

PhysicsCakes



SMU®



CALIFORNIA STATE
UNIVERSITY
EAST BAY

A Taste of Particle Physics

Kathryn Grimm & Katharine Leney

ICHEP, 31st July 2020



Physics Cakes

Two ATLAS Physicists



Katharine Leney



Kathryn Grimm

This talk:

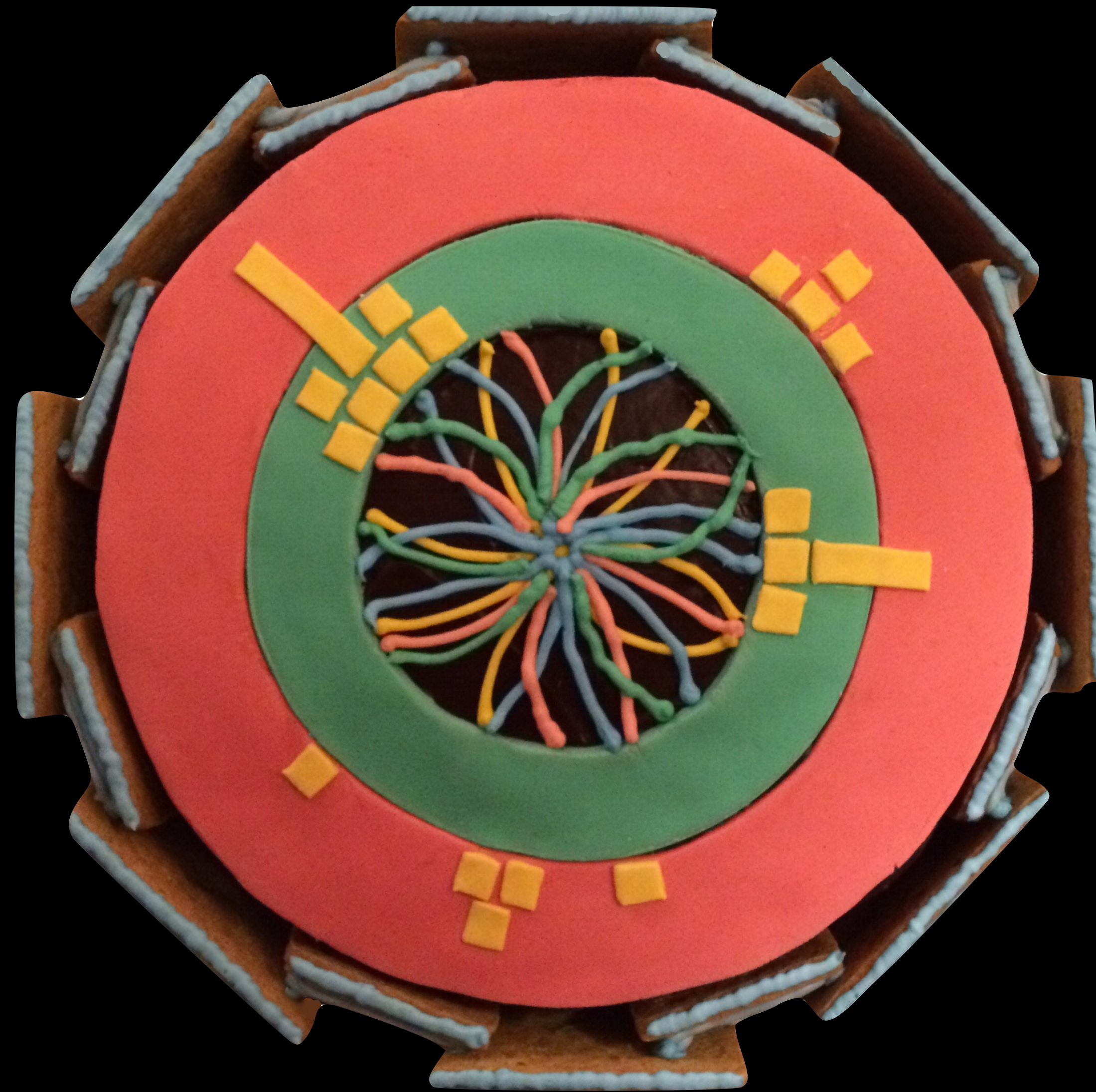
1. Public events
2. Education
3. Media engagement
4. Social media
5. Future plans

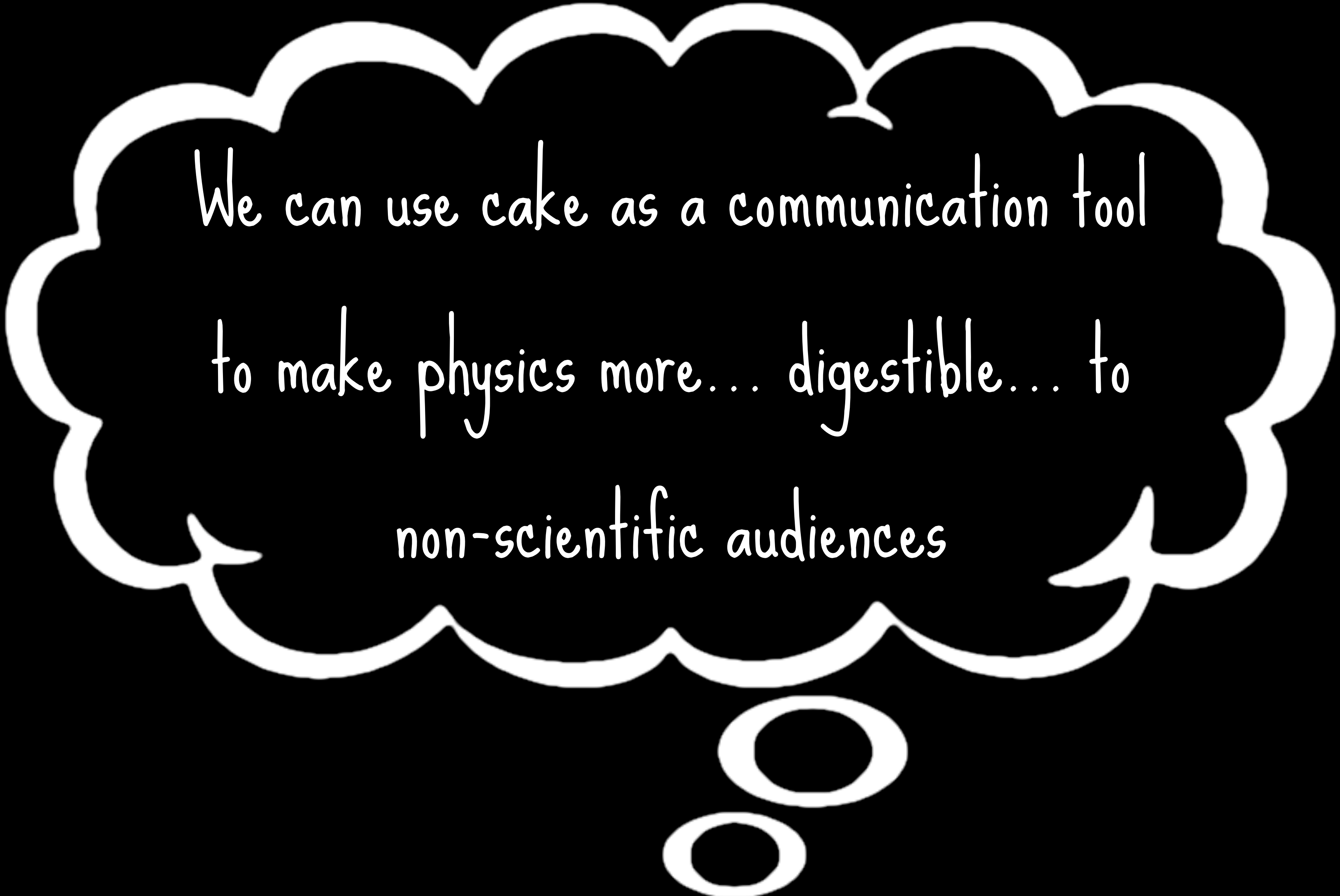
I'll make you a birthday cake!

What would you like it to look like?

Errrrrrmmmm...

the ATLAS detector?!



A large white thought bubble with a scalloped border is centered on a black background. Inside the bubble, the text is written in a white, handwritten-style font. Below the main bubble, two smaller white circles are stacked vertically, connected to the bottom of the main bubble by a thin white line, suggesting a thought process or a sequence of ideas.

We can use cake as a communication tool
to make physics more... digestible... to
non-scientific audiences

Public Events

DARK MATTER DAY at CERN

DON'T BE AFRAID OF THE DARK!

31st October 2017

Attended by 275 people (+100 on a waiting list for tickets) + live webcast.



Dark Matter Cake

... an anatomically correct model of the universe masquerading as a cake



Image: David Morse

Visible matter
(4.9%)

+

Dark energy
(68.3%)

+

Dark matter
(26.8%)

=

The universe

Dark Matter Day

Invited members of the audience to join me on stage to do a mock "survey of the universe" by eating a piece of Dark Matter Cake.



- How many people found some visible matter (white chocolate chips)?
- How many people found some dark matter (dark chocolate chips)?
- Dark energy (beetroot) is very hard to detect!

Dark Matter Day



• This cake is just like the Universe!

It has chunks of white chocolate (visible matter) and dark chocolate (dark matter). It is bound together by something unexpected - beetroot - which represents the dark energy of the Universe.

Without it, the cake would fall apart - just like our Universe without dark energy.



KATHARINE LENEY

ATLAS PHYSICIST
DARK MATTER DAY AT CERN

- Coverage on ATLAS social media
 - Shout-out in The New Yorker
 - Included in Symmetry Magazine
- Dark Matter Day coverage

Image: ATLAS and CERN

Talk by Connie Potter
& Roger Jones

WOMAD Festival - Original Concept

"The Universe in a Teacup" workshop planned for WOMAD Festival (July 2020)

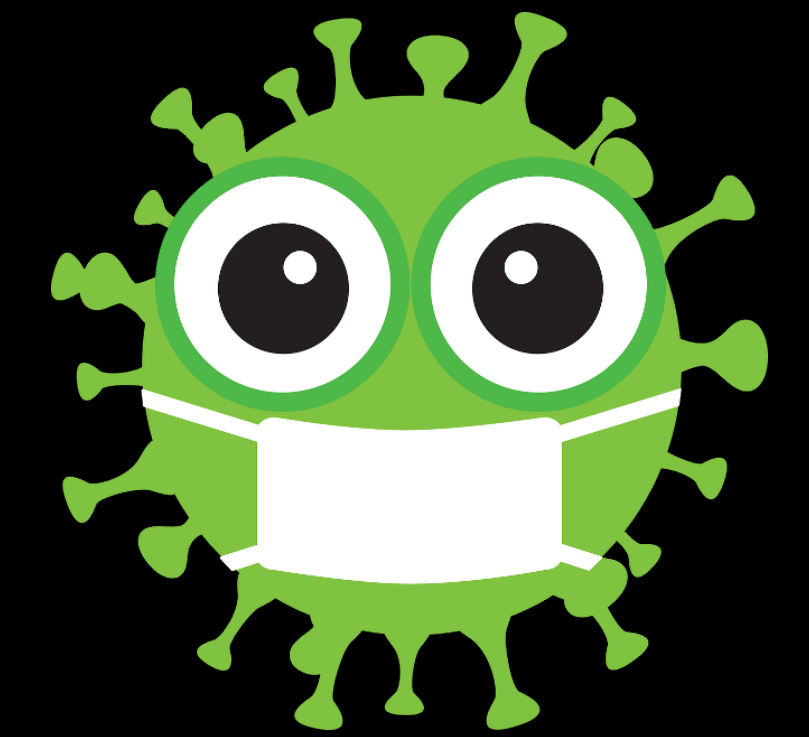
30-40 participants make a "Dark Matter Mug Cake" to learn about dark matter and the composition of the universe

Mug cakes are cooked in a microwave, so use this to discuss the Big Bang and cosmic microwave background

Use the microwaves to measure the speed of light



WOMAD (at home) Festival




@WOMADFestival


WOMAD
AT HOME

RADIO MENU

KATHARINE LENEY - DARK MATTER...AND CAKES!



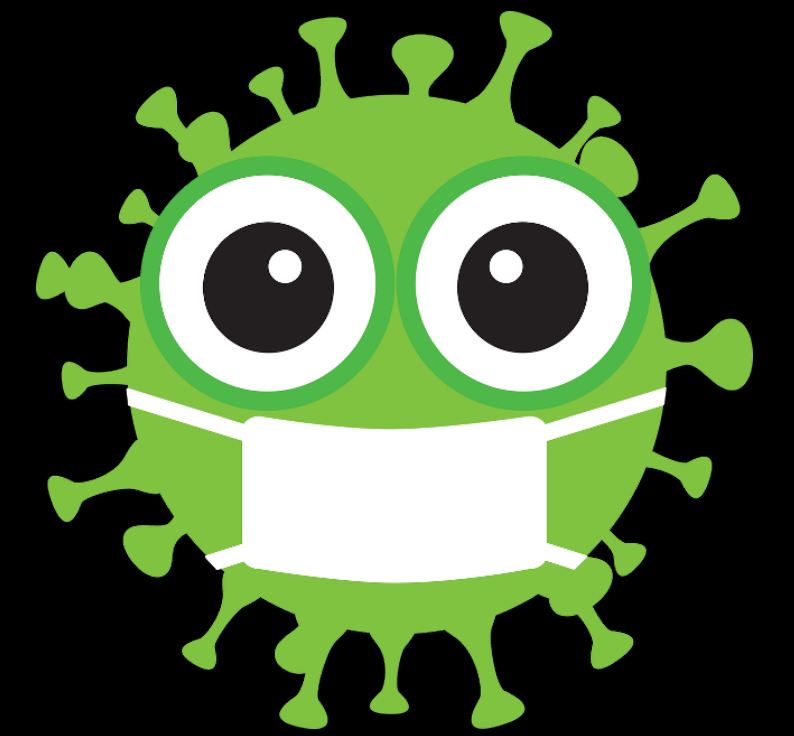
Particle physicist Katharine Leney explains dark matter, and how to make a cake that's an anatomically correct model of the universe! Follow #DarkMatterCake.



DOWNLOAD RECIPE HERE

Handout with recipe + explanation about dark matter, for people to download and keep

WOMAD (at home) Festival




@WOMADFestival

WOMAD
AT HOME

RADIO MENU

Once you've made your dark matter cake, you can decorate it to look like the universe. Get your ganache ready!



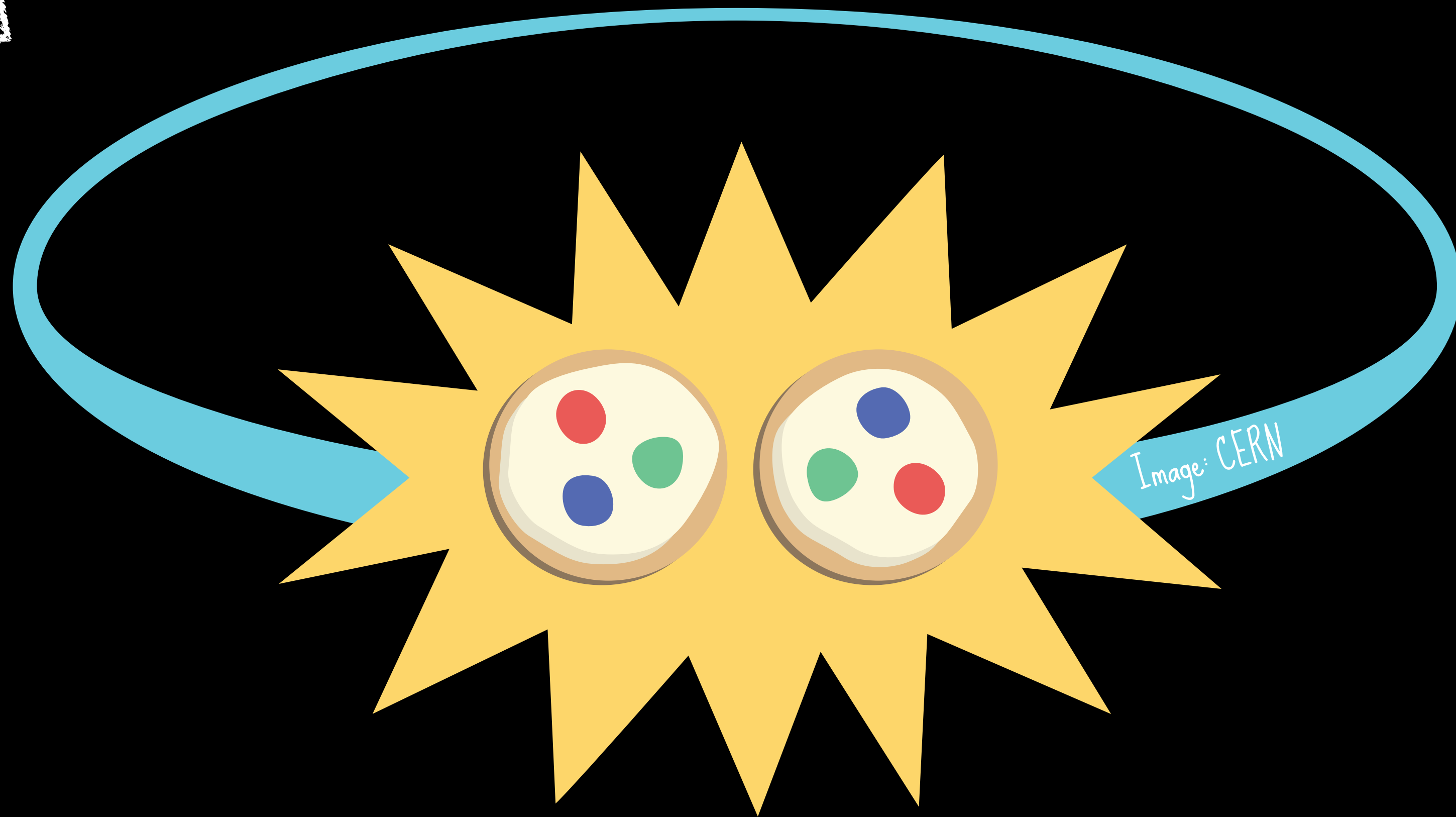
FIND OUT MORE

KATHARINE LENEY - DECORATE YOUR DARK MATTER CAKE

Watch this and the other 'World of Physics' talks at home

Talks by Anna Sfyrla
and Sascha Mehlhase

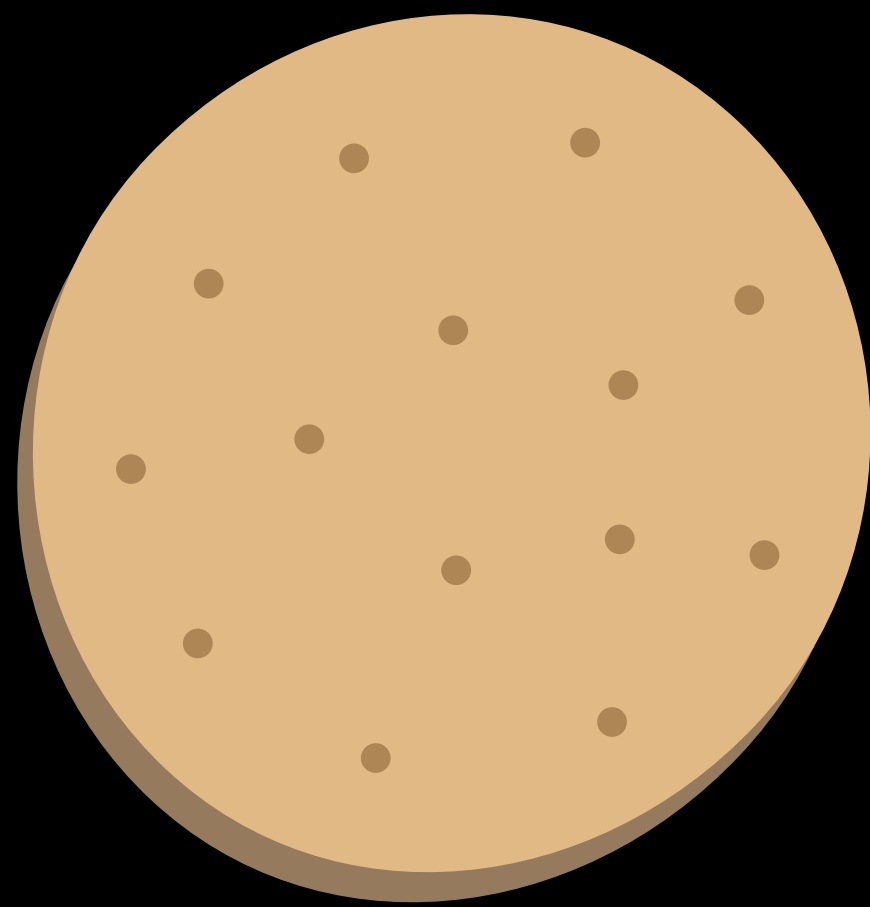
Proton Cookies at CERN Open Days



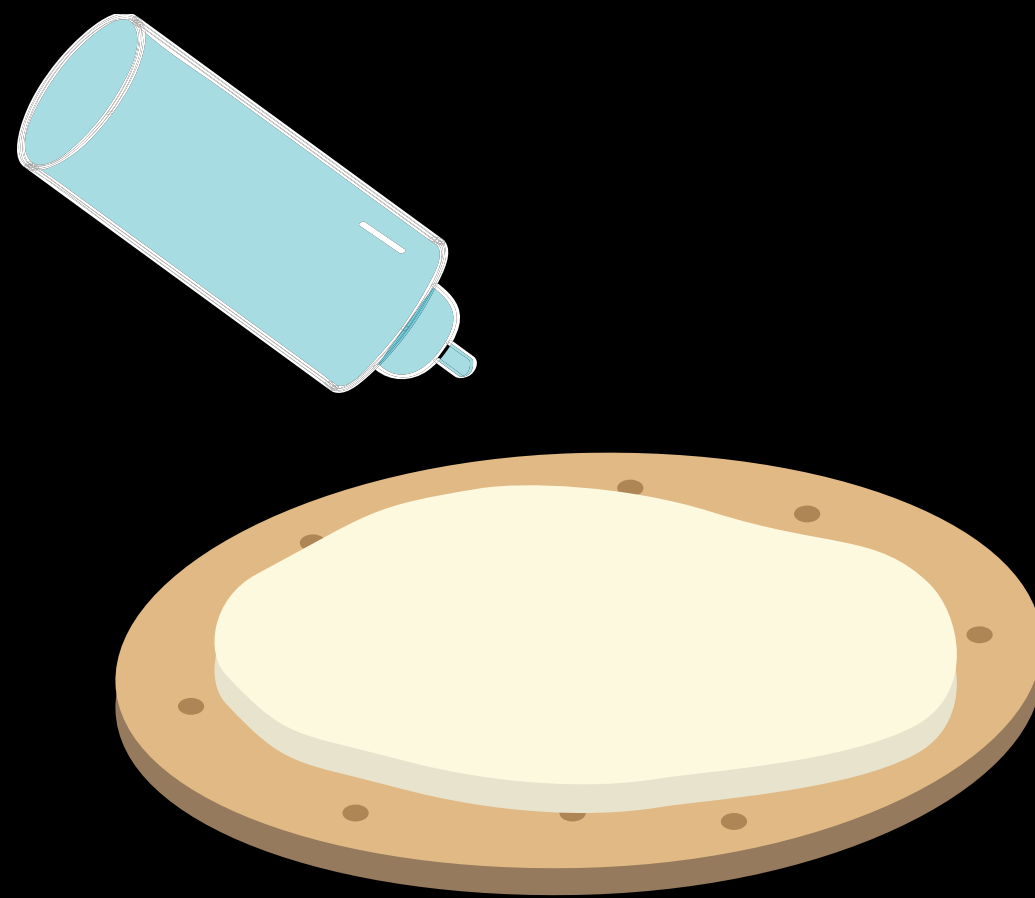
Goal: Fun activity, can be done quickly, suitable for all ages and knowledge levels

Proton Cookies at CERN Open Days

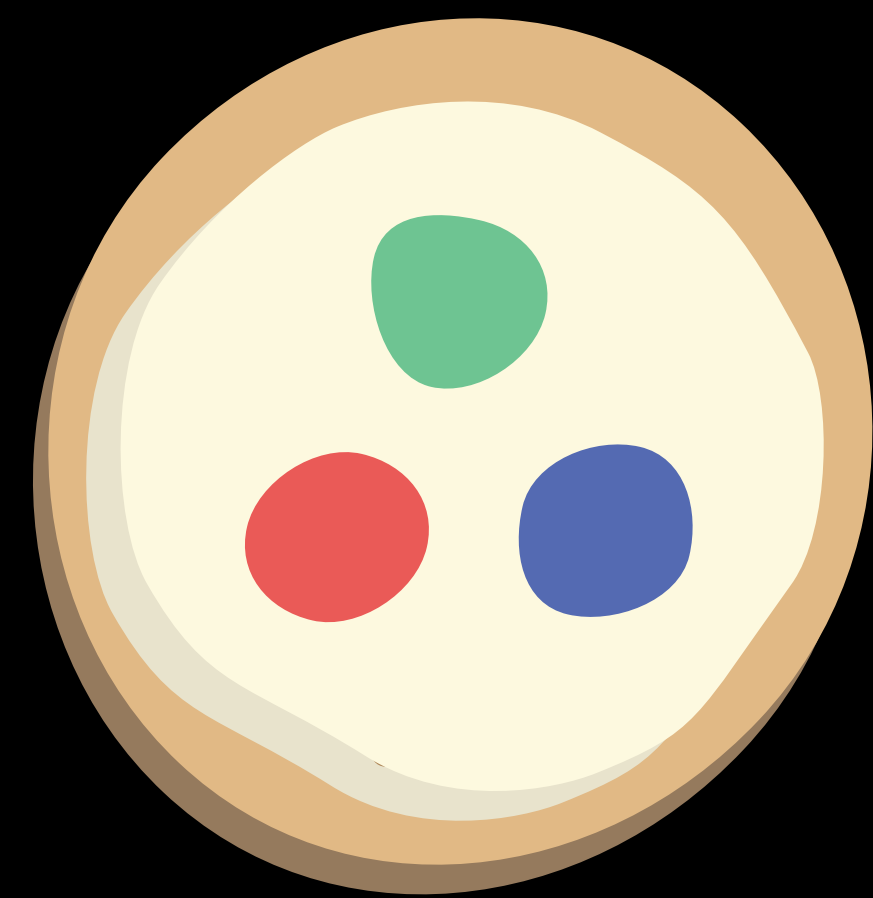
Image: CERN



1. Start with a plain cookie



2. Spread on some gluon icing



3. Add M&M quarks

Proton Cookies at CERN Open Days



1800 cookies



9000 custom-printed M&Ms

(red, green, blue, printed with "u" or "d" on them)

Aside: What does 9000 M&Ms look like?



Buy your own!

Proton Cookies at CERN Open Days



1800 cookies served

Katharine Leney



Proton Cookies at CERN Open Days

Feedback received:

- Adults appreciated that they could spend 2-3 minutes on an activity and leave having learnt something.
- Mixing quark colours together worked well - forced people to think about getting the right combination of M&M's.
- Younger or less confident children could be handed the right quarks.
- Almost every visitor took a photo of their cookie.



Proton Cookies at CERN Open Days

Activity worked well with all demographics and can be easily tailored to different audiences.

"Everything in the world is made of tiny particles"



Image: CERN

"Protons are made of particle called quarks"



Image: Alison Elliot

"Pentaquark discovery!"



Image: Caterina Doglioni

Proton Cookies - a cheap, portable activity

Expanding Your Horizons (November 2019): Reached 400 girls, aged 11-14, at an event encouraging them to consider careers in STEM fields

Variant for Girl Scouts (2017): Make two protons, collide them, and detect the remnants in your mouth.



Image: Catrin Bernius

Possible variant for older students: make different mesons and baryons (REAL flavour physics!)

Education

Feynman Diagram Cookies

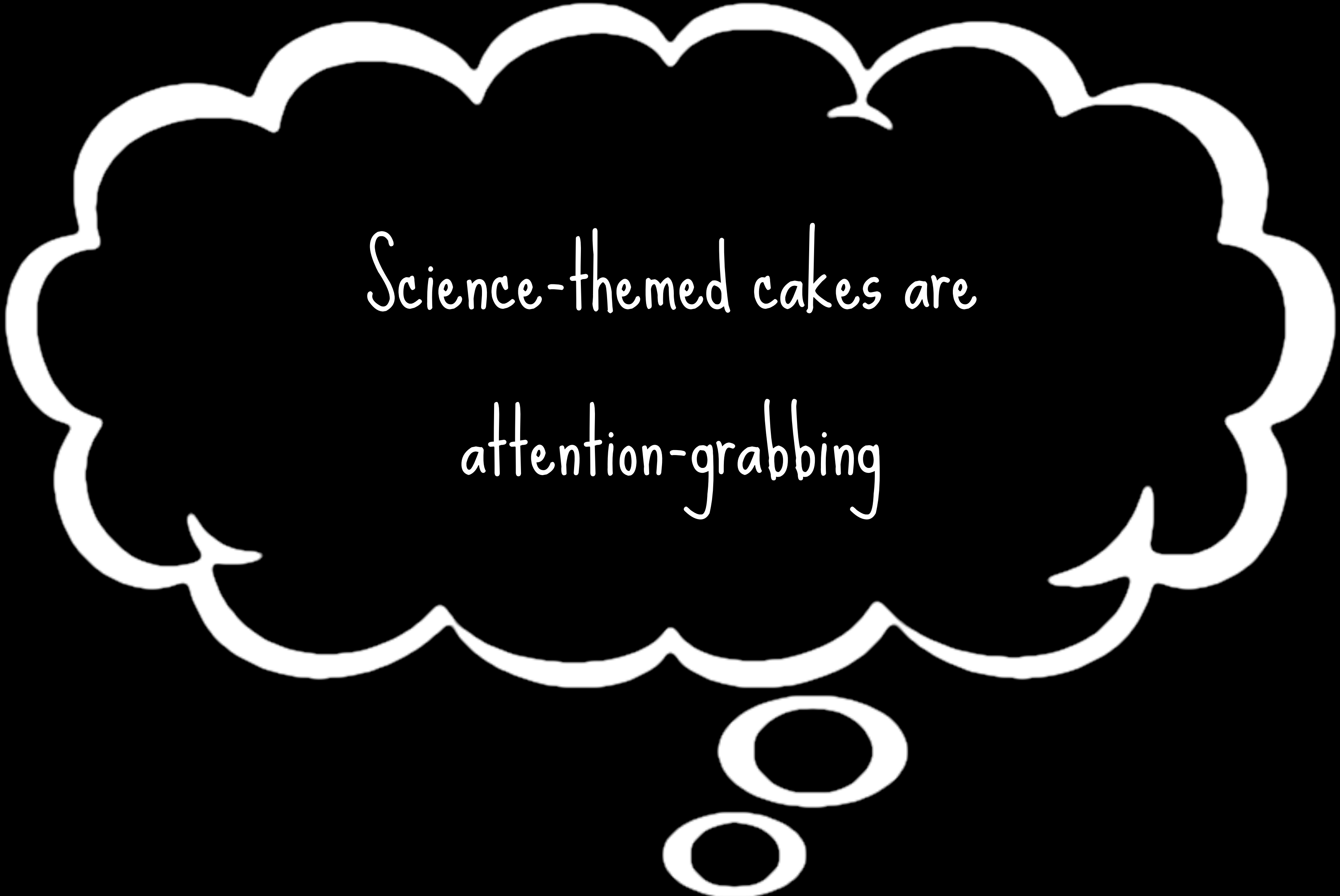


Feynman Diagram Cookies



California State University (East Bay) undergraduate particle physics exam

Media engagement



Science-themed cakes are
attention-grabbing

Talk by Flavia De Almeida Dias

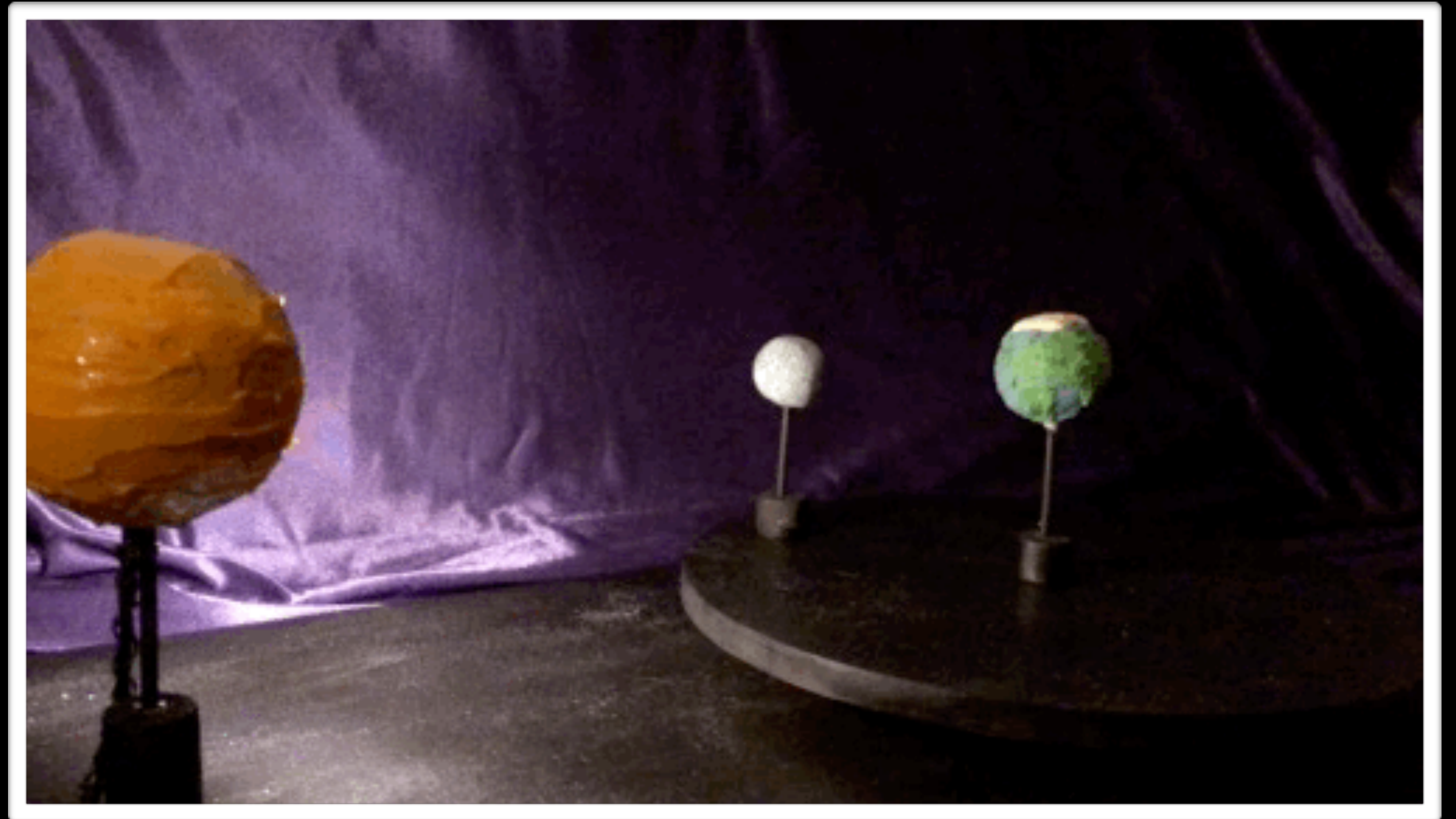
LGBTQ STEM Day (2018)




- Cake for LGBTQ CERN group charity bake sale for LGBTQ STEM Day
- Most popular post from @PhysicsCakes Twitter account (2.8k ❤️'s)
- Trended on #LGBTQSTEMDay hashtag

Centenary of 1919 eclipse

Diorama of solar eclipse using cake pops to celebrate the centenary of the 1919 solar eclipse, which allowed for the first experimental validation of Einstein's general theory of relativity.



Featured in The New York Times, "Celebrating the Eclipse That Let Einstein Shine"



Cake is often associated with
celebrations...

ATLAS & CMS 25th Birthday Celebrations



- Coordinated with ATLAS and CMS outreach teams on cake design for 25th birthday celebrations..
- Posted by CERN on social media and cover photo for article.
- 1.9k likes on Facebook, +500 likes and +180 retweets on Twitter.

CERN 65th Anniversary Celebration



CERN @CERN · Sep 29, 2019

Happy 65th Birthday CERN! 🎉

🍰 What better way to celebrate than with Standard Model? (Cooking and image by @PhysicsCakes)

Find out more about the Standard Model of particle physics: home.cern/science/physic...



82

626

1.5K

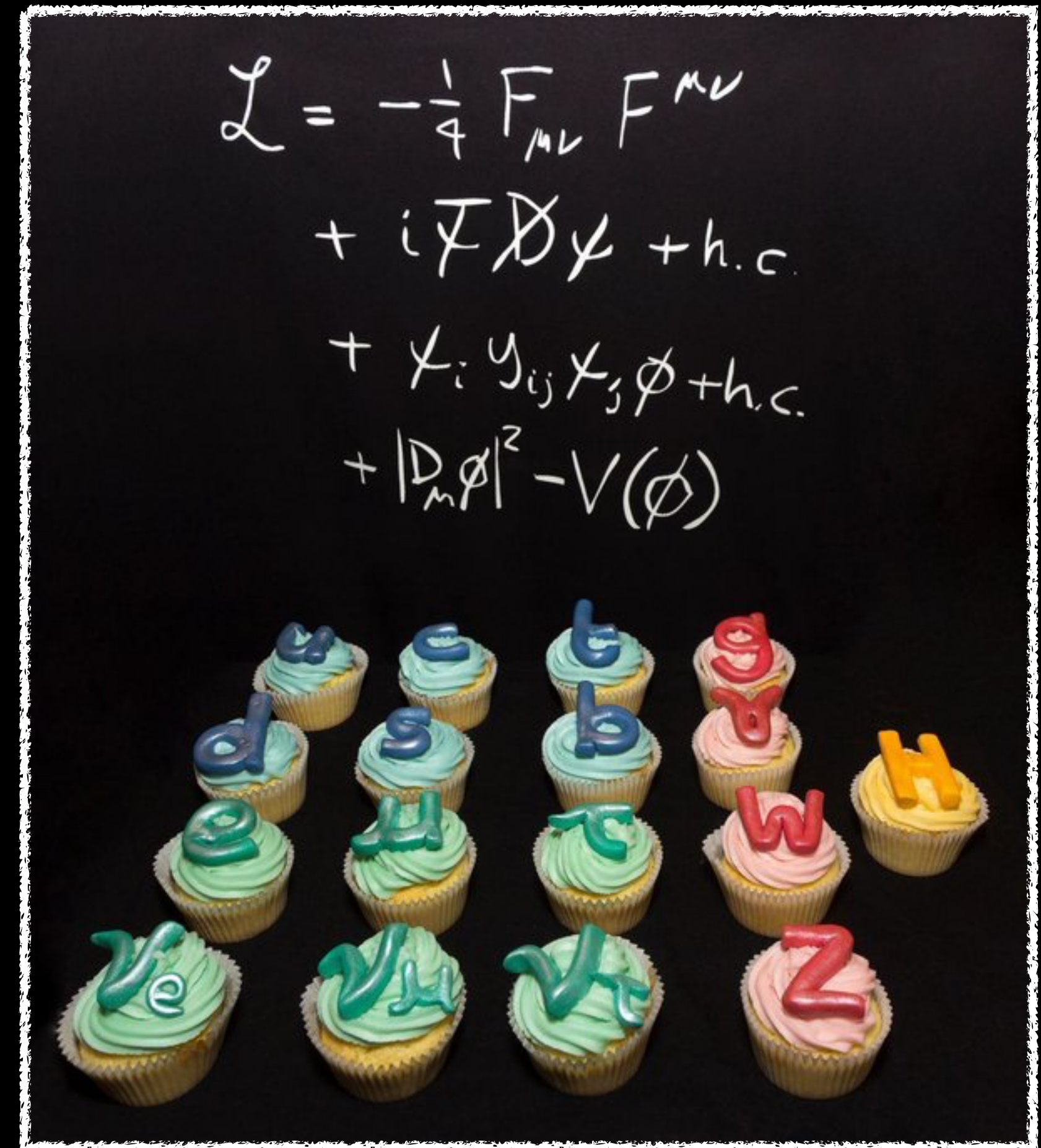


Image: David Morse

Higgs Discovery Anniversary



ATLAS detector cake used for Higgs boson discovery anniversary post on ATLAS social media.

Media Coverage

- A Taste of Particle Physics, Symmetry Magazine, February 2019
- Se l'universo va in pasticceria, La Repubblica, February 2019
- Celebrating science by the slice, Chemical & Engineering News, May 2019
- Have Your Science And Eat It: Scientific Research As Cakes, Forbes Magazine, December 2019

Katharine Leney

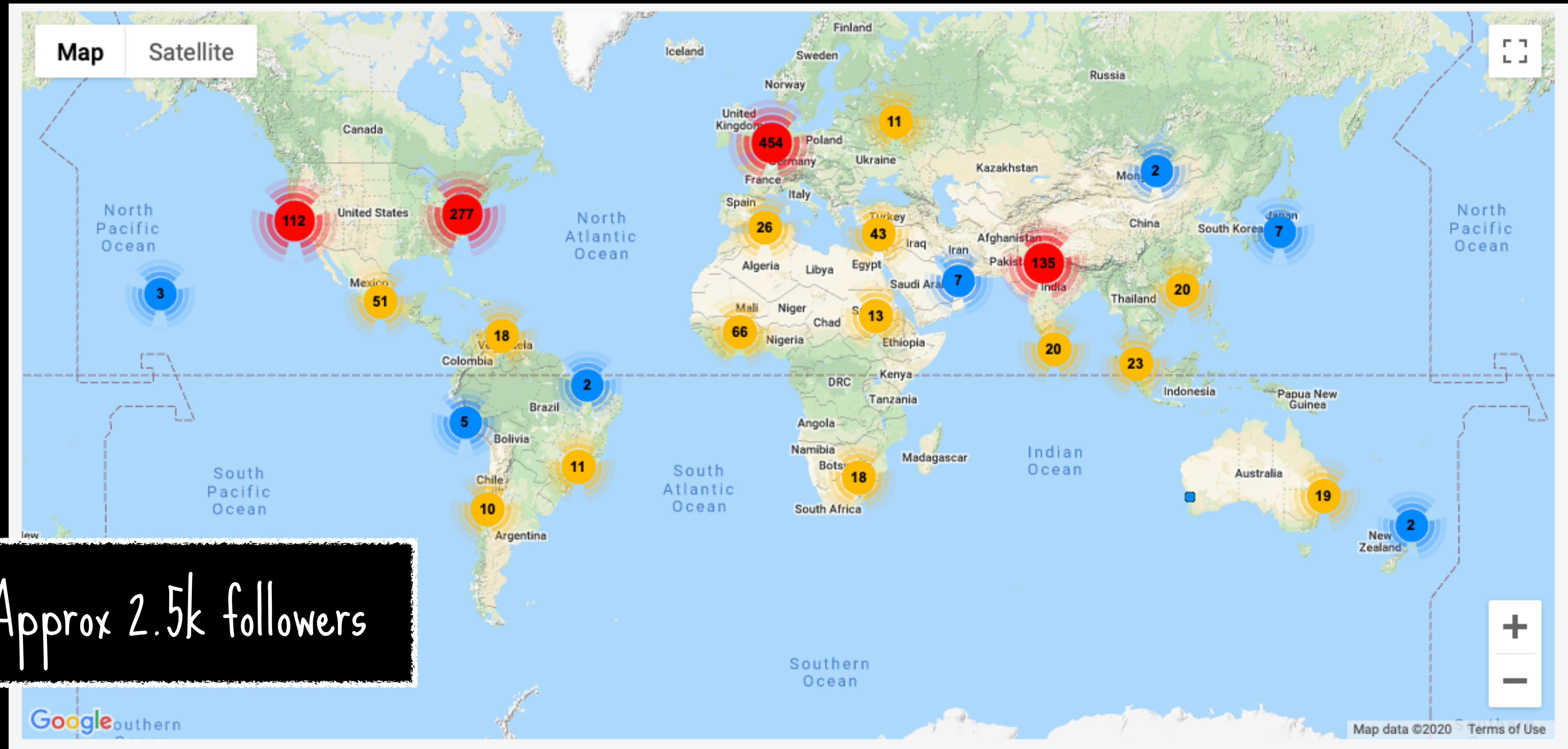




Can cakes help us reach new
and non-typical audiences?

Social Media

@PhysicsCakes Twitter

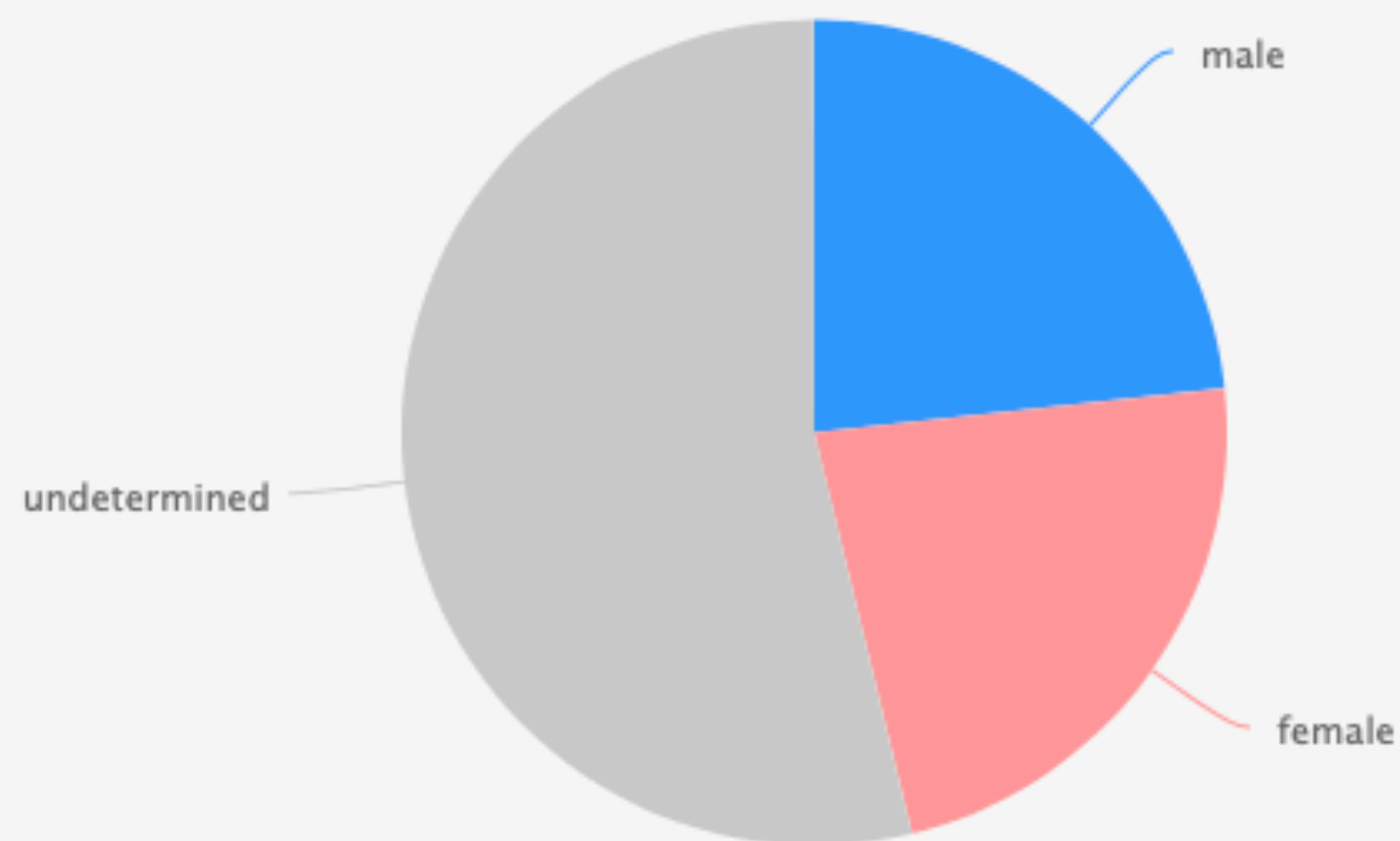


Approx 2.5k followers

@PhysicsCakes Twitter

Inferred gender of PhysicsCakes's followers

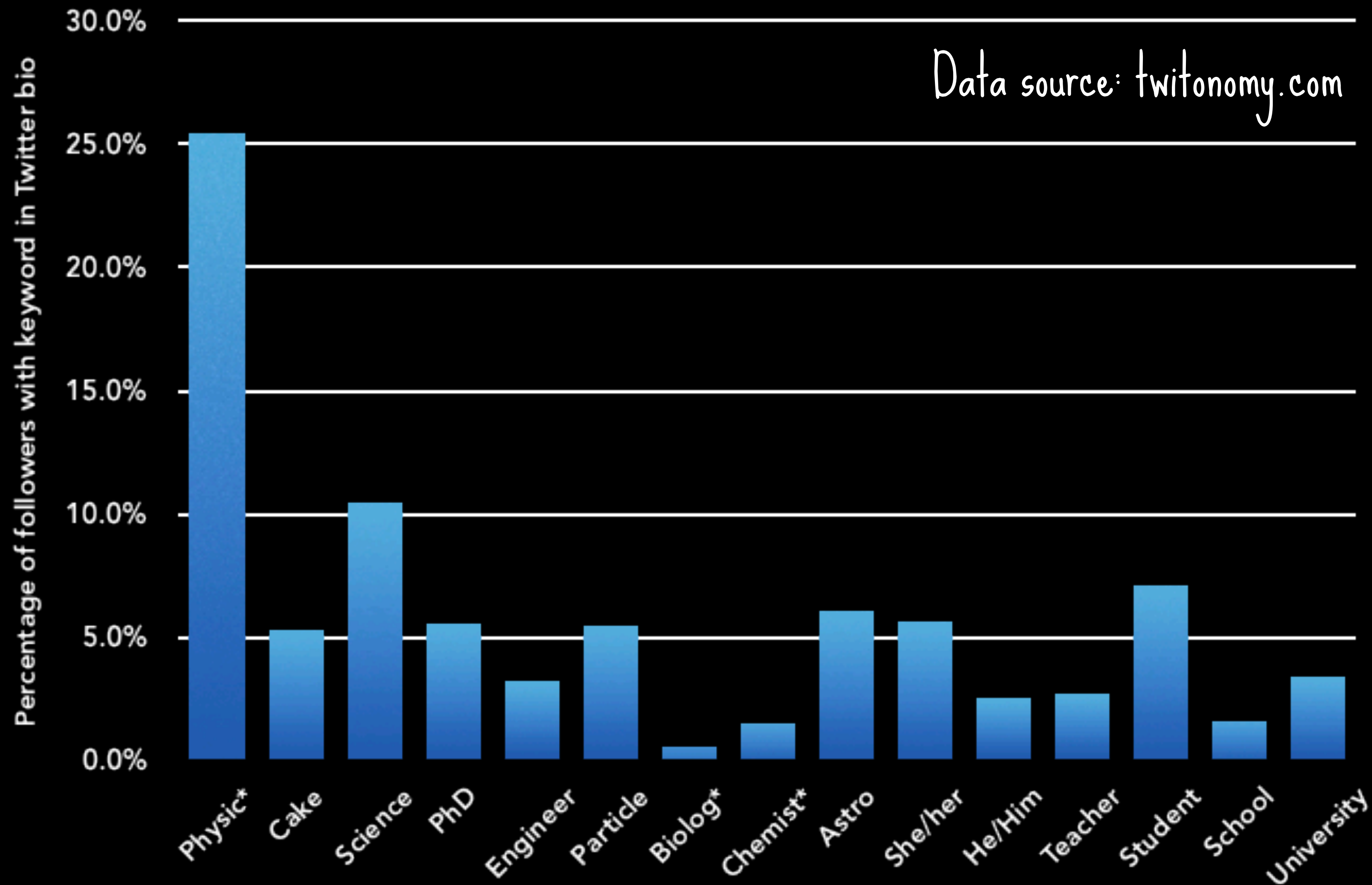
Based on an analysis of users' profile data, when applicable and available, we guess their gender.



Breakdown

592	23.3%	male »
580	22.9%	female »
1,364	53.8%	undetermined »

@PhysicsCakes Twitter



Future Plans

Physics Cakes - the book

- Aim to publish a book with approx 15 original recipes for physics-themed bakes.
- Each recipe contains some information about a physics topic, and instructions so that the reader can bake their own version.
- Aimed at people with an interest in particle physics, but no specialist education.

Photographer: David Morse (CMS physicist)

www.davidmmorse.com



Image: David Morse

Summary

- Demonstrated that cakes are a fun, quirky way to communicate physics topics in a light-hearted way.
- Created new recipes where people can learn about physics while baking/eating the cake.
- Physics-themed cakes can be a good way to grab people's attention, e.g. on social media, or as a hook for articles.



Image: David Morse

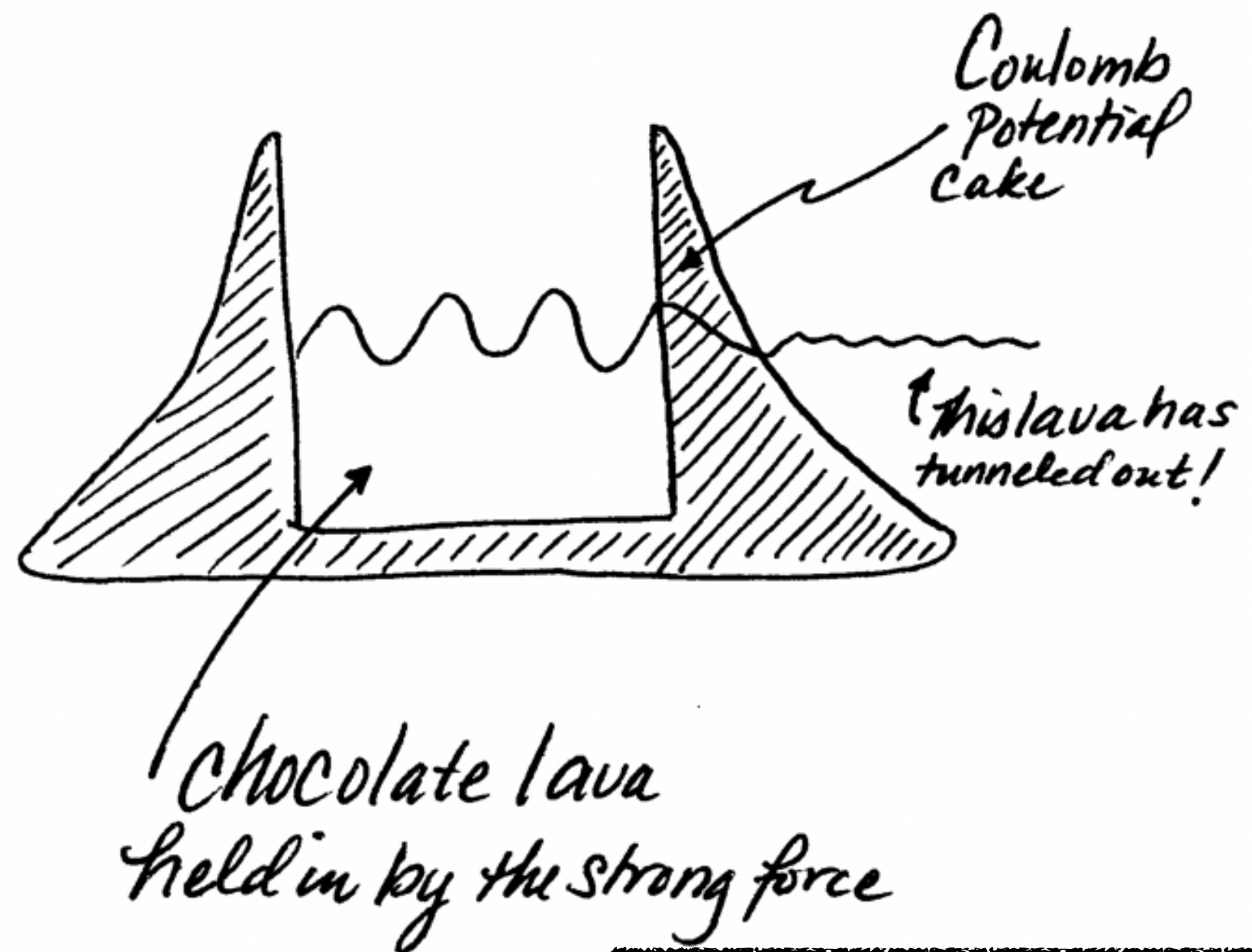
The End



Chocolate Lava Nuclear Potential

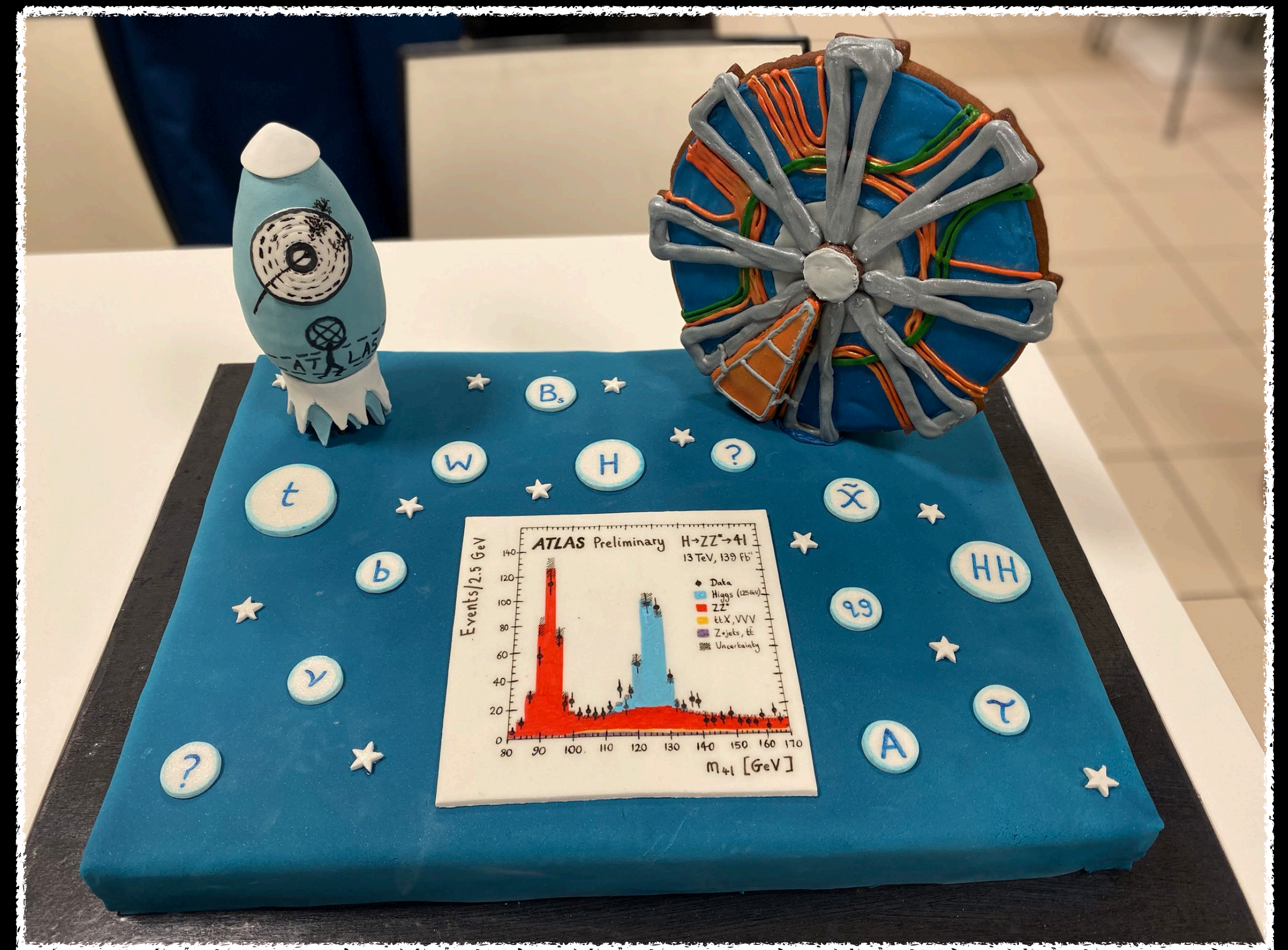
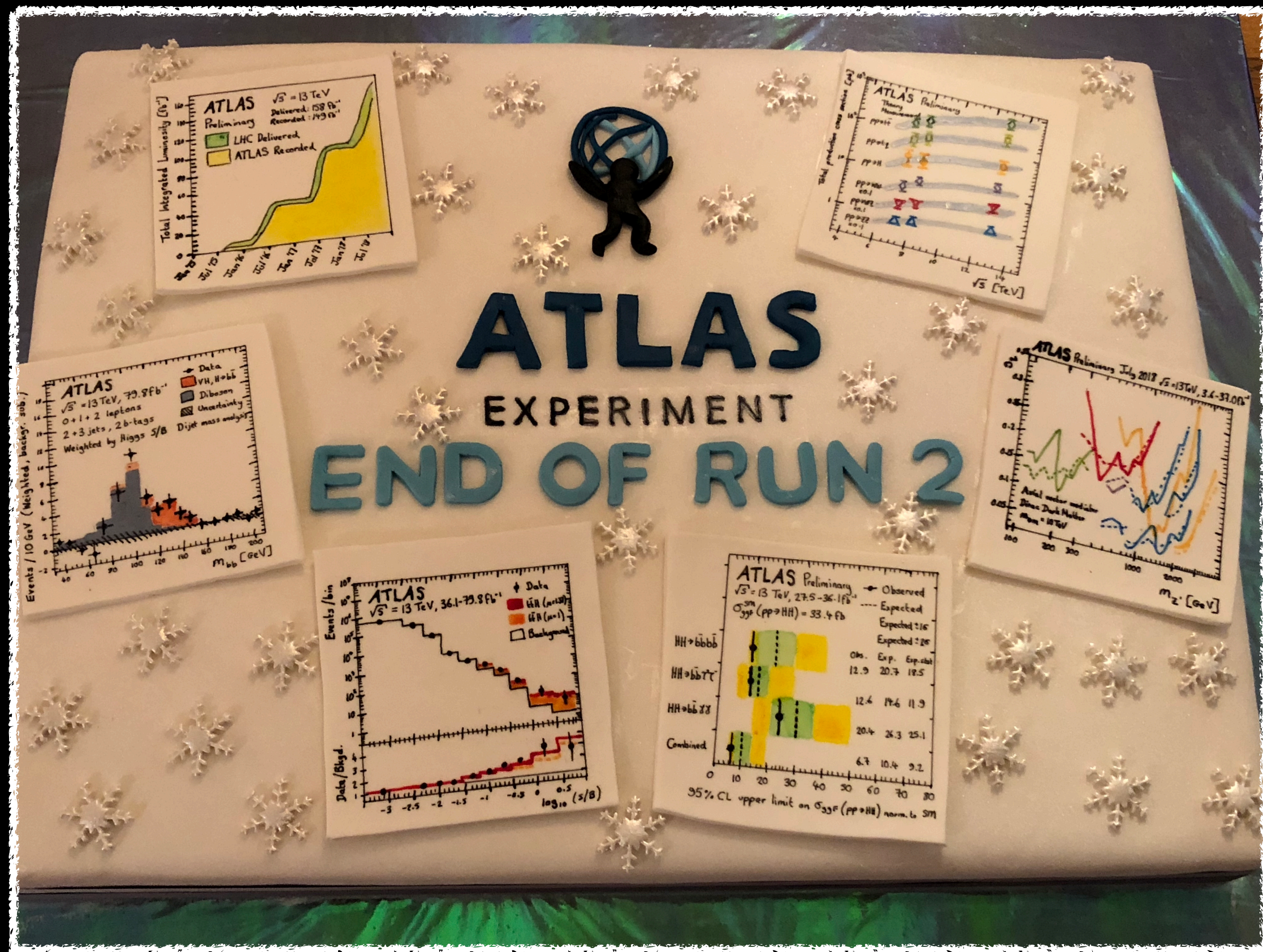


Chocolate lava nuclear potential cake
(modeled after alpha emission in Uranium 238)
Will the lava make it out of the cake?!
Probability is non-zero!



Handout for CalState East Bay physics students

ATLAS End Of Year Celebrations



Abstract: A novel approach to science communication is presented, using cake to explain particle physics ideas to engage new audiences. This talk will present a public engagement strategy where baking has been used to engage the general public, in events such as the CERN Open Days in 2019, and using online platforms such as social media. This innovative approach using the juxtaposition of cake and physics makes for a fun and memorable experience, and has been demonstrated to engage new and low science capital audiences and spark their interest in particle physics.