Dark matter introduction

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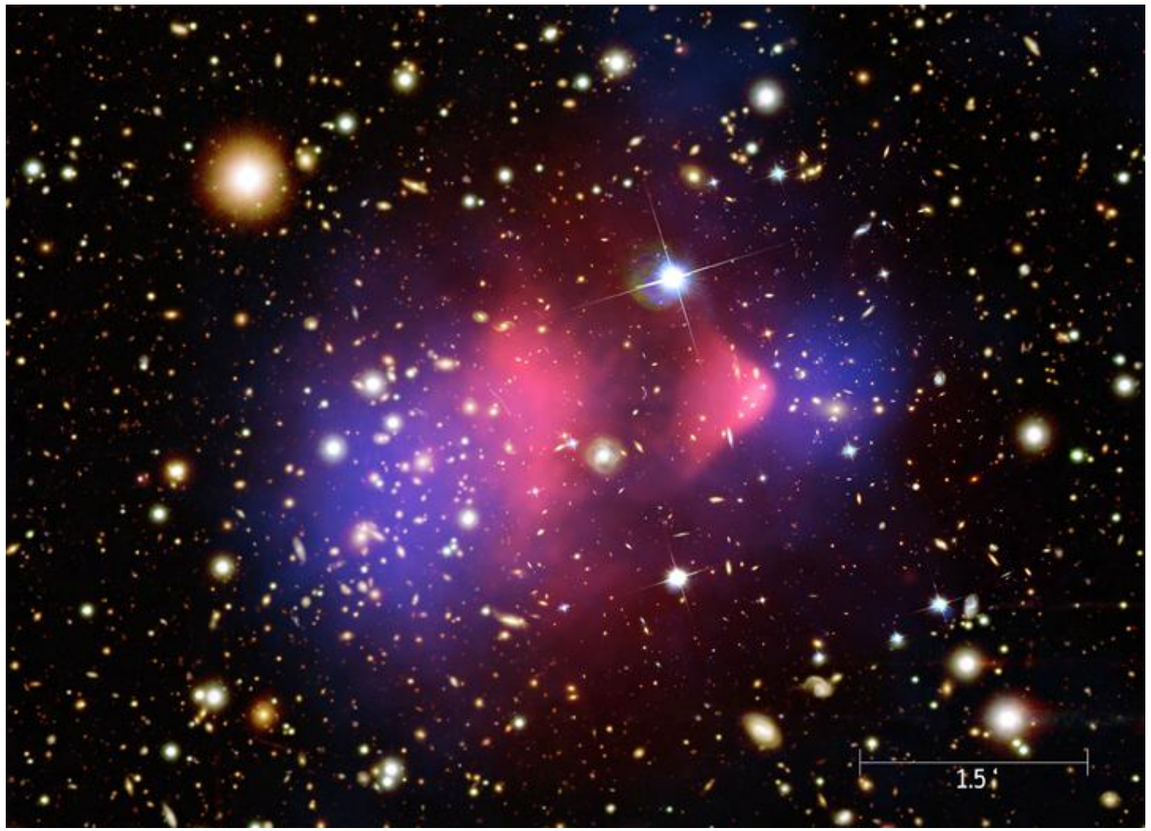
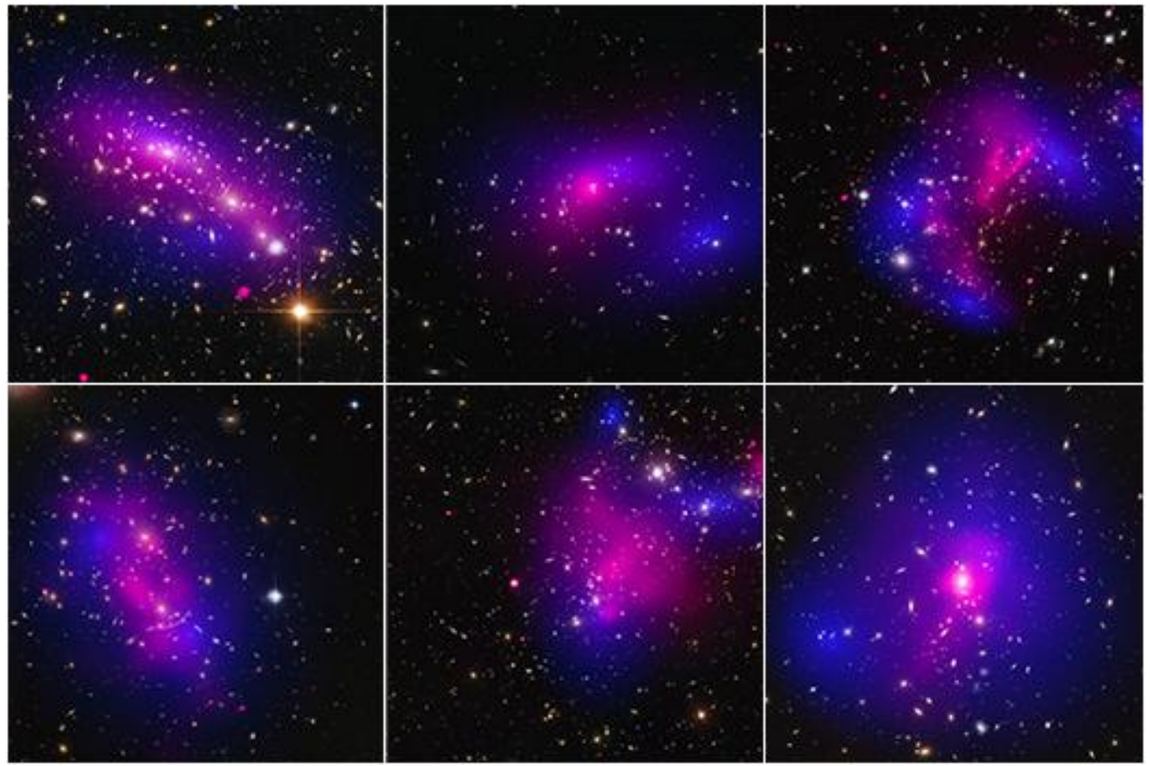
Are we sure about Dark Matter?

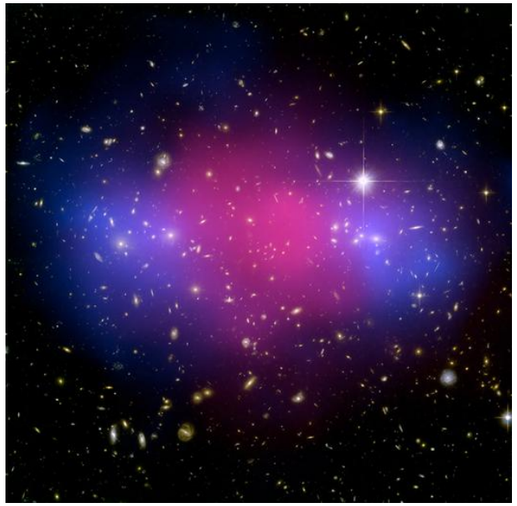


- The Bullet Cluster
- This is my least favourite evidence for dark matter in astronomy (sorry!)
- … it is also one of the most striking illustrations where we can 'see' dark matter
- My issue: one example cannot prove a systematic overabundance of material in the universe

Bullet Cluster continued



http://chandra.harvard.edu/press/15_releases/press_032615.html



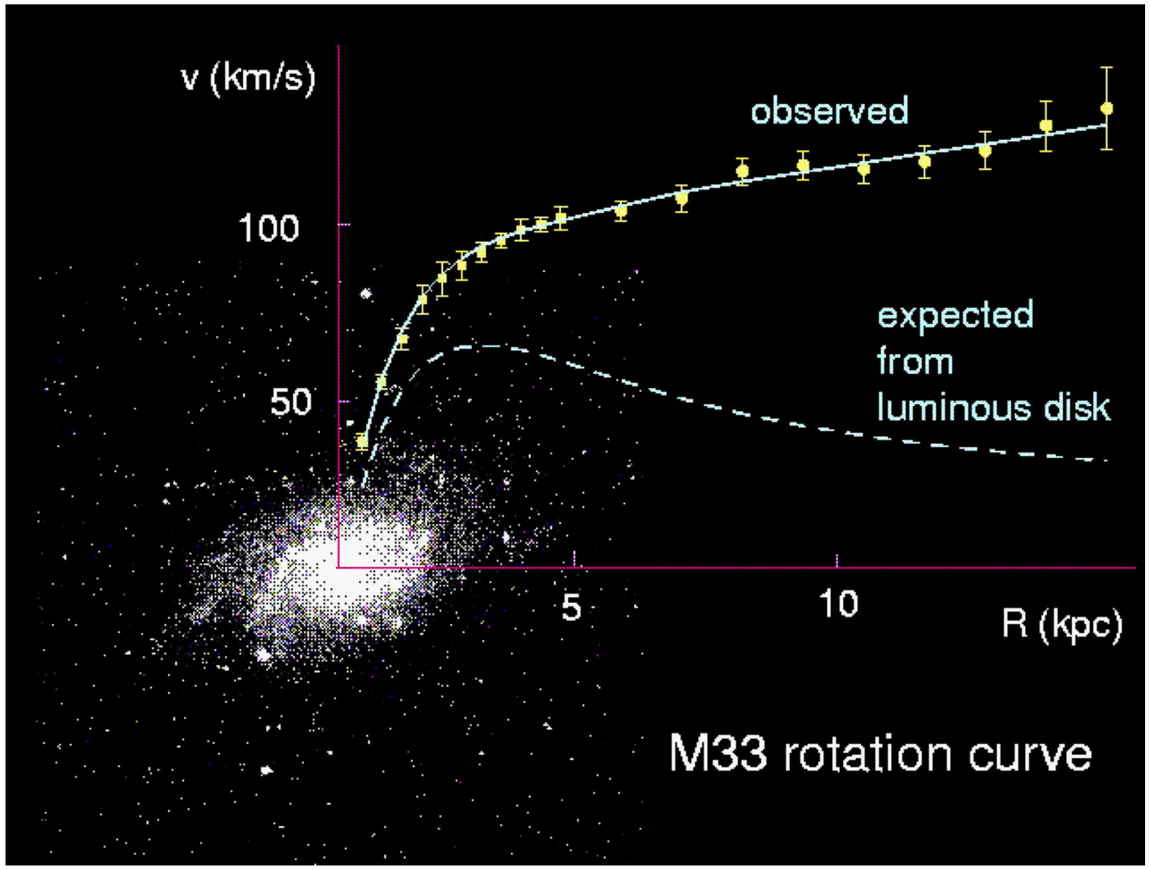
- Actually, there are a lot of colliding clusters like the bullet cluster.
- 72 similar clusters being studied by NASA & Chandra
- Giving a more systematic look at dark matter distributions on cluster scales

Galactic rotation curves

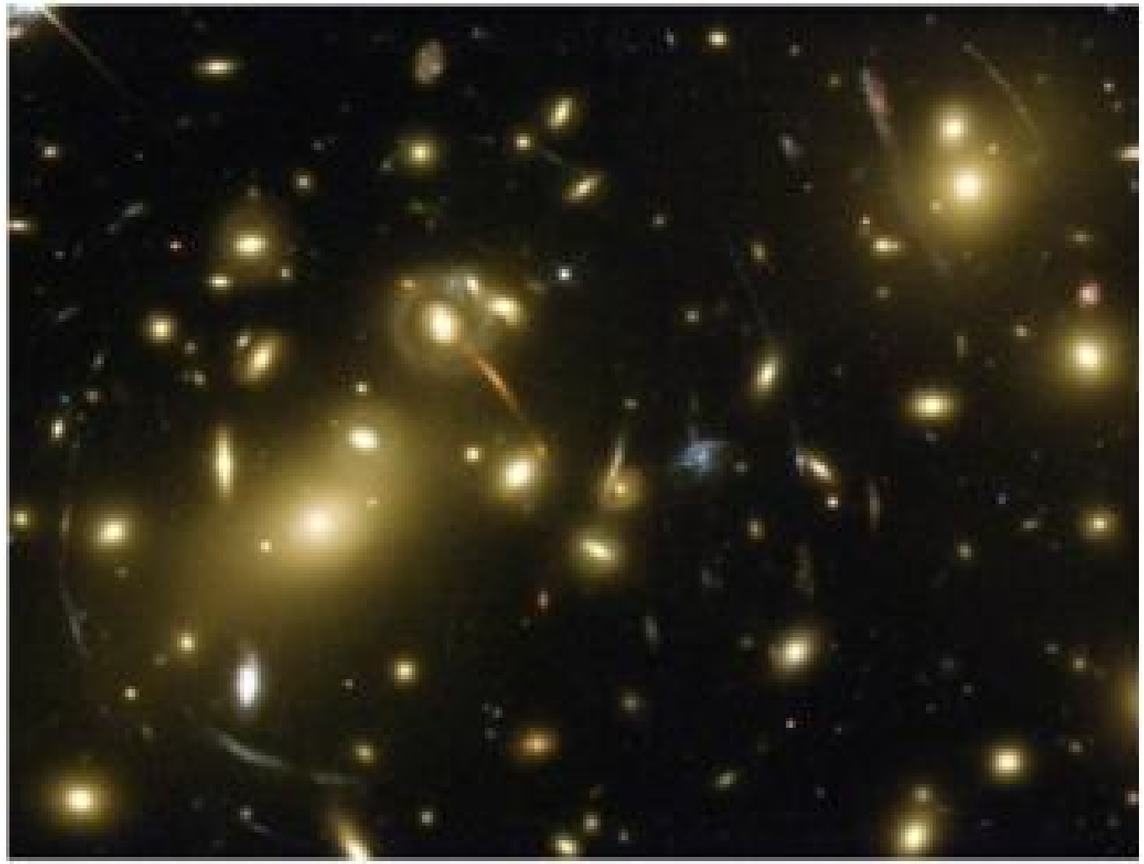
- As a random thought analogy:

  Think about riding your bike around a roundabout – the faster you go, the more grip (force) you need to keep you from being thrown out of the roundabout!

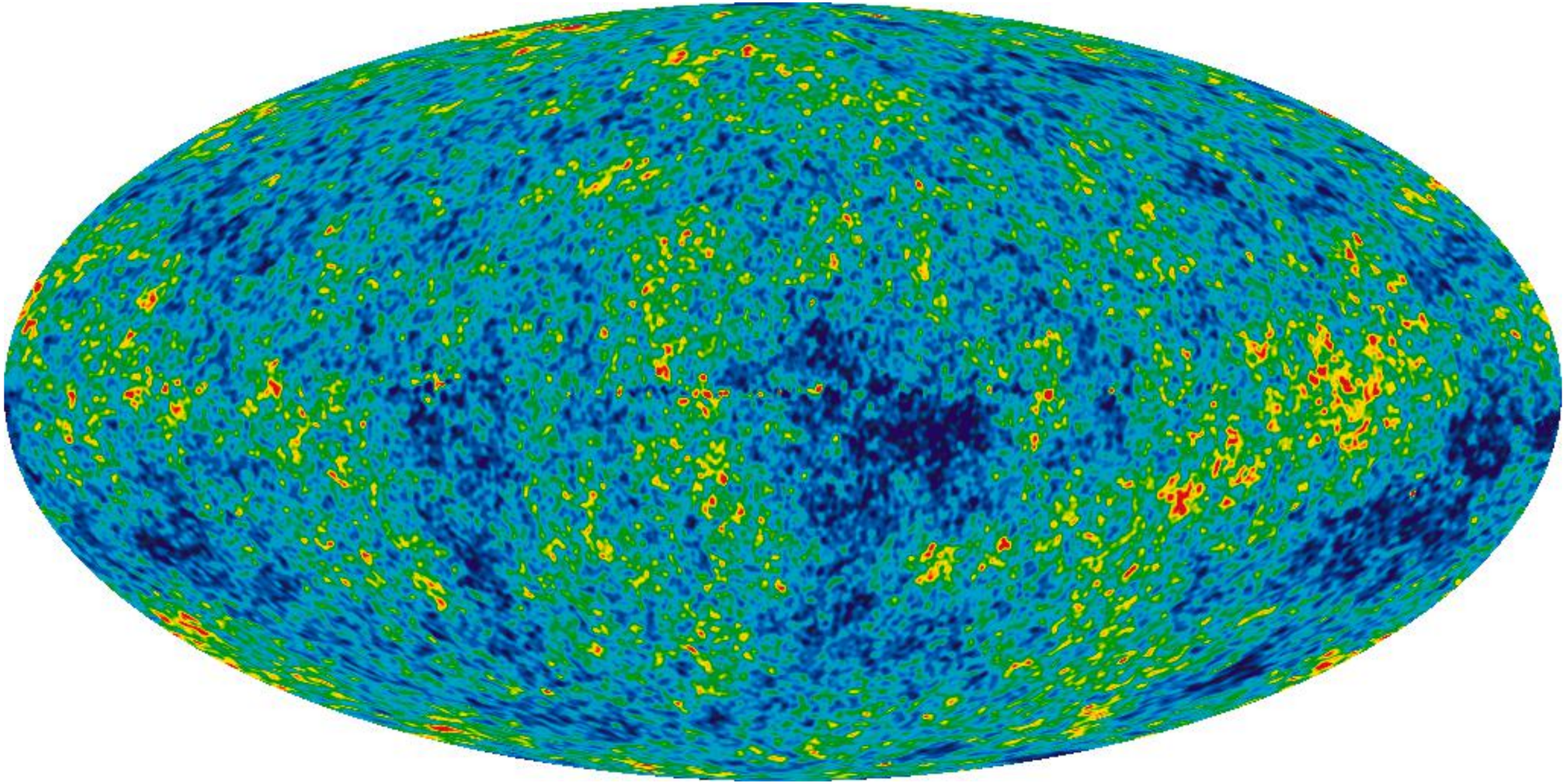
- If the stars are going **that fast** and not being hurled out of the galaxy, there is some extra gravity (force!) keeping them in there



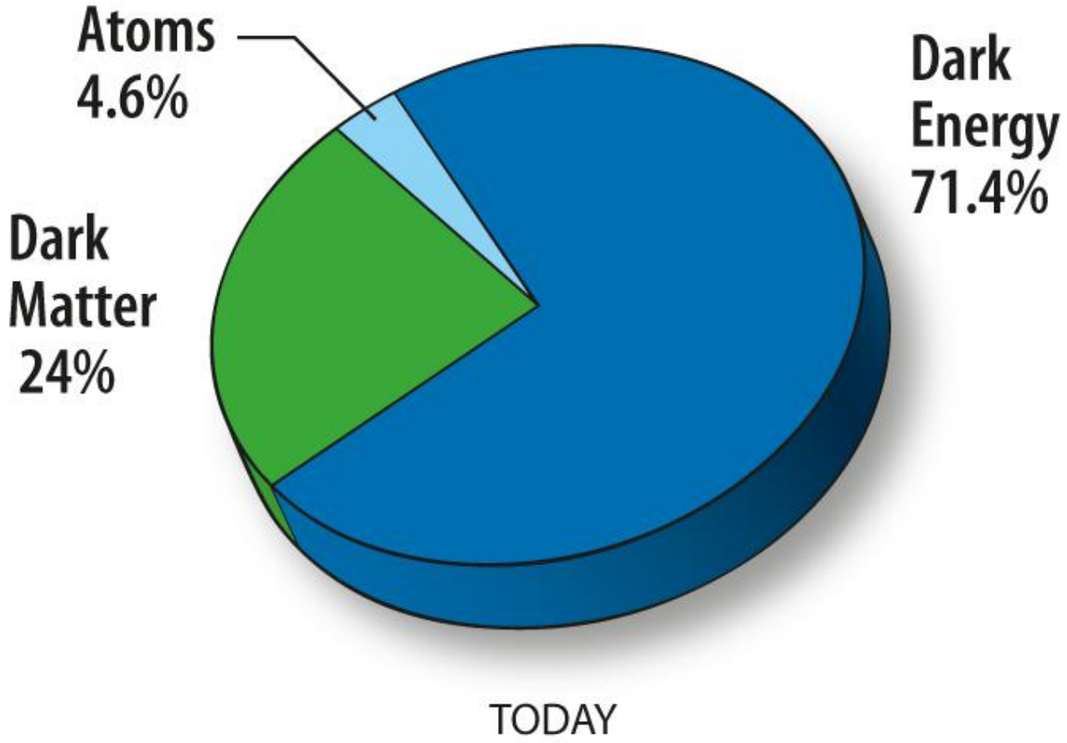
Galaxy Cluster lensing and rotation curves

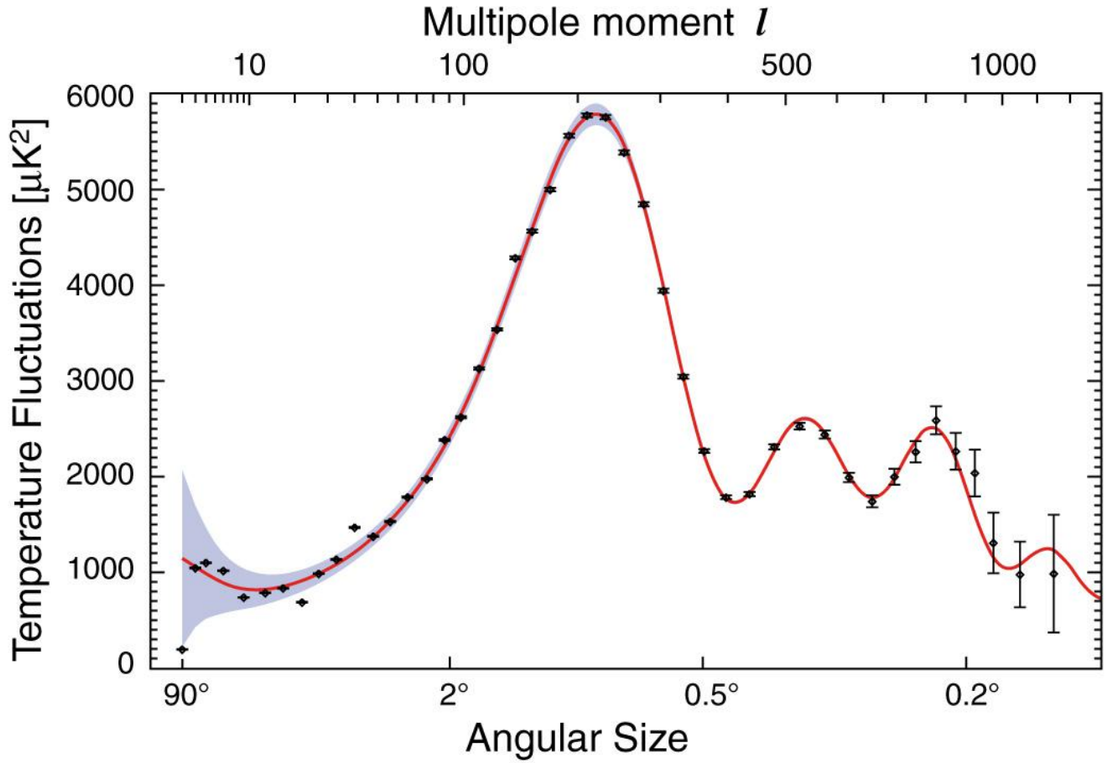


Large scale structure and the CMB



What does it all add up to?





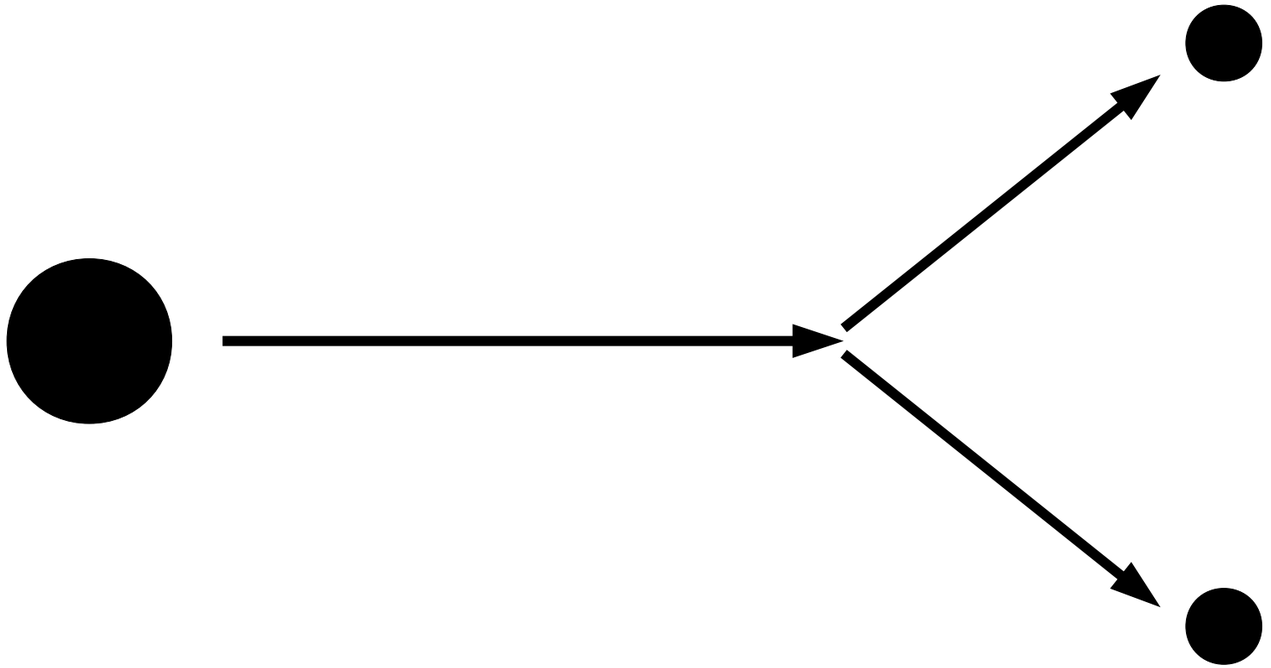
How do we find out what all this Dark Matter is?

I am a particle physicist

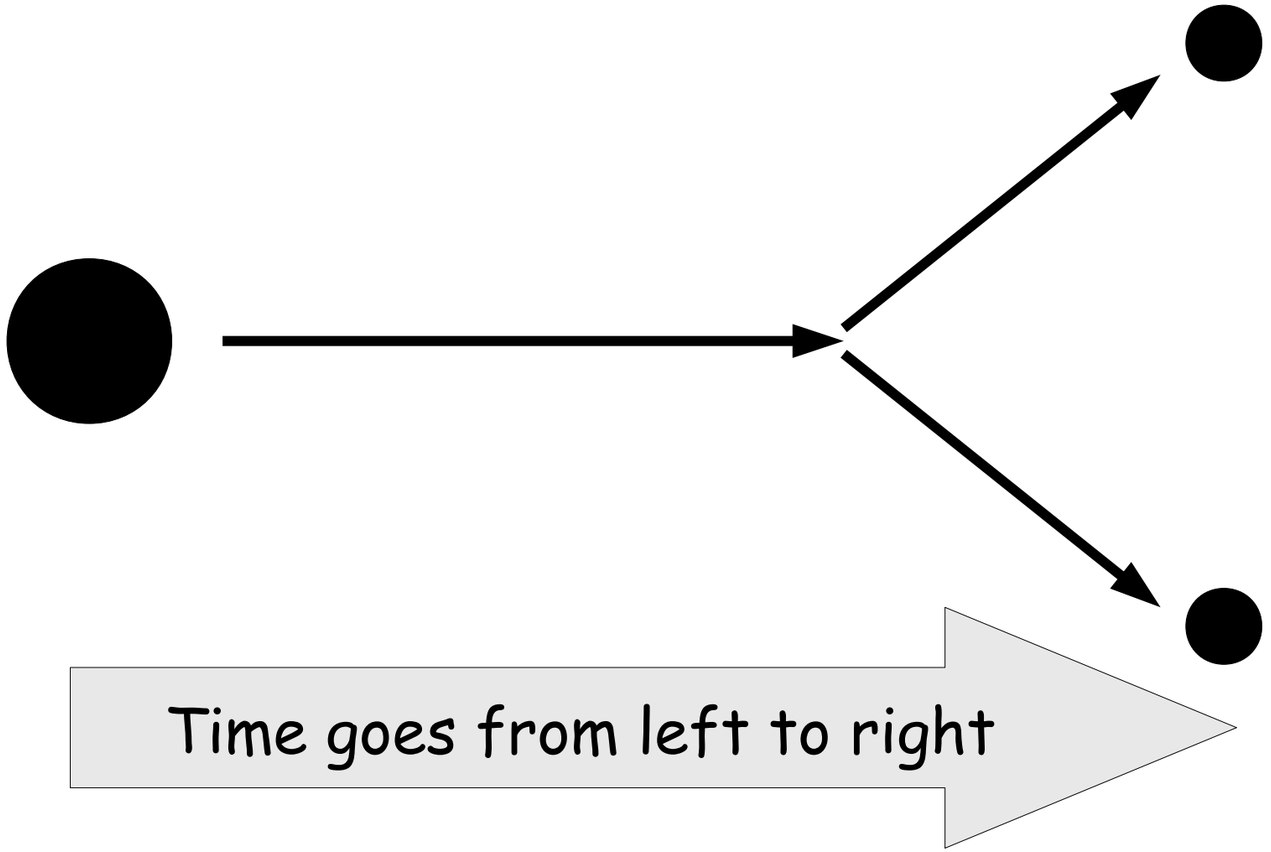
I search for dark matter as a new kind of particle.

I use something called a **Feynman diagram** to study interactions between the particles I know... and the particles I am searching for

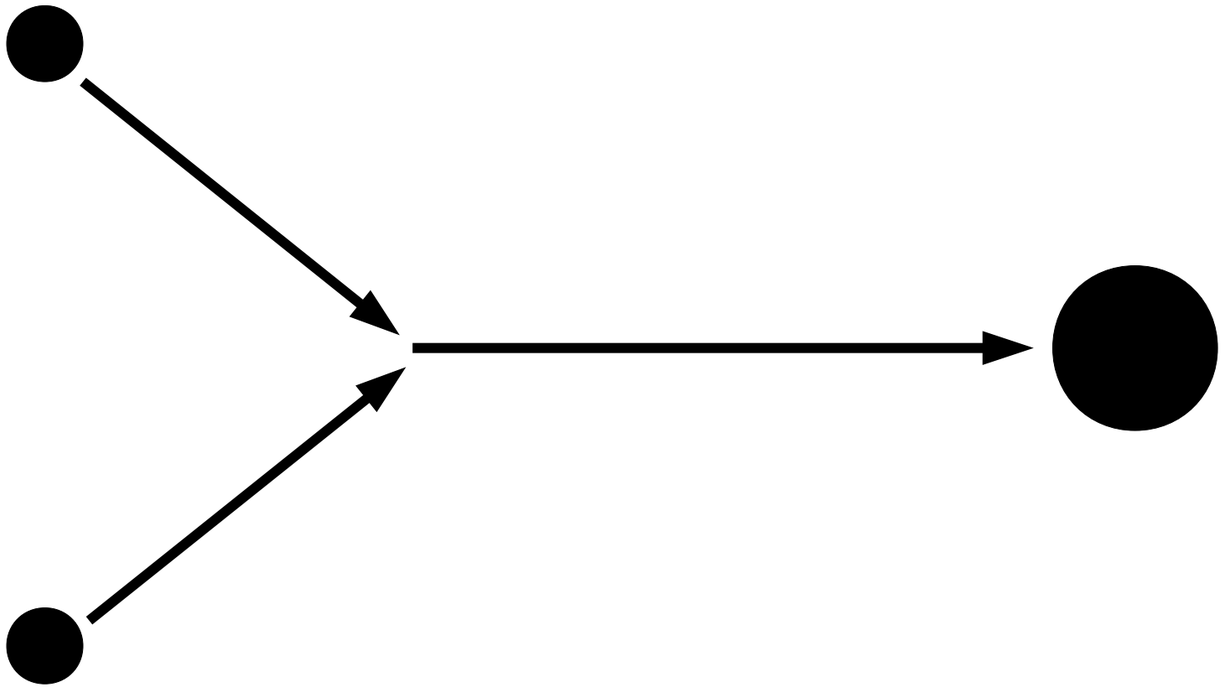
Particle decay



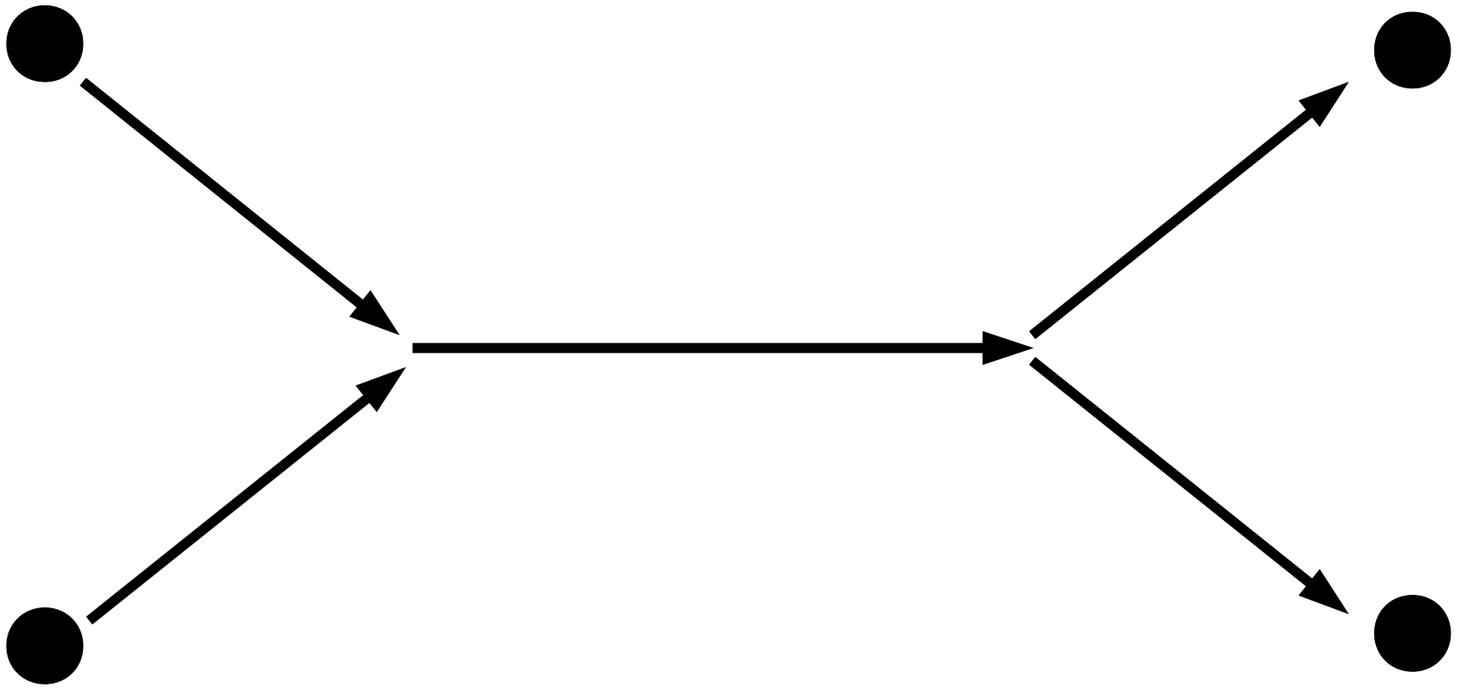
Particle decay



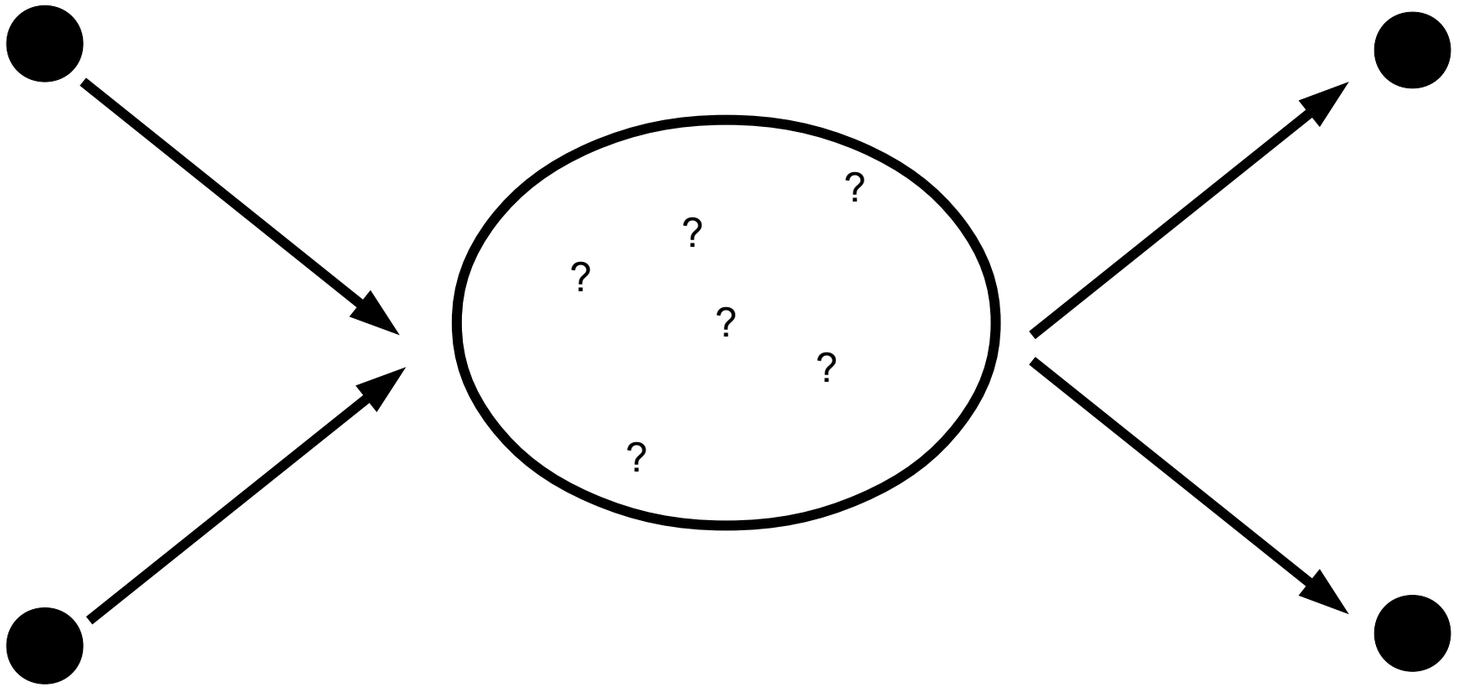
Particle production



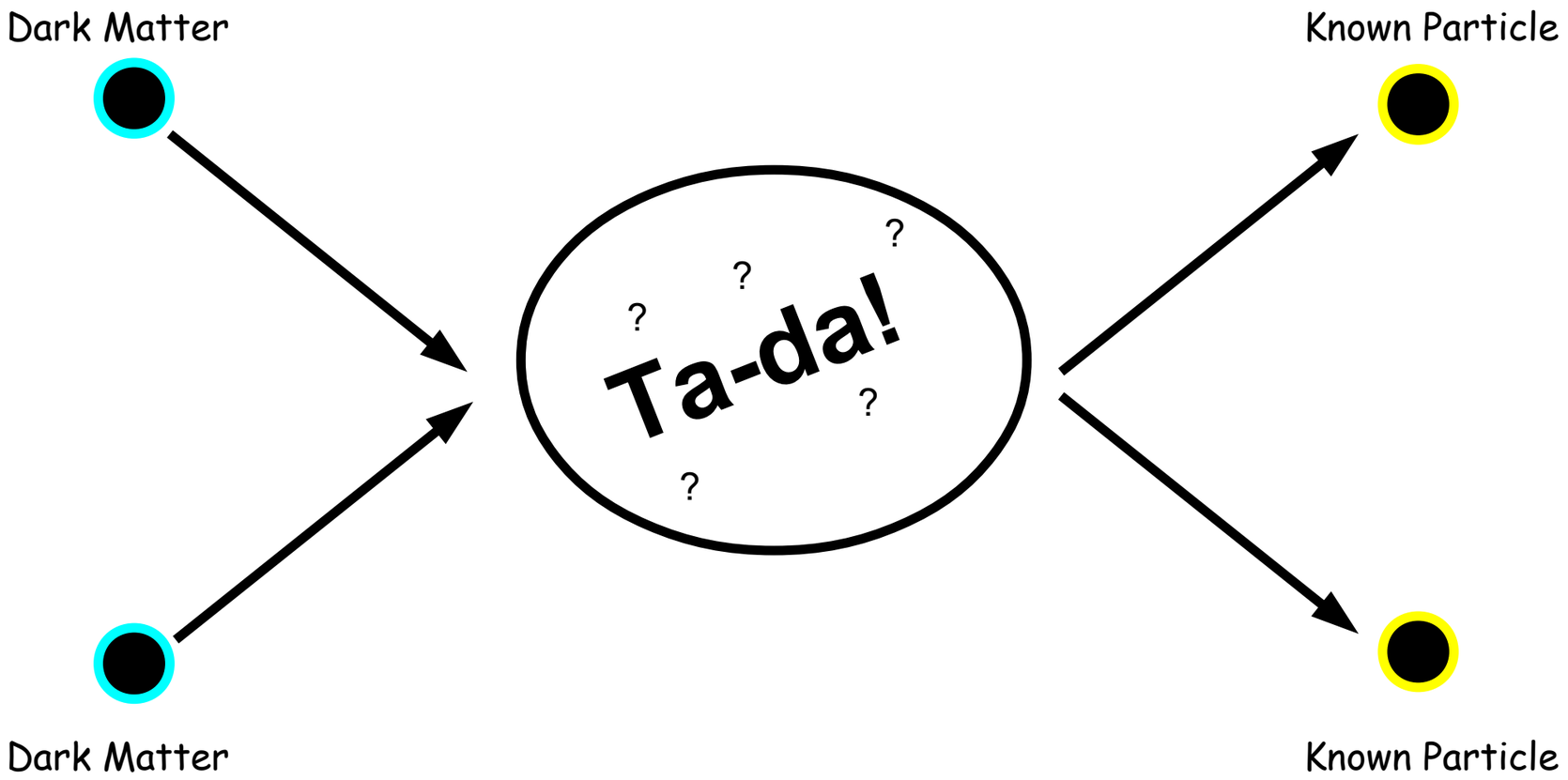
Particle interaction!



Interaction we don't know about

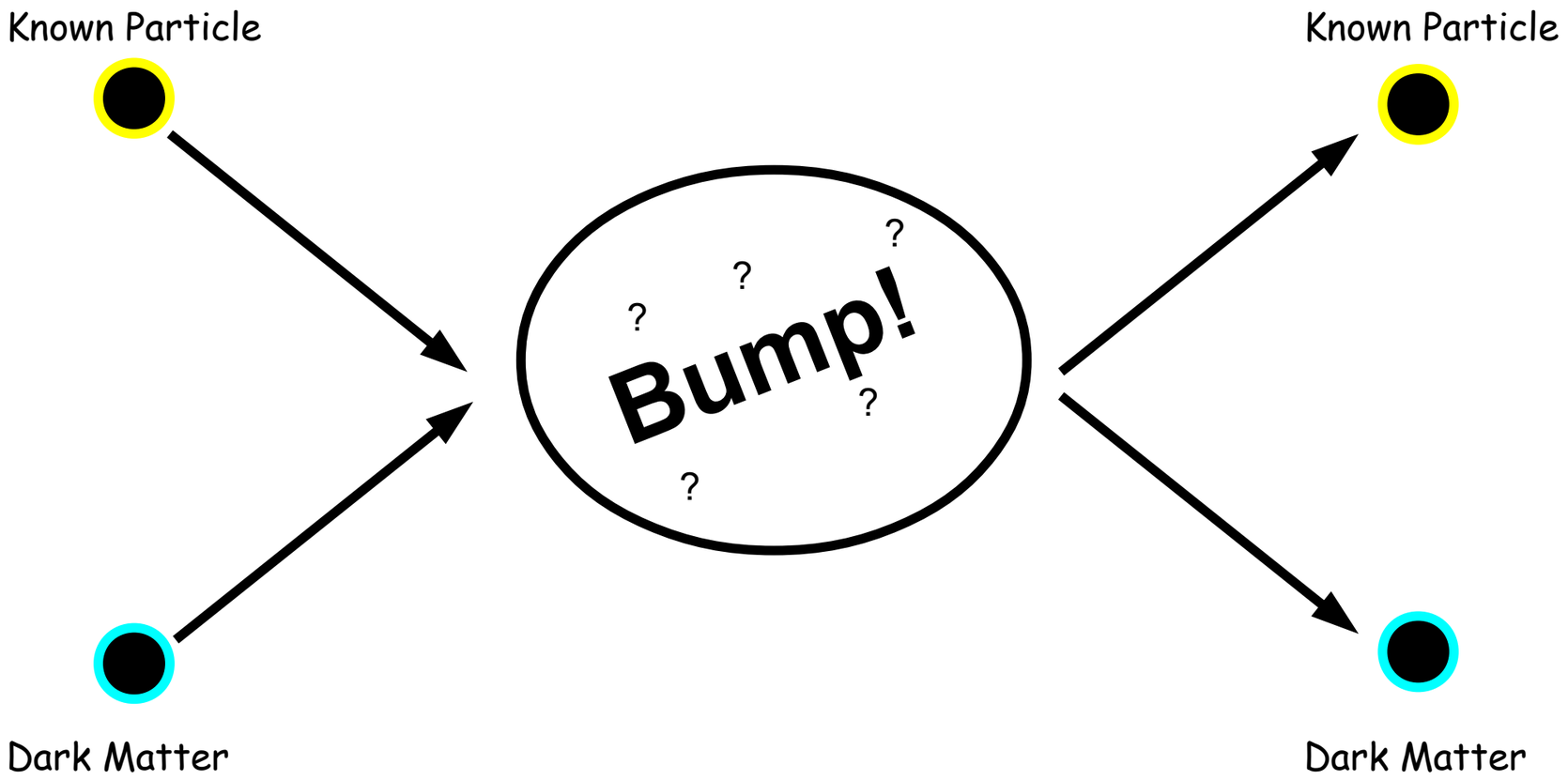


Dark matter annihilation



By Adam Evans - M31, the Andromeda Galaxy (now with h-alpha)Uploaded by NotFromUtrecht, CC BY 2.0,

Dark matter direct detection



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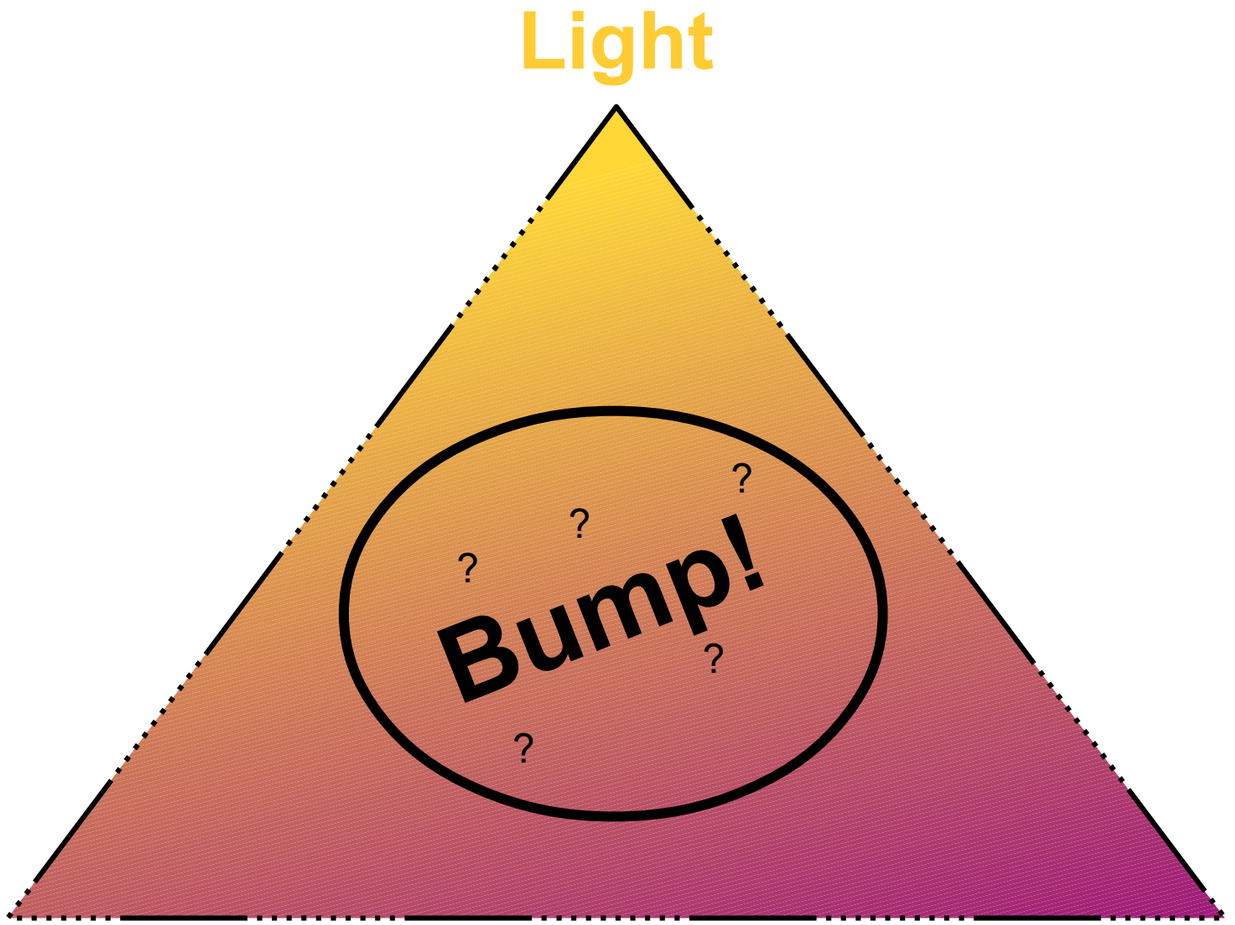
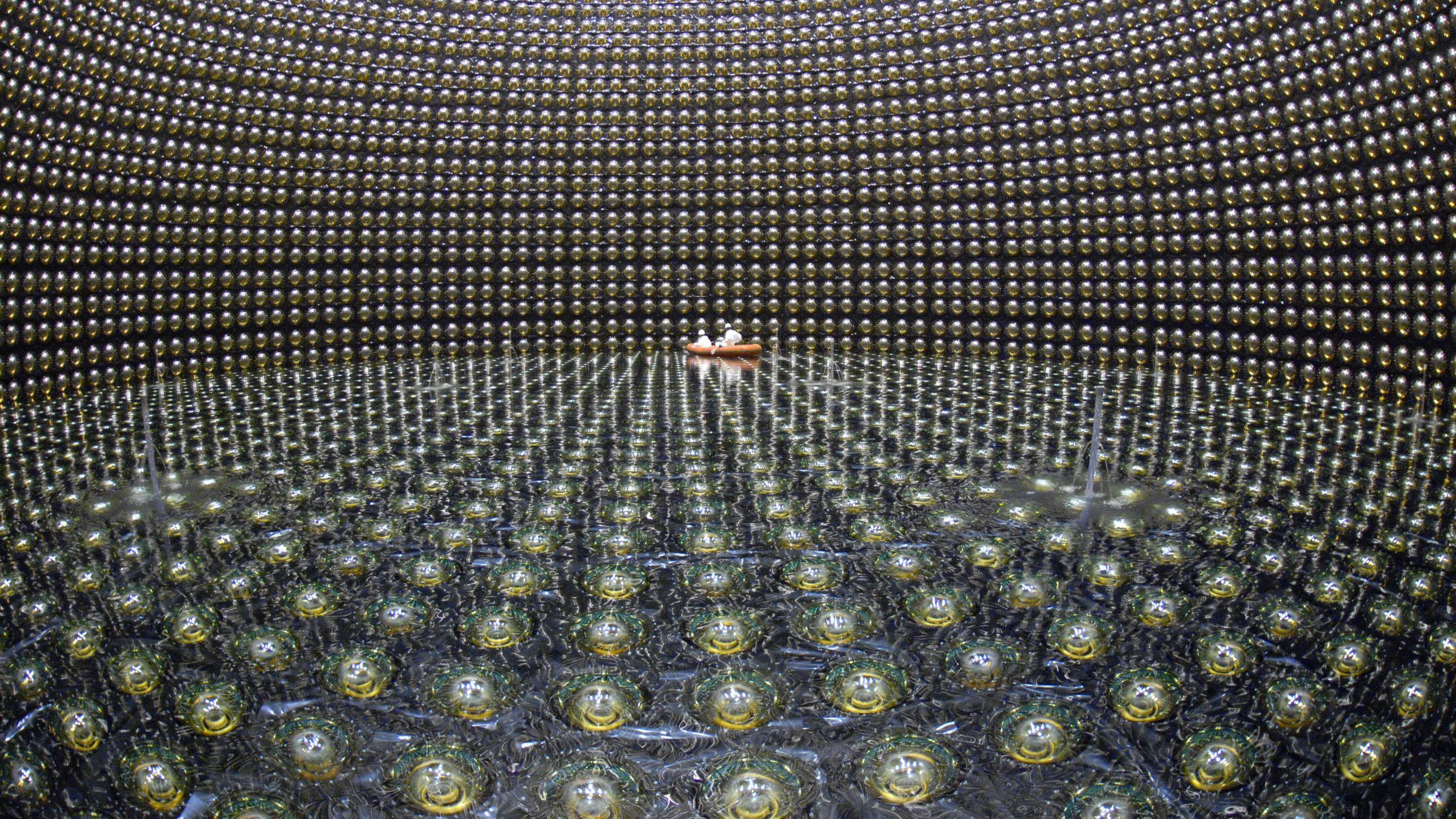
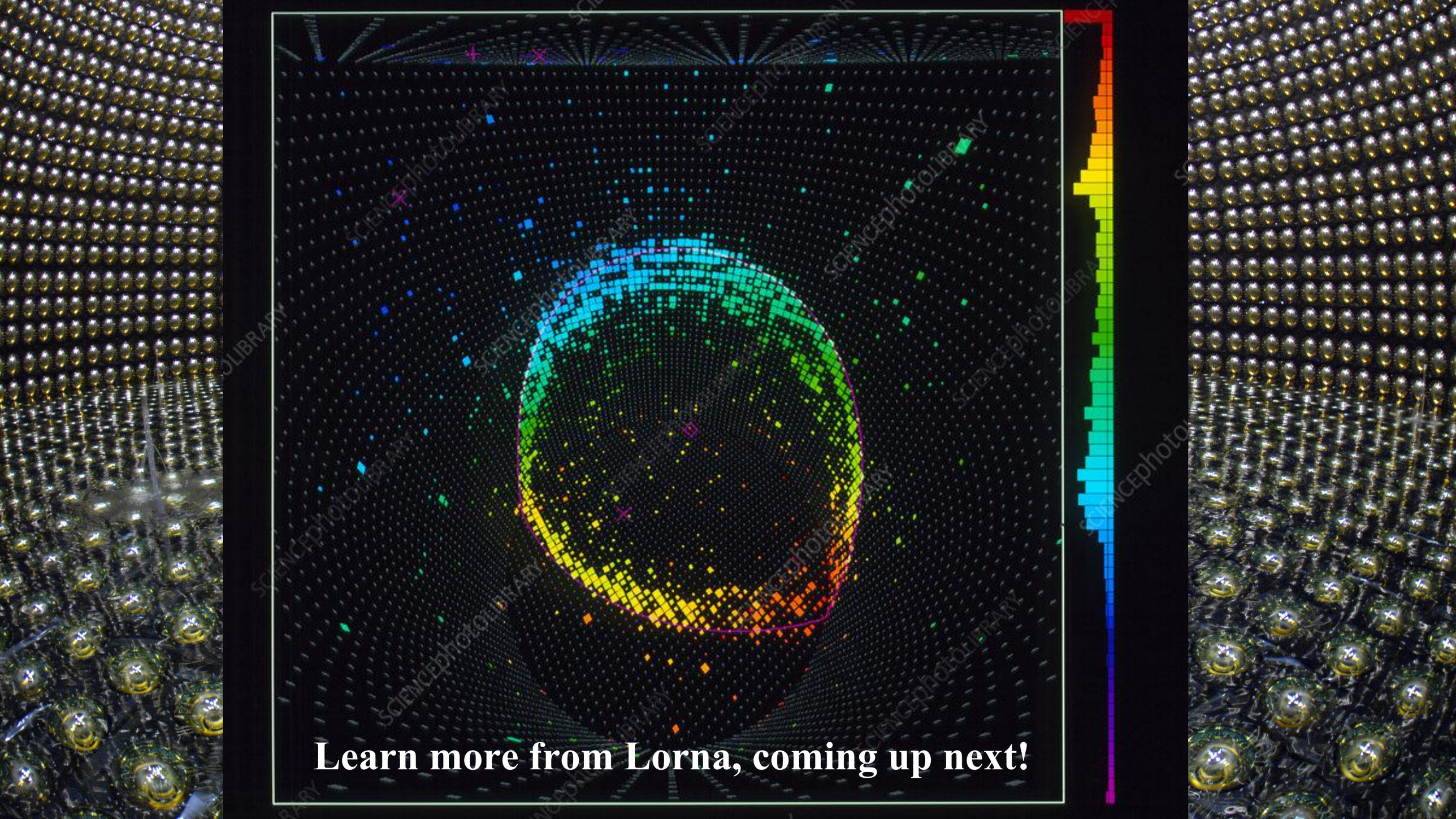
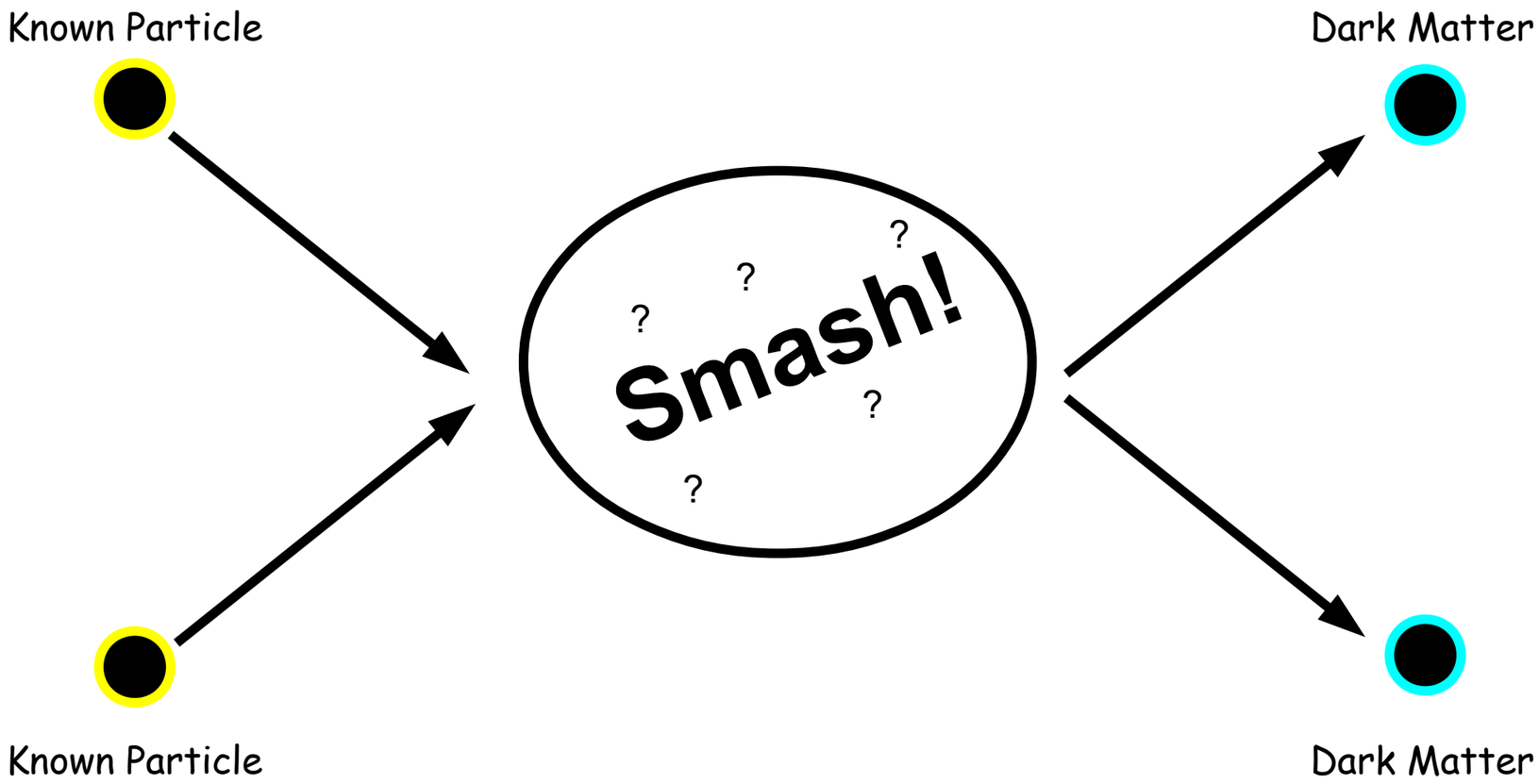


Light




Learn more from Lorna, coming up next!

Dark matter production



The Large Hadron Collider

Find out more from Marcella and Joe soon!


The search for cold dark matter
Is just heating up?

The future of dark matter

Is very bright?

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Thank you for your attention!

We only have time for a couple live questions, but we will be monitoring the chat throughout, and would love to answer your questions there!