

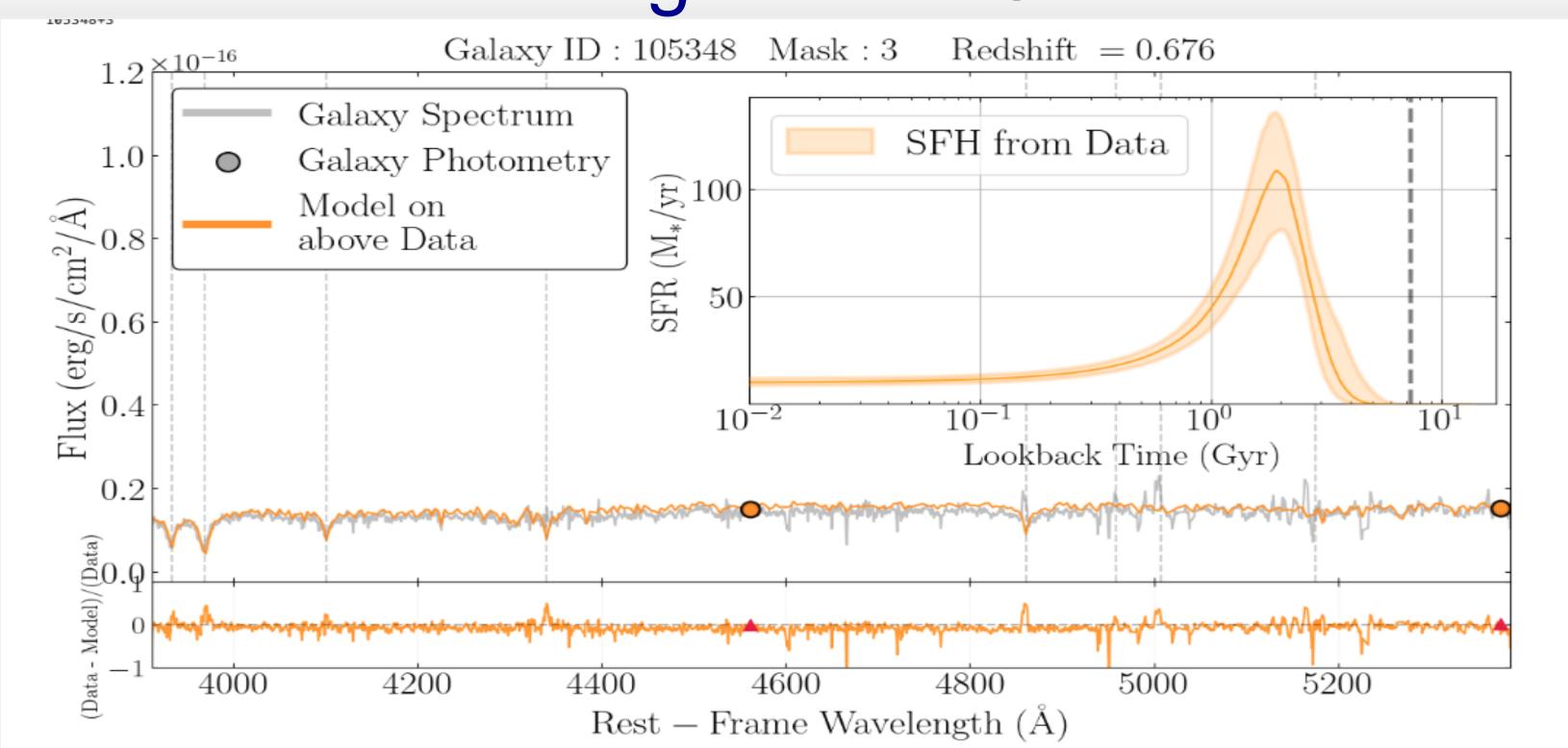
Testing a Theoretical Model ("UniverseMachine") for Galaxy Star Formation czs13@pitt.edu Histories Derived from the LEGA-C Survey

**Undergraduate Poste** Session 2023

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## Testing Galaxy Growth in the UniverseMachine with LEGA-C Galaxies

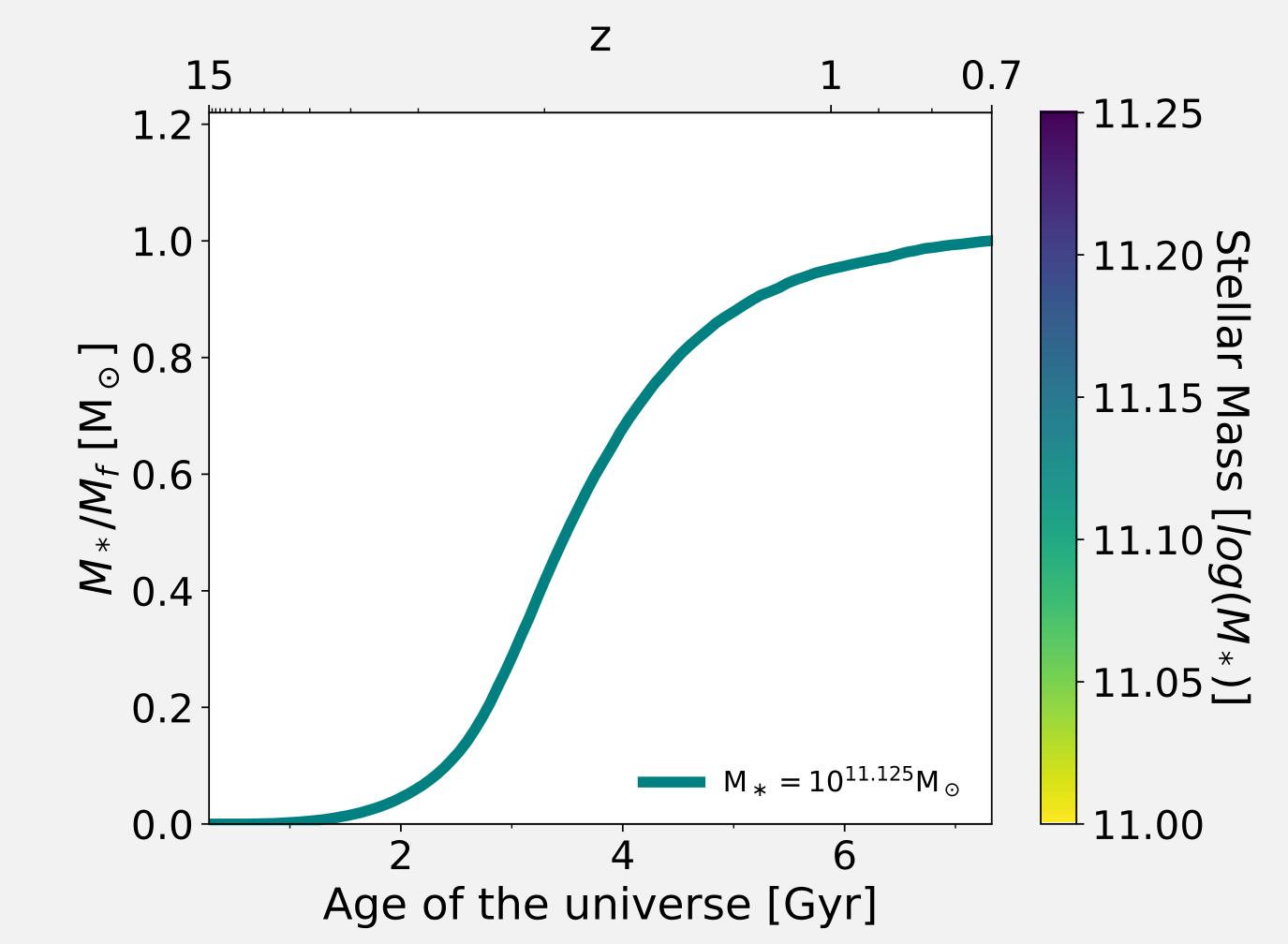
We look back in time to half the age of the Universe when young stellar populations left powerful spectral-imprints to 0 retrieve star formation histories. Star formation histories are essential for understanding the LEGA-C evolution of galaxies and the Galaxies Universe. 6,000,000,000 **Present** Age of the Universe [Years] UniverseMachine predicts galaxies become larger with (Behroozi+2019) time and quenched. Inferring Galaxy Star Formation History at Half the Age of the Universe



The Large Early Galaxy Astrophysics Census (LEGA-C) collected high-fidelity spectra for ~3000 galaxies observed at half the age of the Universe. These data allow reconstruction of star formation histories into the early universe via "stellar population synthesis modeling".

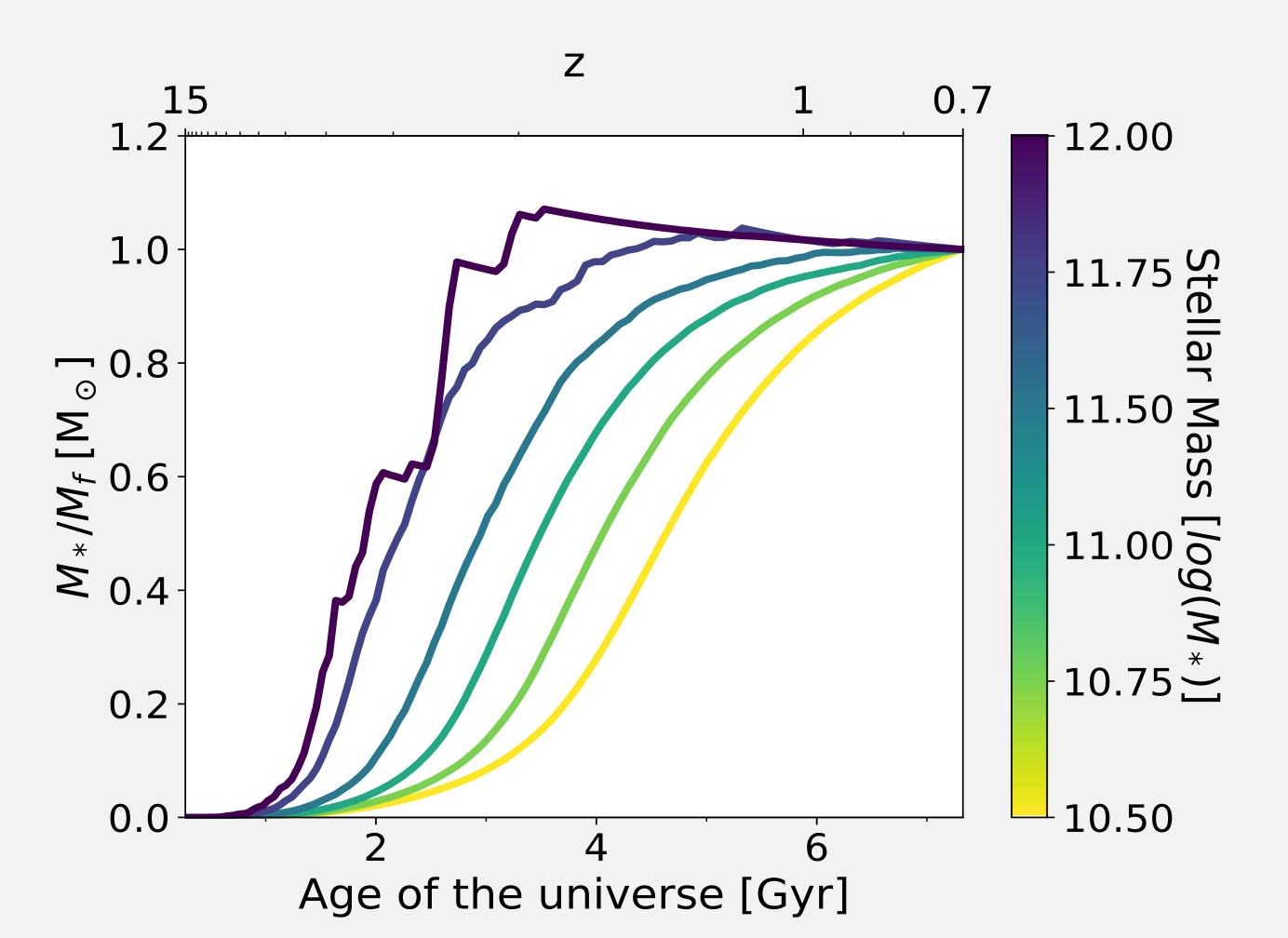
### UniverseMachine Model Predicts that Galaxy Growth Scales with Mass

The UniverseMachine is a theoretical model that describes galaxy demographics across cosmic time, including the growth histories of stars.



Higher mass galaxies increase in mass earlier at a faster rate

than lower mass galaxies.



Mass of individual galaxies and their median trend divided by their z = 0.7 mass as a function of time and redshift.

Median mass divided by their z = 0.7 stellar mass as a function of time and redshift.

# Data vs. Theory: Testing Average Star Formation Histories

# **Expectation:**

**Theoretical** 

More massive galaxies form more of their stars at early times over a shorter time period.

Star-forming galaxies have more recent assembly histories.

#### in the UniverseMachine Model Quenched StarForming ge Data Data Theory Theory 10.5 11.0 12.0 10.5 11.0 11.5 11.5 12.0

Stellar Mass bins [log(M\*)]

Median times at which galaxies reached 50% (t50) and 90% (t90) of their stellar mass at the look back time of LEGA-C.

Stellar Mass bins [log(M\*)]

### **Conclusions:**

Real quenched galaxies form their mass later in time than model galaxies.

Real star-forming galaxies form 90% of their mass later than model galaxies.