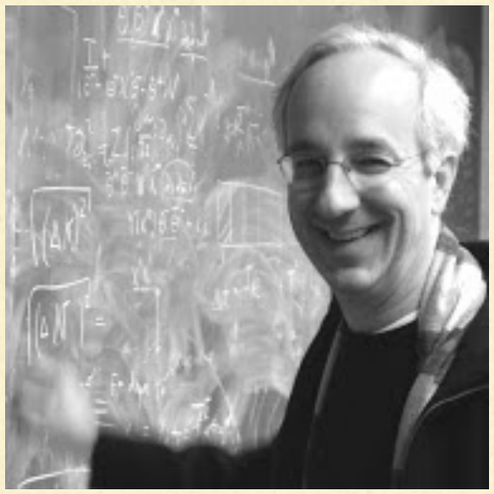
Virtual KITP workshop
October 26-December 18, 2020

UC SANTA BARBARA
Kavli Institute for Theoretical Physics

Program Coordinators

Sergei Gukov
Caltech

Sarah Harrison
McGill



Jeff Harvey
University of Chicago

Ken Ono
University of Virginia

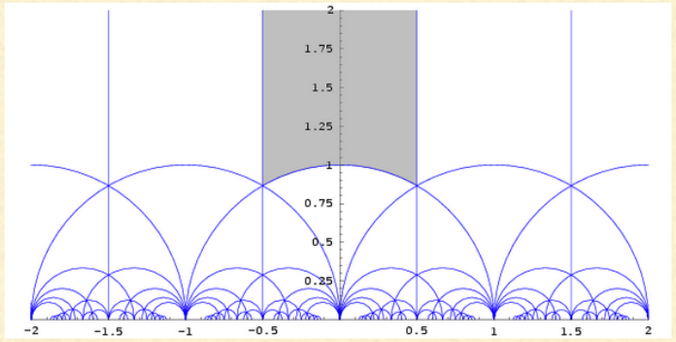
Why this program?

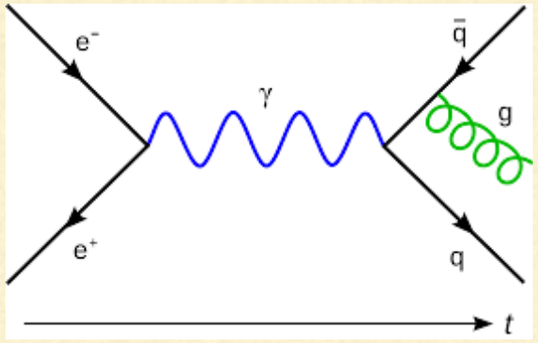
"Modularity in Quantum Systems"

$$f\left(\frac{a\tau+b}{c\tau+d}\right)=f(\tau)$$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \in SL(2,\mathbb{Z})$$

$$-\frac{\hbar^2}{2m}\nabla^2\psi+V\psi=E\psi$$





Mathematics ⟷ Physics

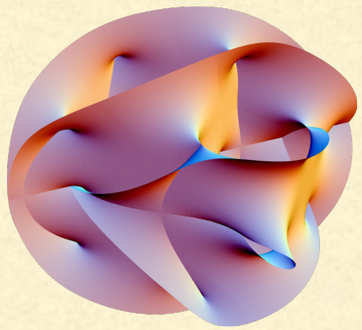
Mathematics

Physics

number theory

geometry

topology



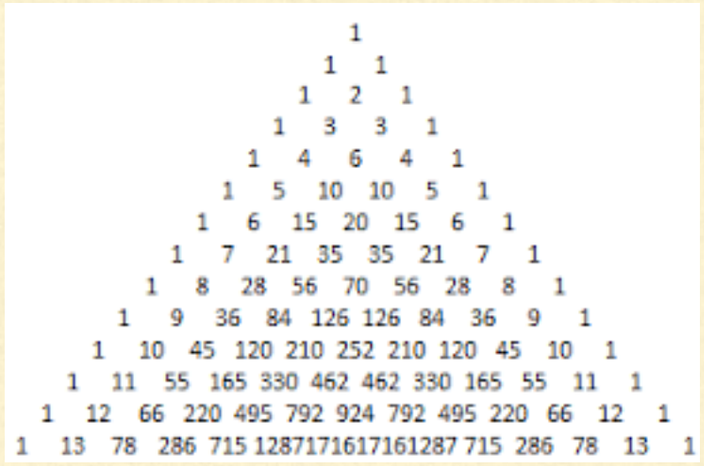
conformal field theory

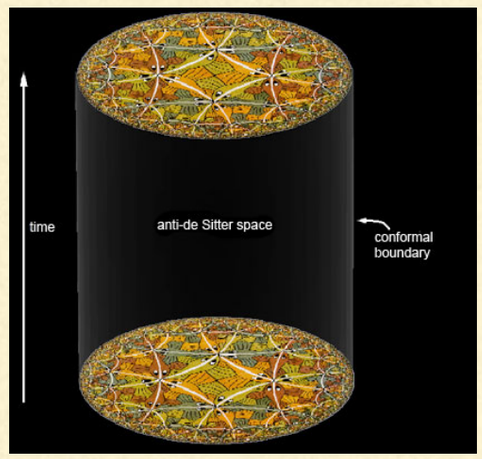
quantum field theory

string theory

representation theory

AdS/CFT





There are many fascinating developments and open questions linking fundamental areas in **mathematics** and **physics**, which are distinguished due to the key role of **modular symmetry**

Some of these include…

- mock and quantum modular forms
- chiral algebras and 2d CFT
- moonshine
- AdS/CFT
- three manifold invariants
- Calabi Yau modularity
- topological modular forms
- BPS states, black holes and string theory
- …

The goal of this program is to *bring together mathematicians and physicists* to teach and learn from each other, *facilitate conversation and collaboration*, and to come up with *new ideas* to attack questions such as:

What is the physical explanation of new moonshines relating finite groups and (mock) modular forms?

Can we find new/develop existing deep connections between chiral algebras, topological invariants of manifolds, and quantum field theory?

What can we learn about 3-dimensional quantum gravity by combining holography and techniques of modularity?

…and many others not mentioned here

Online Program:

we must work around many time zones, and usual personal, family, and teaching duties for participants, speakers, and coordinators

To facilitate collaboration….

Slack channel: please let us know if there are specific sub channels you would like to see added

Google drive folder: will contain these talk slides and slideshow with participants

Not too late to add your participant bio slide to the google slides file!

Talks will be on Zoom

You must register here!

Talk schedule:
Tuesdays and Thursdays 8-9 am California time
(=4pm in Europe on October 27 and 29, but 5pm in Europe for the rest of the program!)
No talk on November 26 (Thanksgiving)

This week's talks:
Tuesday, Oct 27: Amanda Folsom (Amherst) "Mock and quantum modular forms"
Thursday, Oct 29: Atish Dabholkar (ICTP) "Three avatars of mock modularity"

Questions encouraged! (45 min talk + 15 min questions)

Webpage and talk recordings

The program webpage: https://www.kitp.ucsb.edu/activities/mod20

Talk recordings: https://online.kitp.ucsb.edu/online/mod20/

Acknowledging the KITP

The KITP requests all participants to report their publications stemming from collaborations formed or furthered during this workshop, as well as to include the following funding acknowledgment in their papers:

This research was supported in part by the National Science Foundation under Grant No. PHY-1748958.

Additional program activities

Besides the regularly scheduled seminars, we would like your feedback about what additional activities you would like to see during the program, both social and scientific

Some possible options:

- *Brief meeting previewing the talks for the week (Monday)*
- *Summary of talks of the previous week by a participant, meant to stimulate discussion (Monday)*
- *Discussion sessions or tutorials led by a participant about additional topics not directly covered in the seminars (M/W/or F)*
- *Weekly "coffee hour" for social interaction (M/W/or F)*
- *(Non-)Randomly assigned breakout groups to facilitate discussions among participants who may not know each other; questions or prompts for discussion topics provide by coordinators or other participants*

Please send your feedback to coordinators and/or leave in Slack!

sarharr@gmail.com
gukov@theory.caltech.edu
jaharvey@gmail.com
ko5wk@virginia.edu