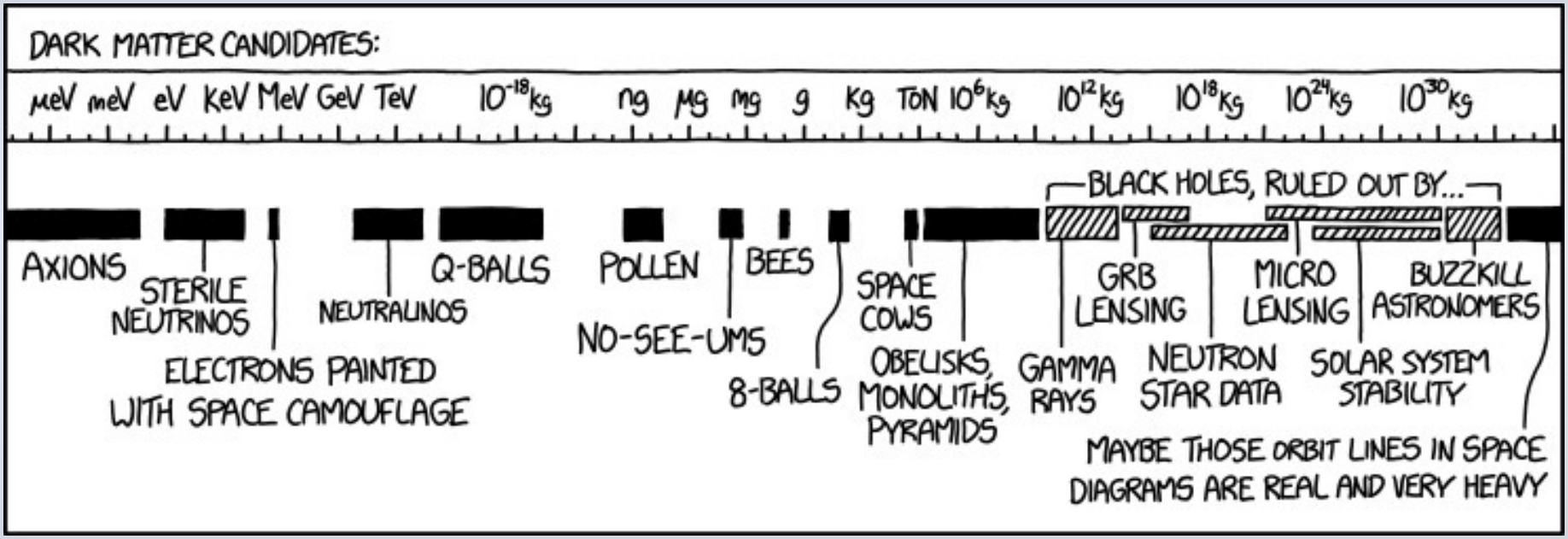
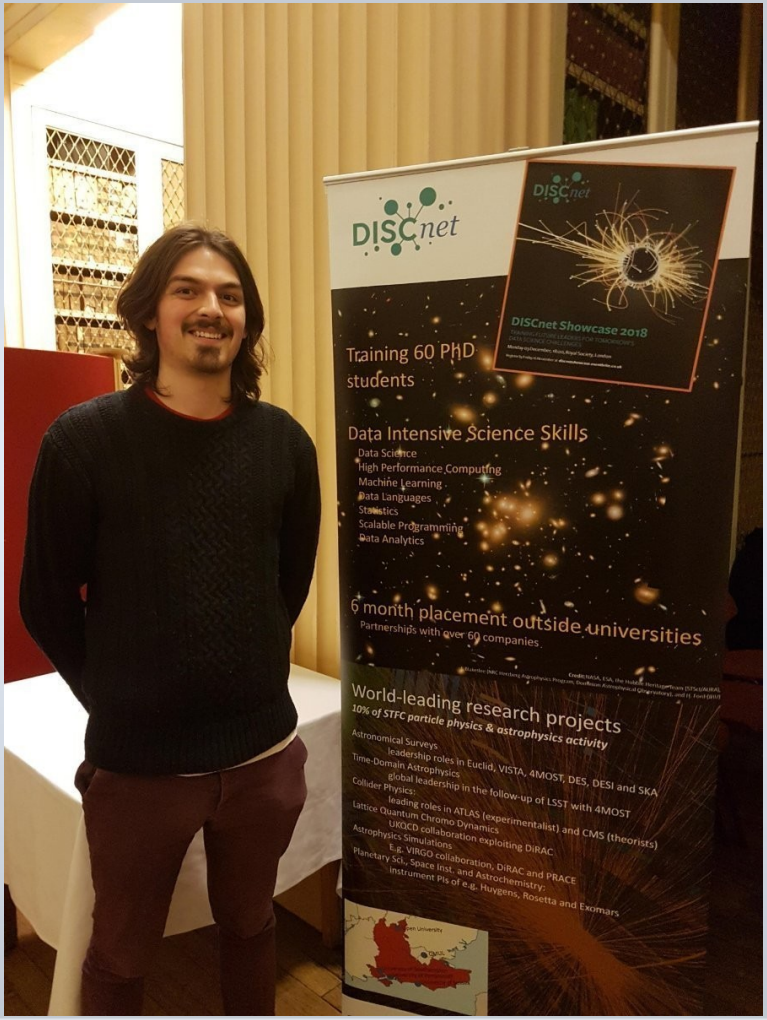
The Puzzling Problem of Particle Dark Matter



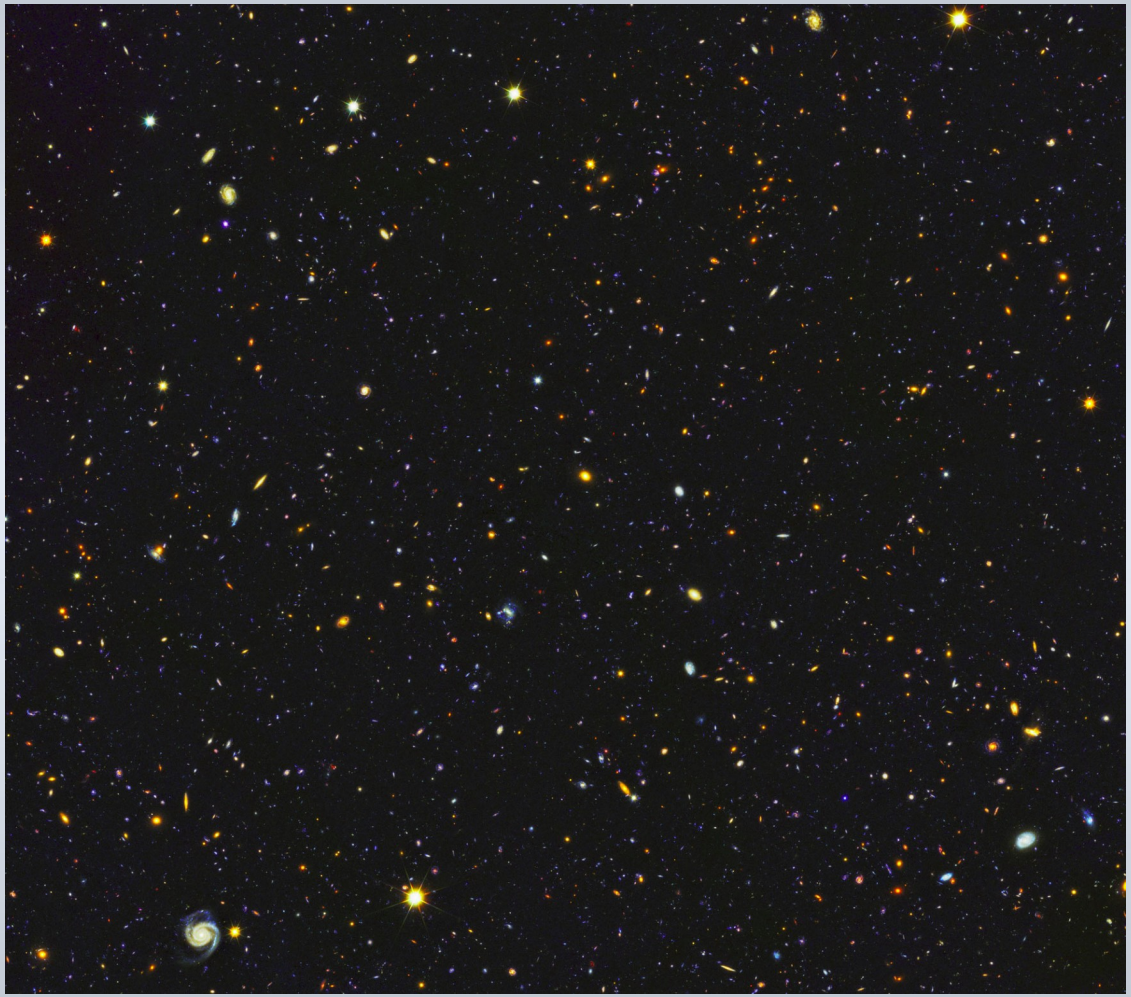
Joe Davies

Queen Mary University of London

Introductions

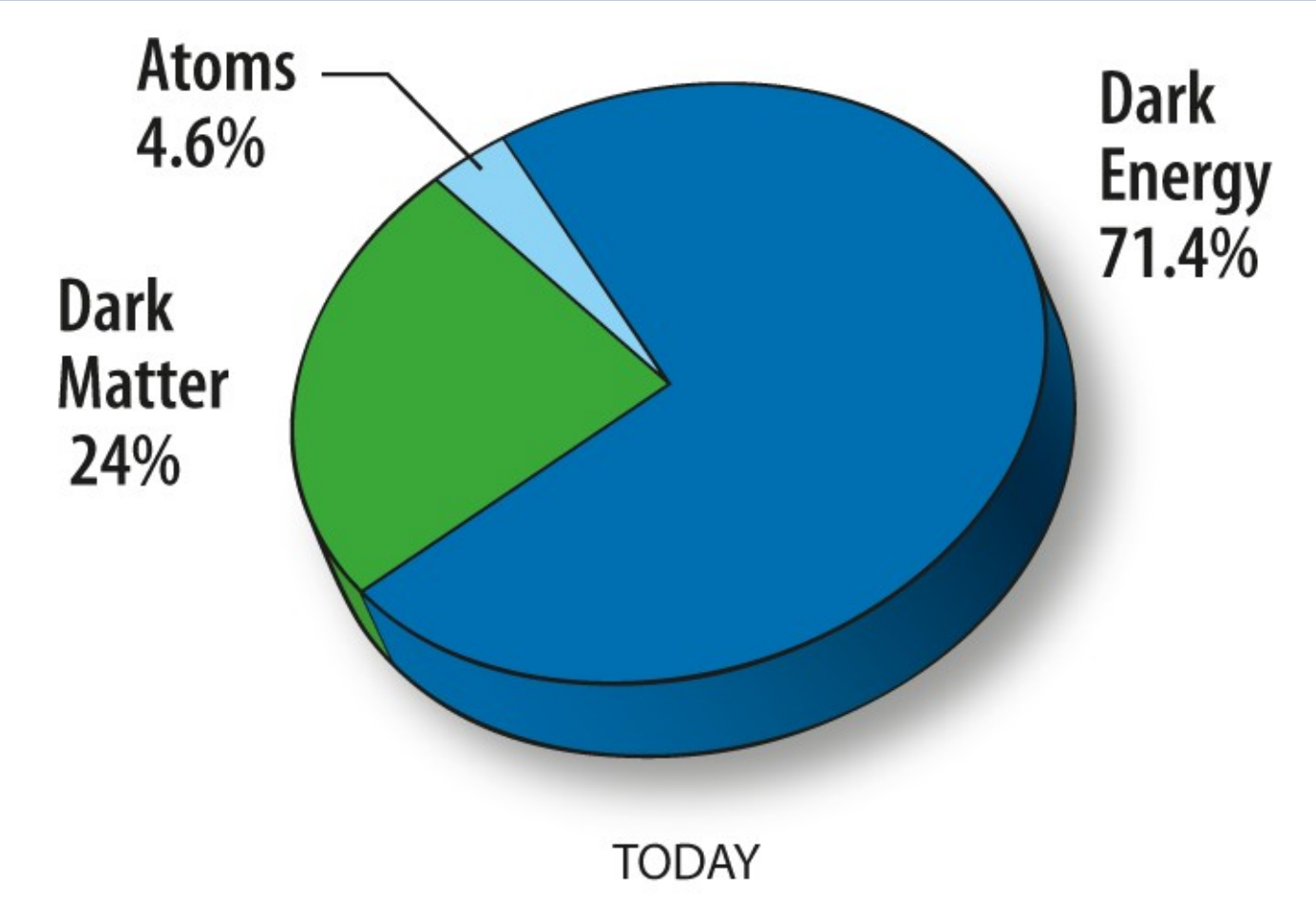


What’s the Problem?



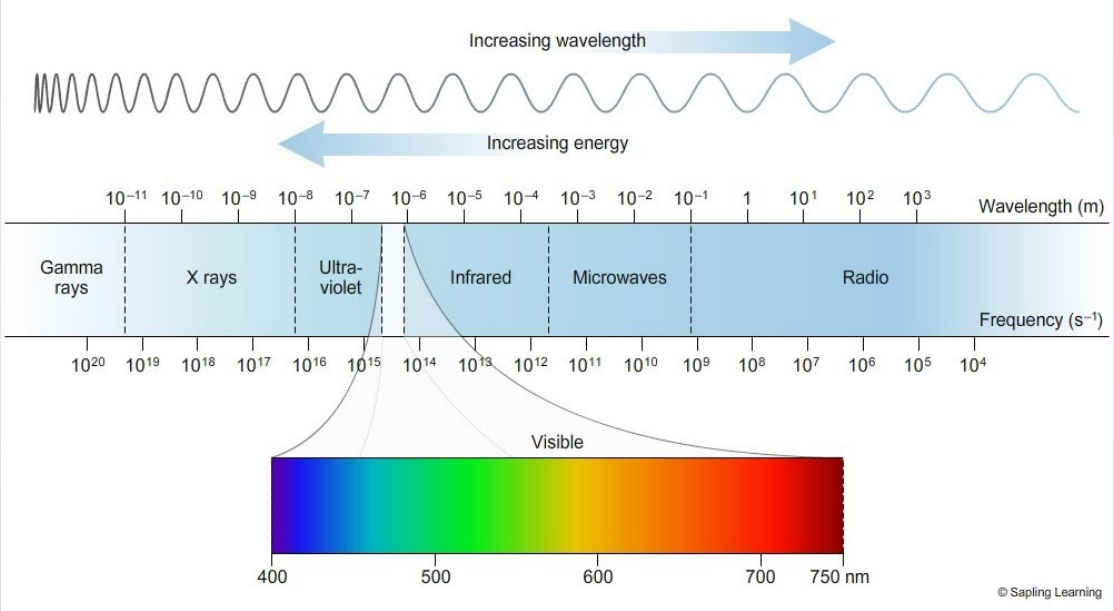
http://www.sci-news.com/astronomy/hubble-deep-uv-legacy-survey-image-06320.html

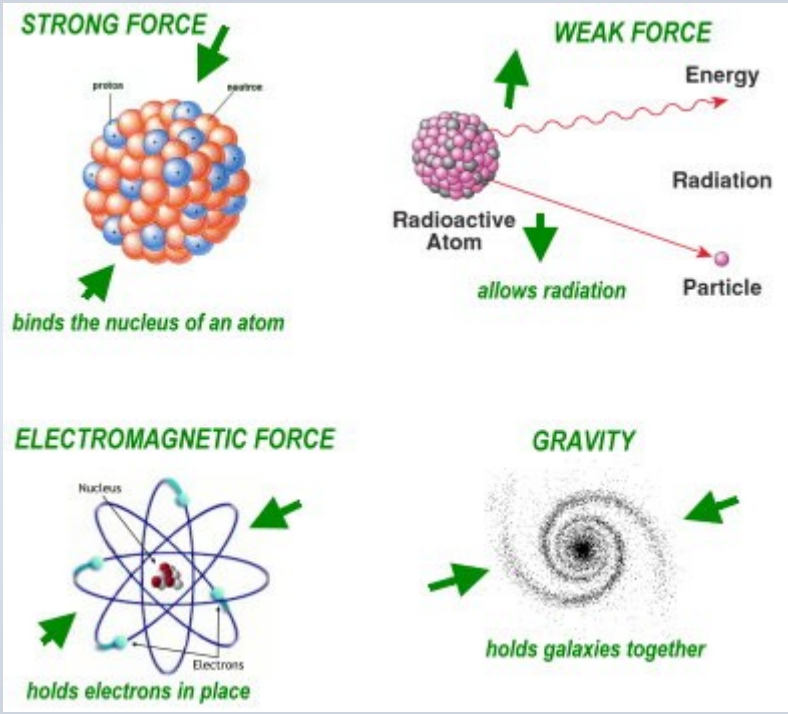
5%?!



https://frontierfields.org/2014/10/03/what-is-dark-energy/

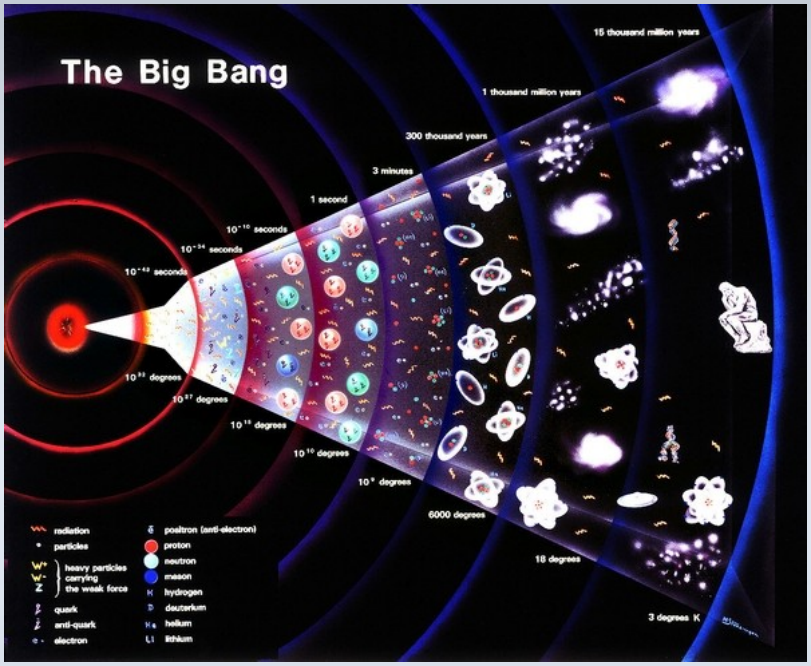
Who are you calling a WIMP?





https://sites.google.com/site/chempendix/em-spectrum
http://quincymoy.weebly.com/four-forces.html

Prove it!

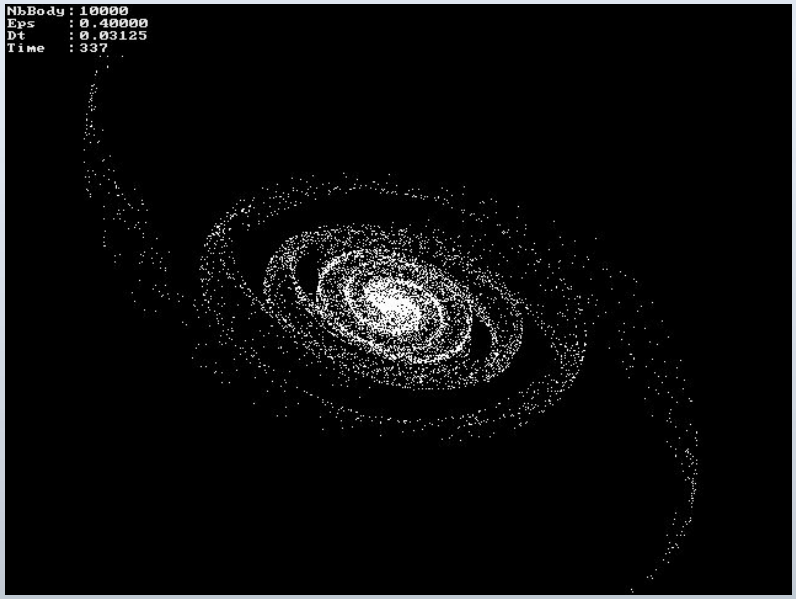


Early Dark Matter Remnants

- Early Universe was hot but then cooled down
- Properties of WIMPs match what we see today

Big Simulations

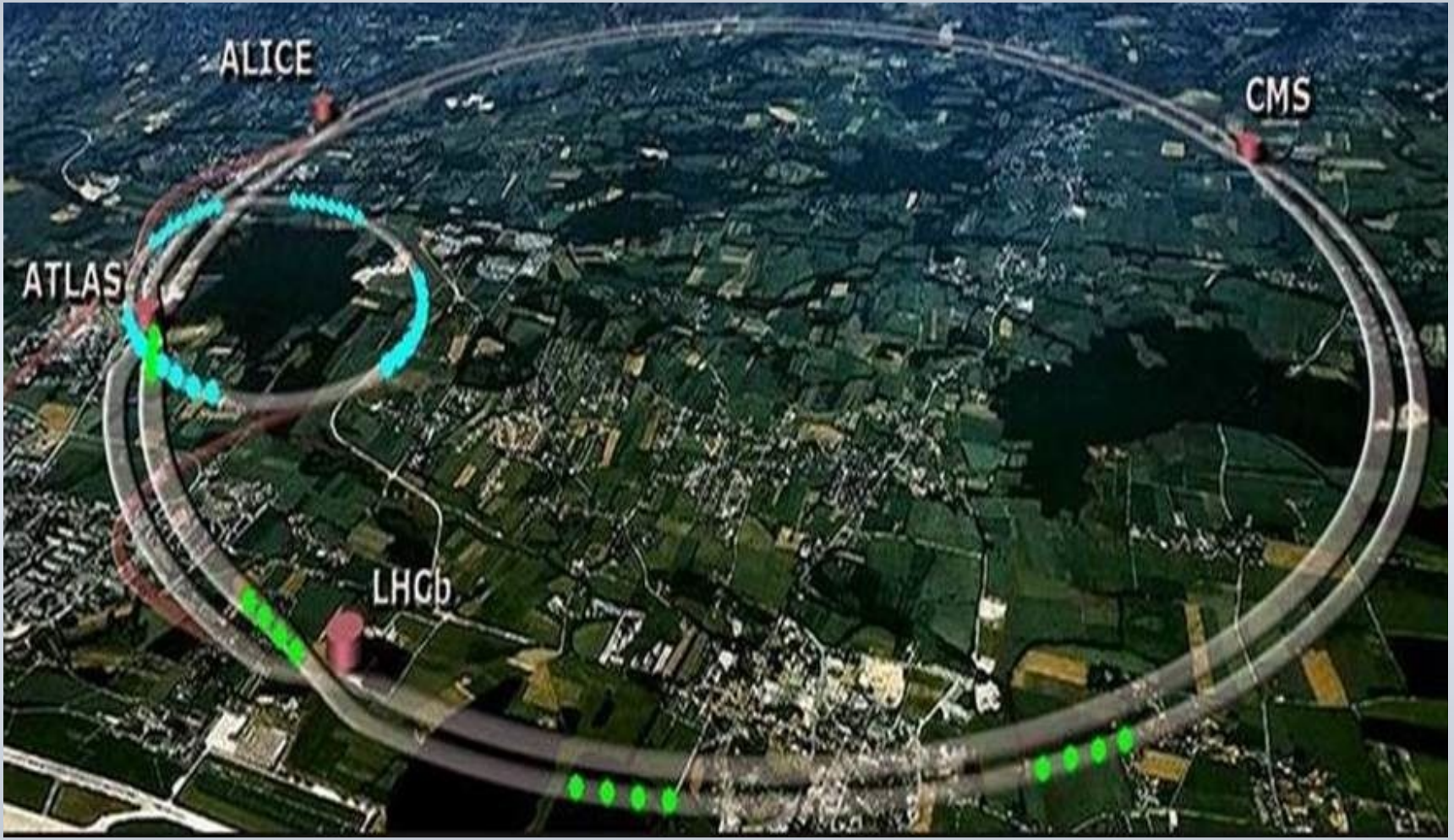
- These allow us to understand how the Universe evolves over time
- Omitting Dark Matter makes our simulations not match very well to what the Universe looks like today



http://osnetdaily.com/2014/04/alleged-evidence-of-cosmic-inflation-devalues-big-bang-mythology/

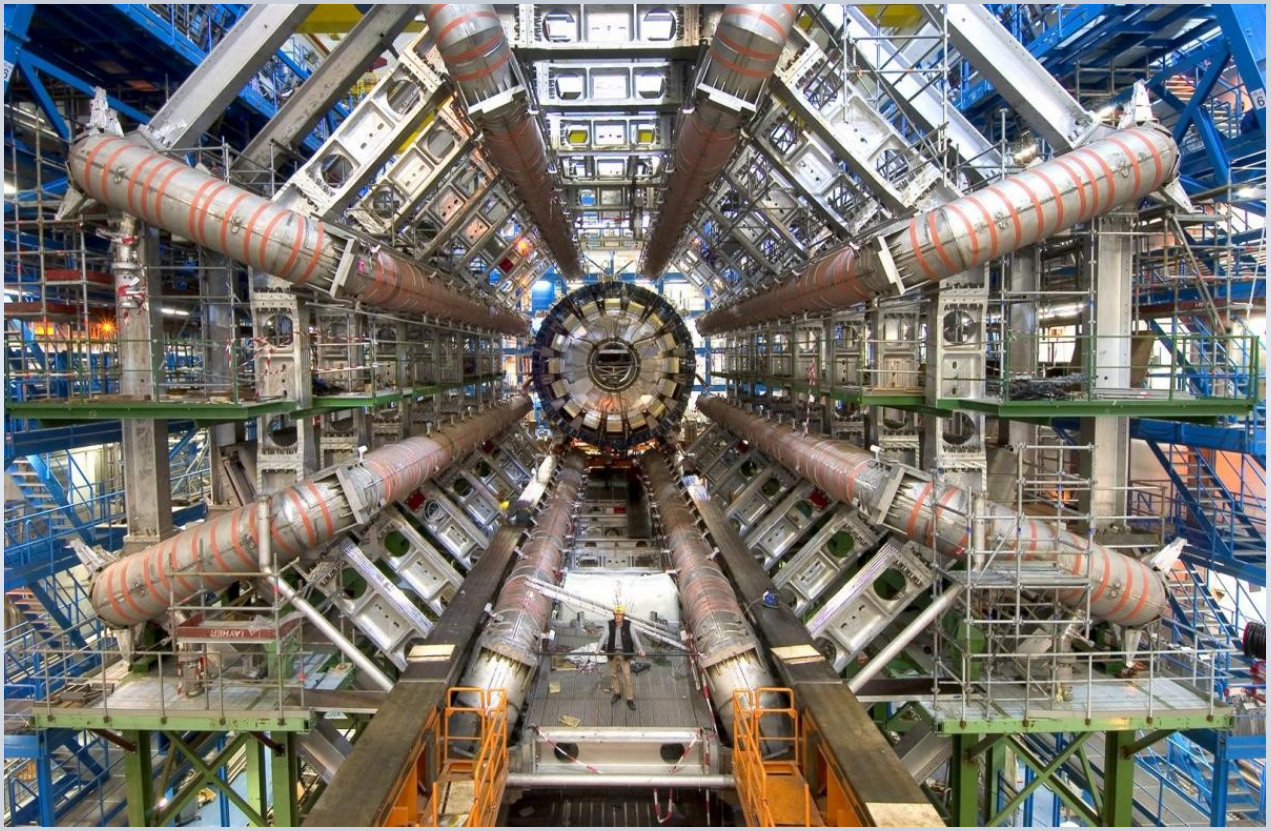
https://insidehpc.com/2015/05/direct-n-body-simulation/

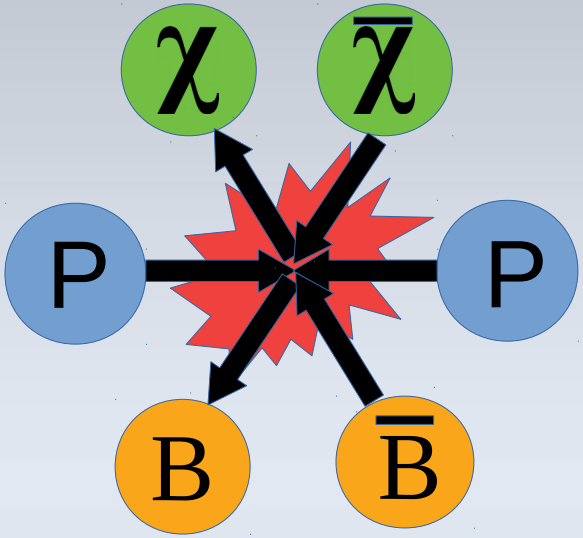
The Large Hadron Collider

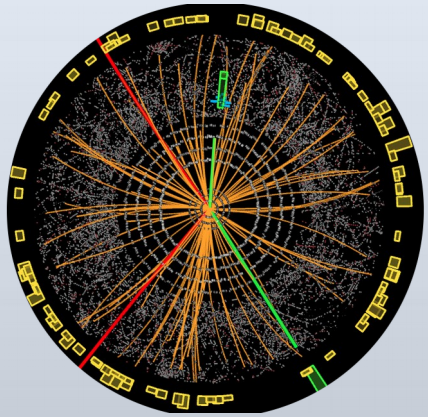


https://www.onenewmaninstitute.org/large-hadron-collider-cern

The ATLAS Search

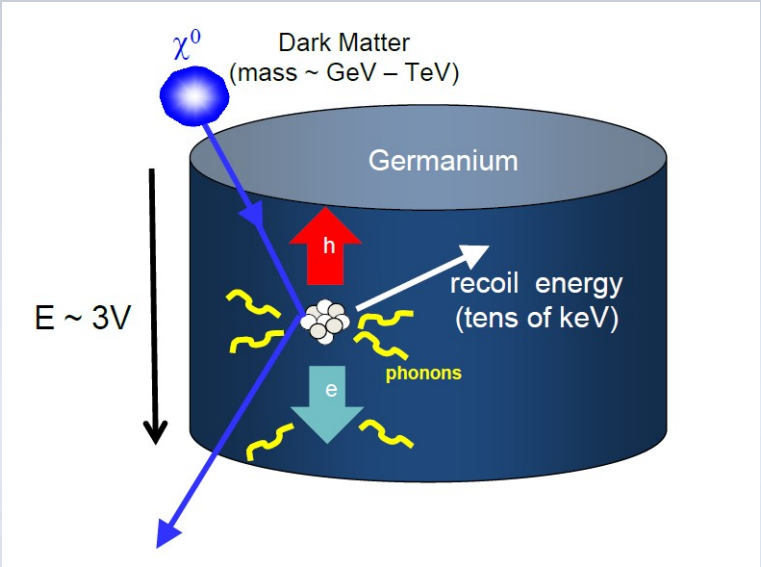






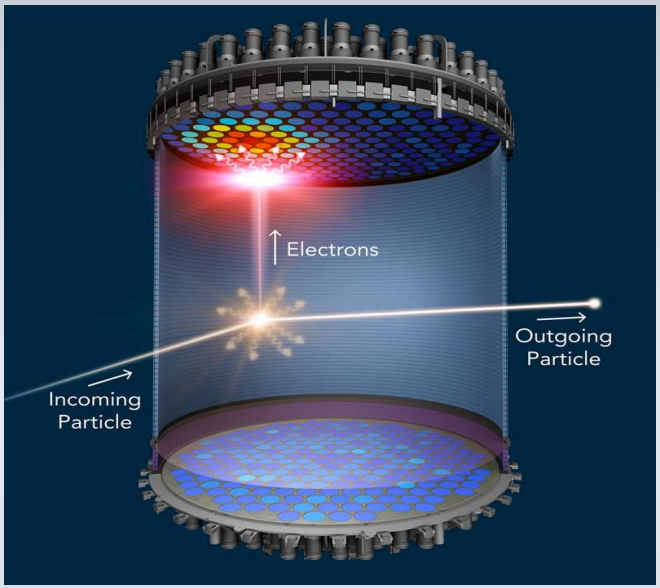
https://arxiv.org/pdf/1710.11412.pdf

Direct Detection



Cryogenic Dark Matter Search (CDMS)

- Cooled to near absolute zero
- Background processes mostly recoil from electrons, dark matter mostly from nucleaus



LUX-ZEPLIN (LZ)

- Dark matter strikes a Xenon nucleus
- This emits a very small flash of light and some electrons

https://kipac.stanford.edu/research/topics/direct-dark-matter-detection
https://sciencesprings.wordpress.com/2016/06/01/from-slac-prototype-of-lux-zeplin-dark-matter-detector-tested-at-slac/

Conclusions

- Particle Dark Matter may never be found or could be found tomorrow!
- WIMPs are our best guess for particle Dark Matter but there are other candidates
- Asking these questions is important, although sometimes it doesn’t seem it!