

# PEEPING INTO THE PAST OF GALAXIES

No Jargon Talk

UC Santa Cruz

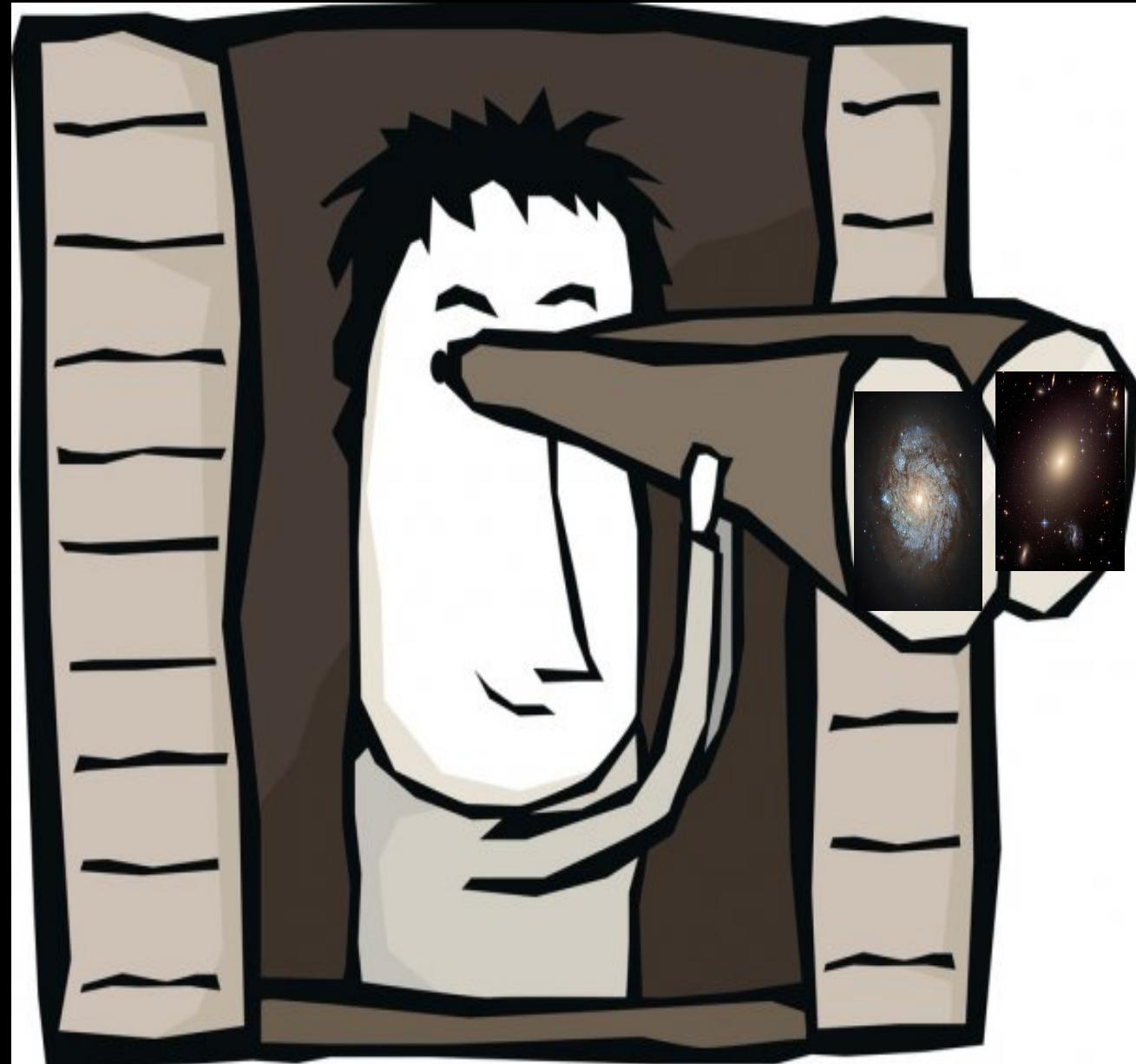
22 April 2021

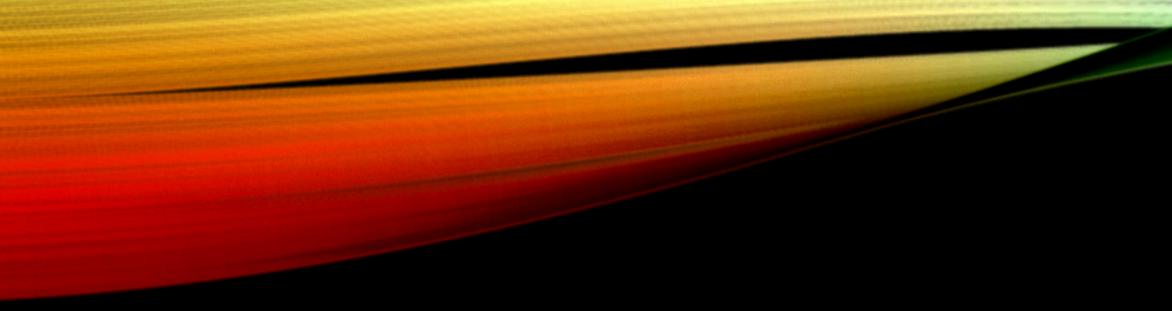
YASHA KAUSHAL

PHD CANDIDATE III YEAR

ADVISOR - Dr. RACHEL BEZANSON

UNIVERSITY OF PITTSBURGH





A tree!

Stars!

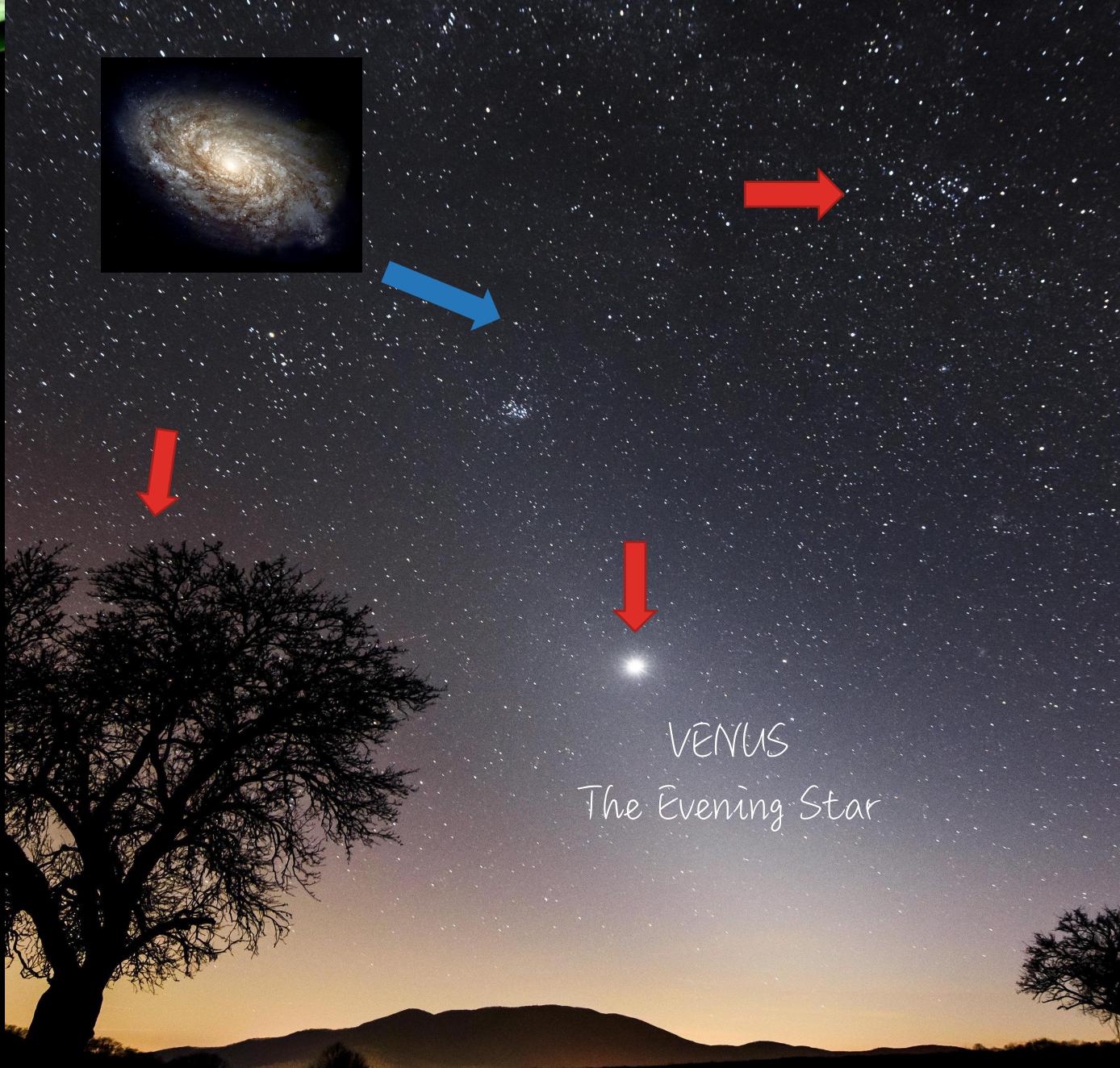
A planet..

Venus!

There's more ...

Not all tiny dots are stars...

Some are systems of **billions** of stars, gas and dust held together by gravity called **GALAXIES**





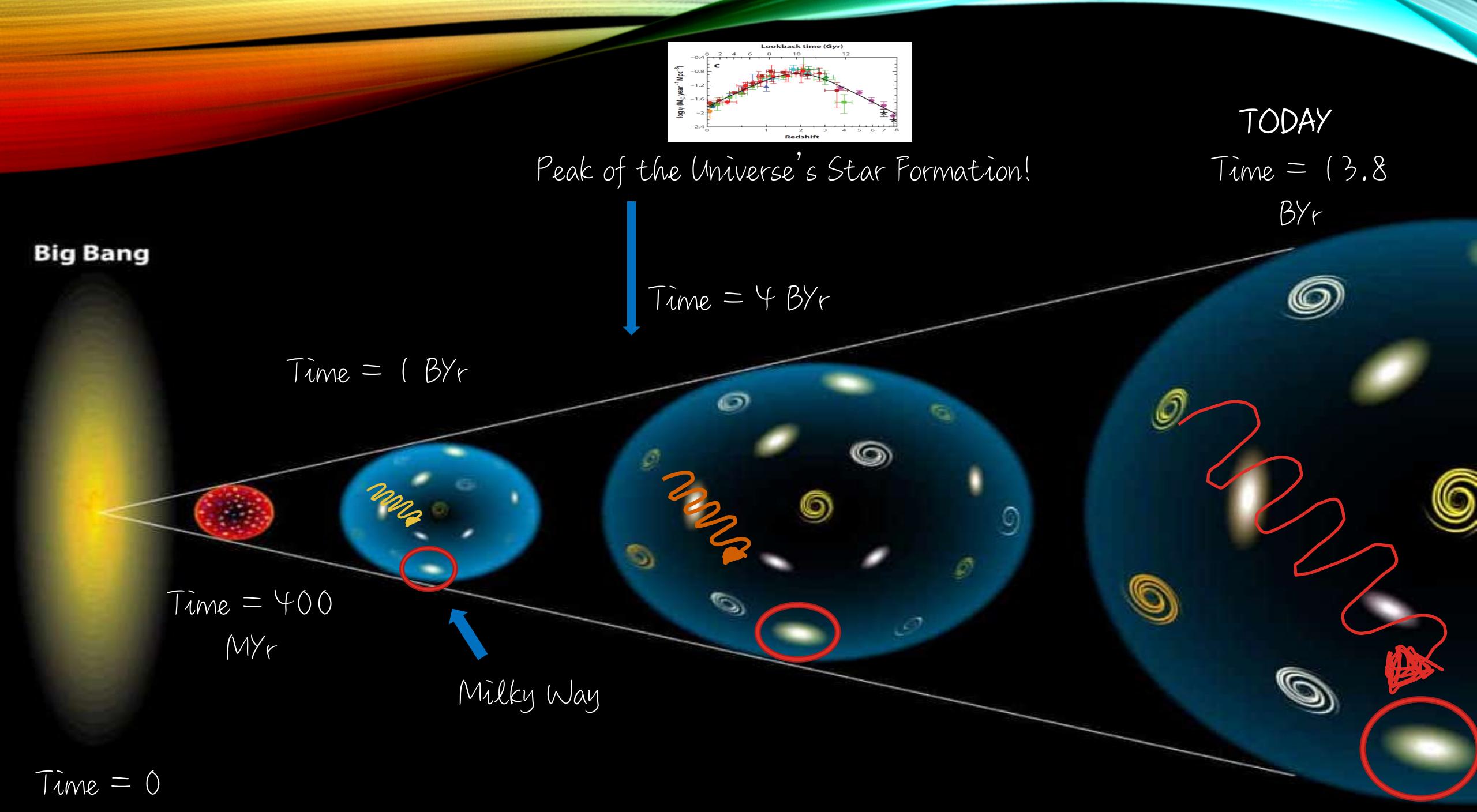
WHAT'S SO SPECIAL ABOUT THIS LIGHT?



A LONG TIME AGO IN A GALAXY FAR, FAR AWAY....

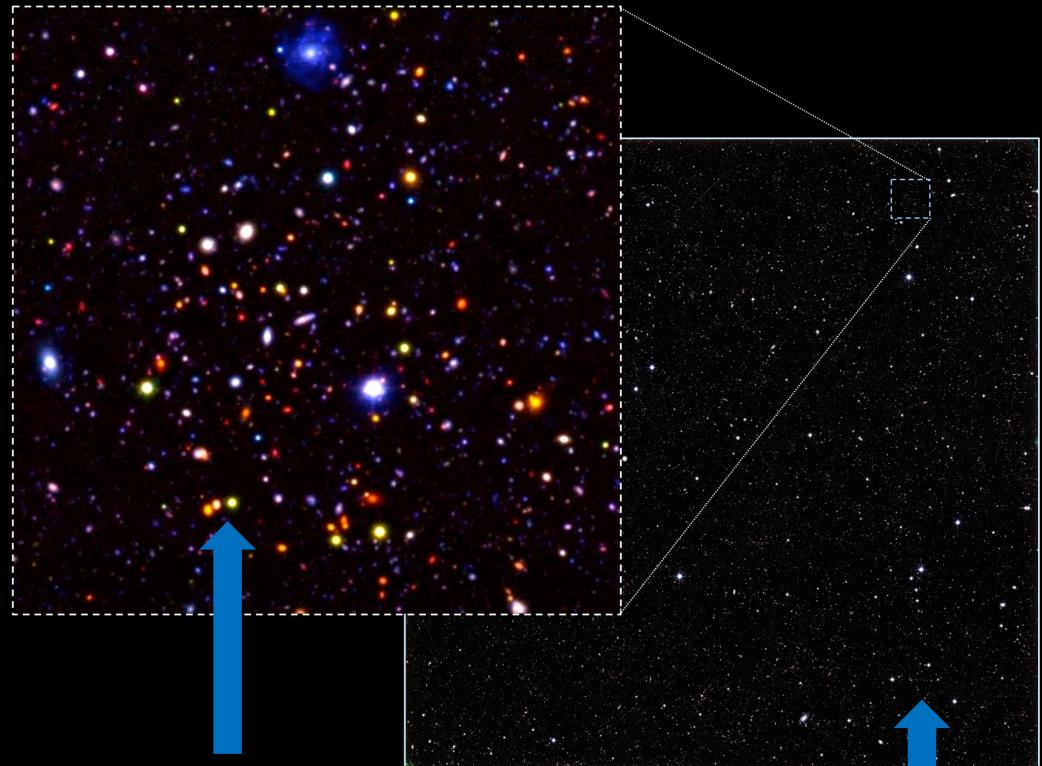
STARS STARTED EMITTING LIGHT ...





# LEGA-C DATASET

- VLT-VIMOS 130-night spectroscopic survey of 4000 galaxies covering 1.3 sq degrees in COSMOS field
- From the time when universe was just 6 billion years old ...
- Each galaxy observed for 20 hours (unlike ~1 hour typically) to obtain high signal-to-noise ( $S/N > 20$ )



What telescopes see ..

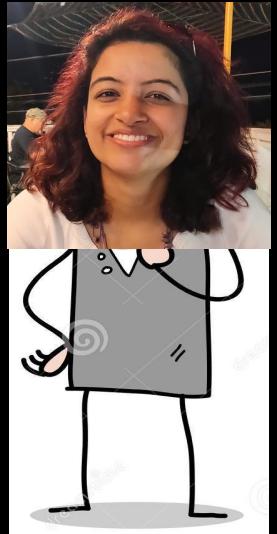
What we see ..



HOW CAN WE ANALYZE THIS LIGHT?



Curious Human



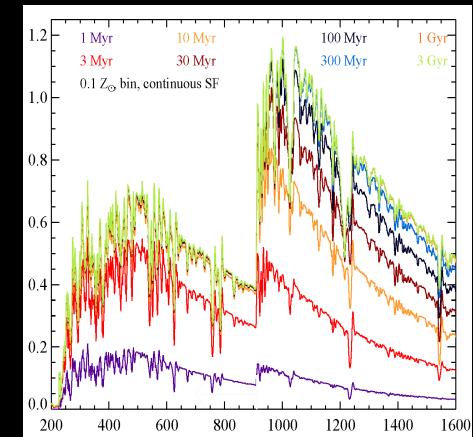
Telescope



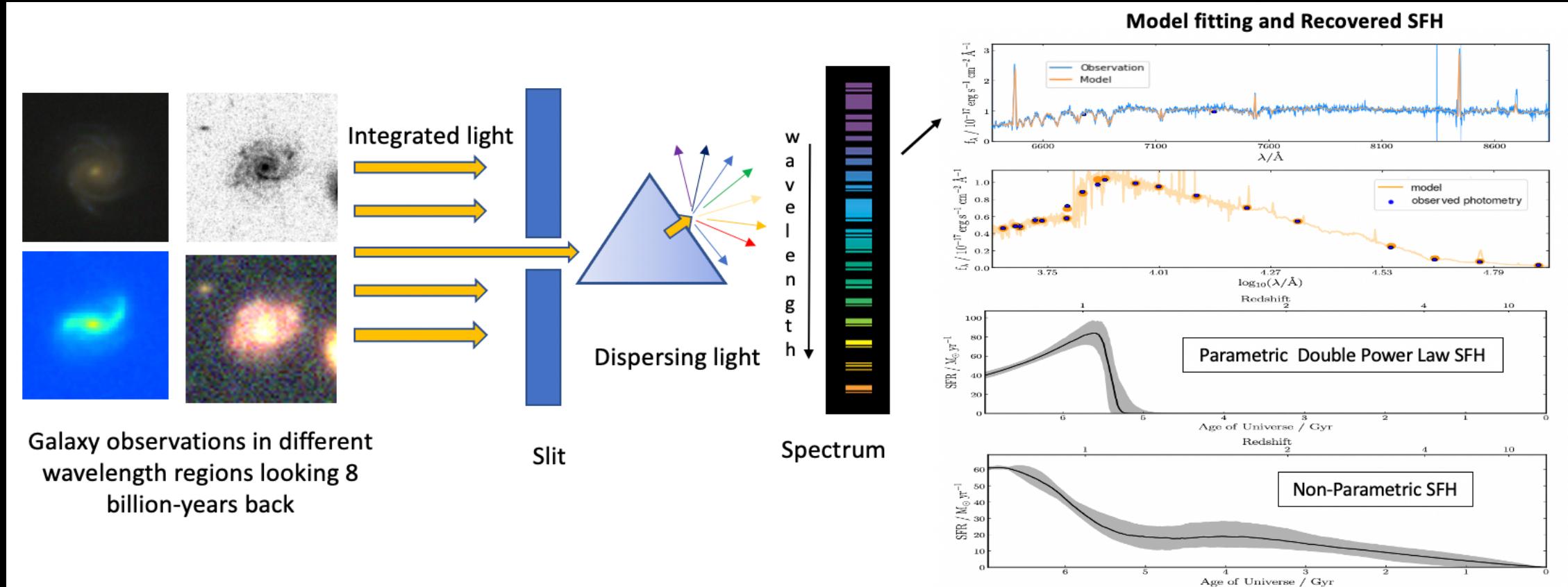
Supercomputer



Models



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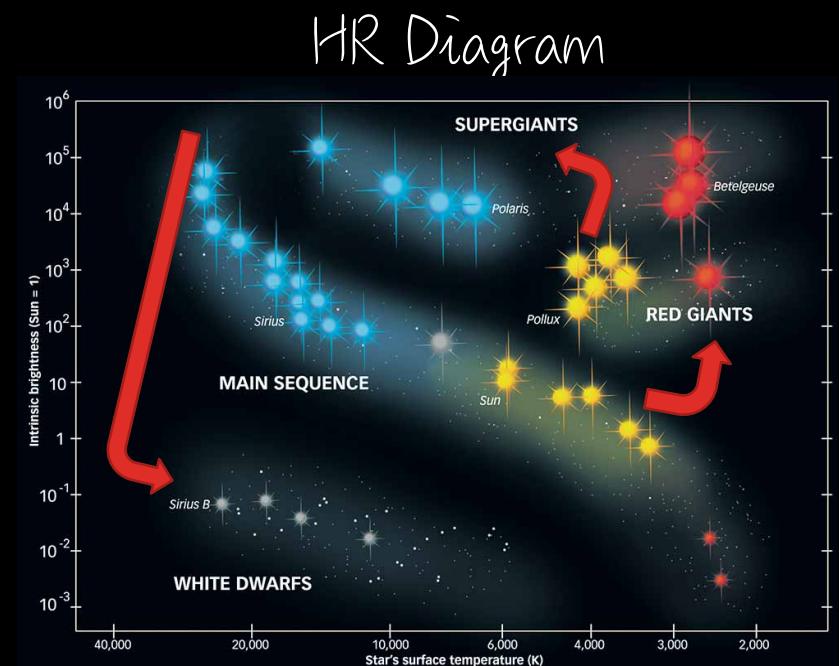
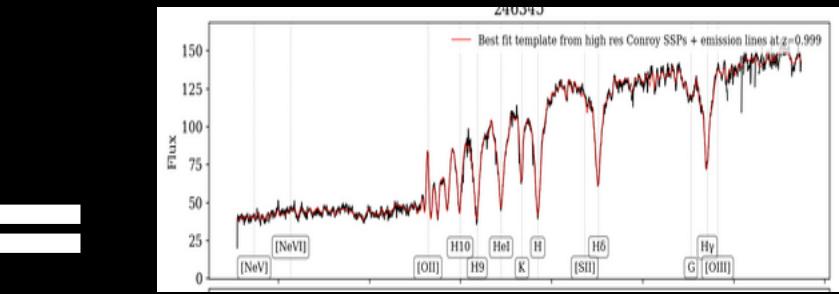
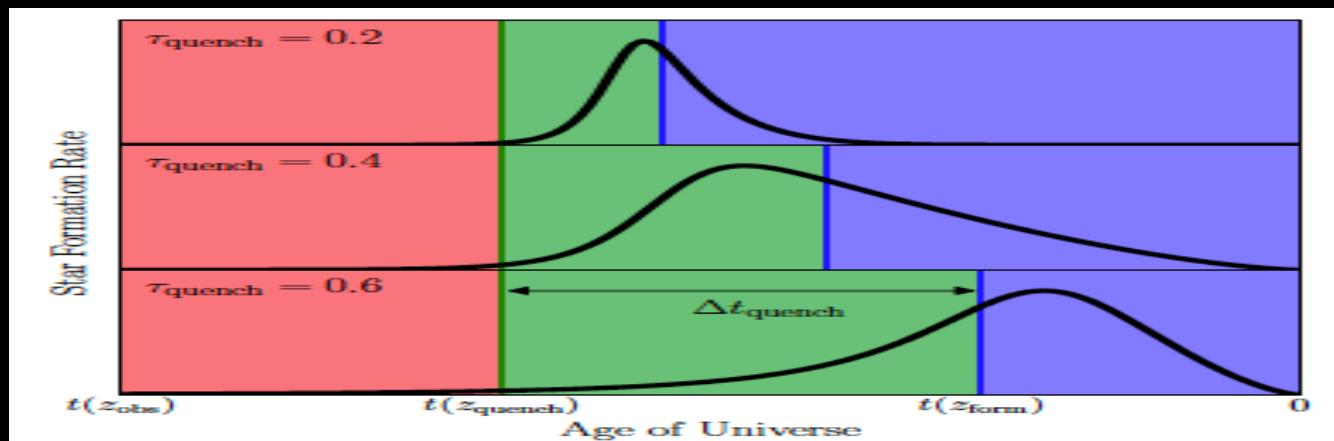
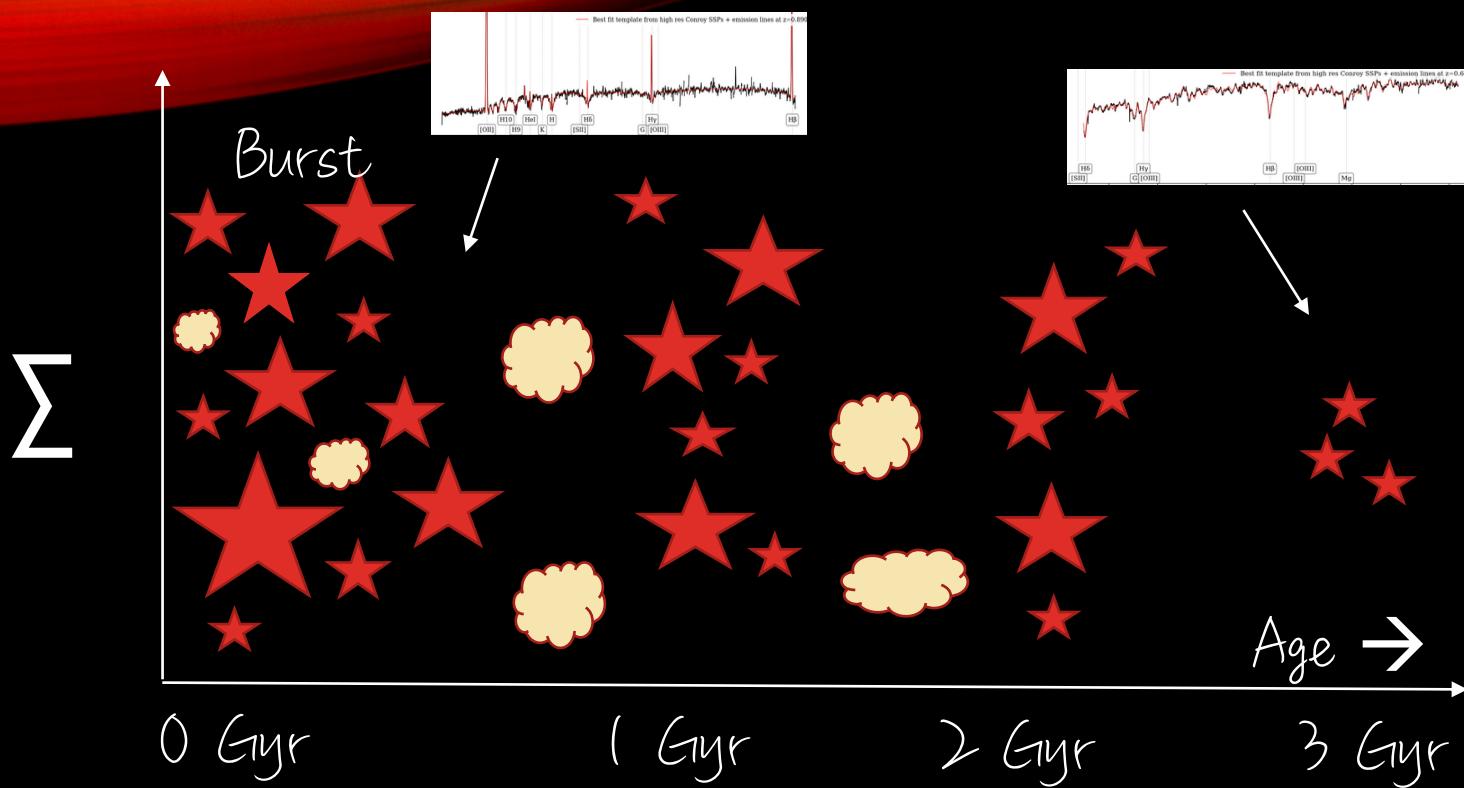




HOW MODELS WORK?

# MODELS!

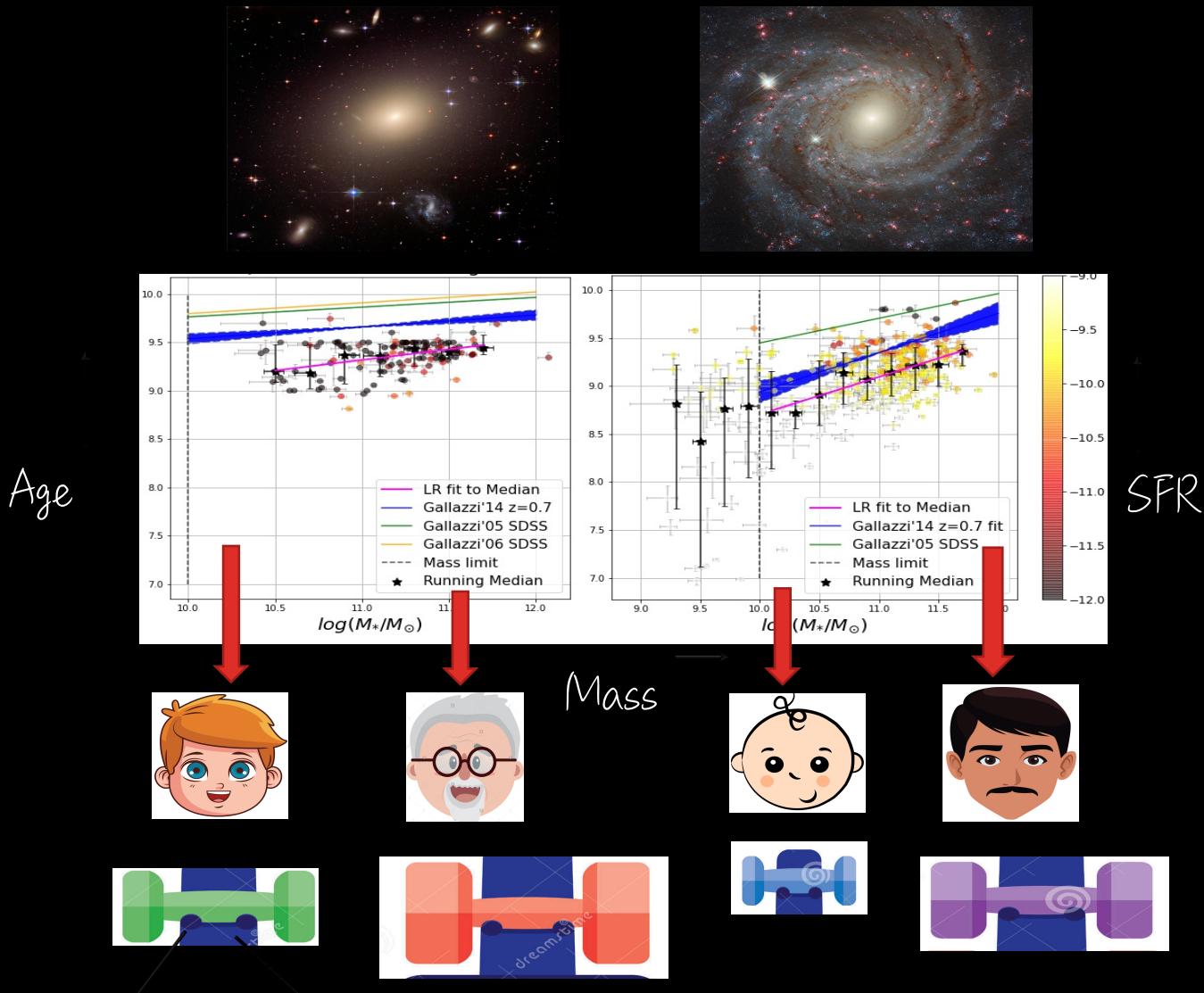
## STELLAR POPULATION SYNTHESIS





WHAT OTHER INFORMATION CAN WE OBTAIN FROM  
THIS?

- Star Formation History (SFH)
- Stellar Mass
- Stellar Metallicities (C,N,O,Fe..)
- Dust Content
- Stellar Dynamics
- Stellar Ages
- Star Formation Rate (SFR)

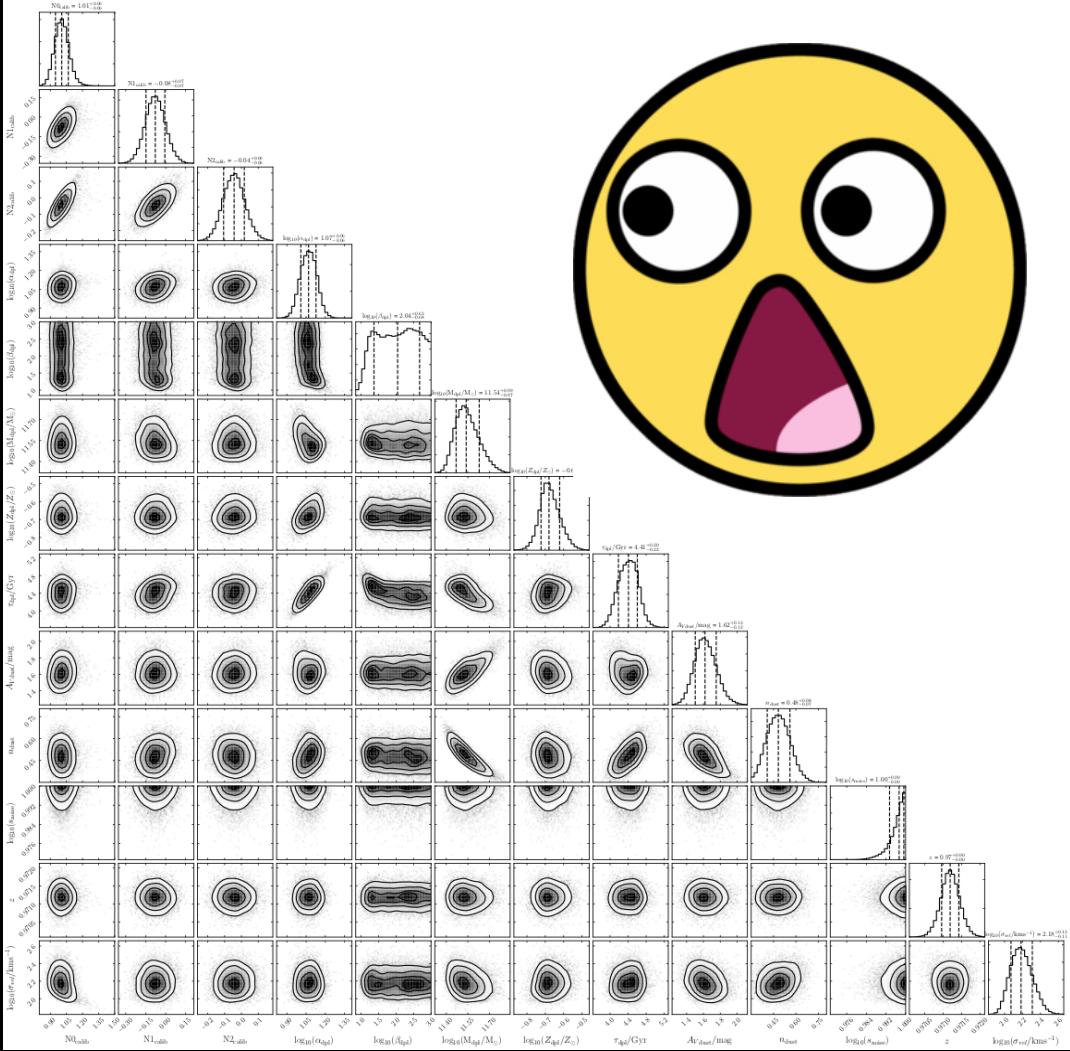


SWEET! I KNOW EVERYTHING!



# CHALLENGES:

## COMPUTATIONALLY EXPENSIVE

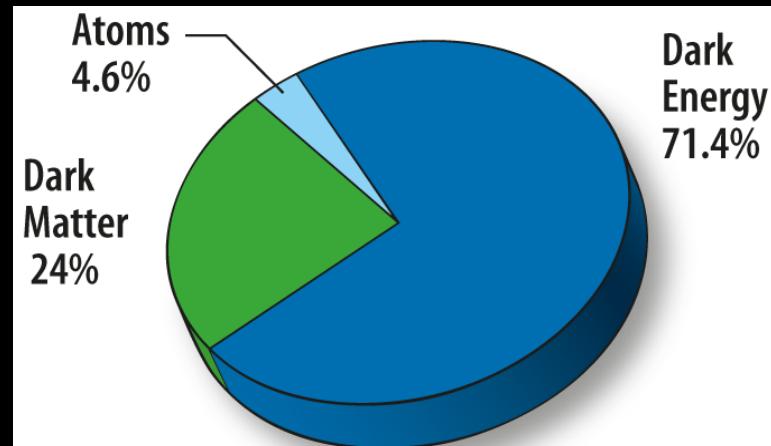


- > 15 parameters in the Model
- $10^{-11}$  meters resolution
- Proposal approved for 3.5 million CPU hours

<https://crc.pitt.edu/Finding-Light-Eight-Billion-Years-Old/>

# MANY QUESTIONS YET TO BE ANSWERED...

- How galaxies form and evolve?
- How their chemical composition changes with time?
- Why and how they suddenly stop forming stars?
- How their properties correlate with their environment and nuclear activity?
- Connecting the known to the UNKNOWN!!





THANK YOU !