

USING THE METAL CONTENT OF GALAXIES TO INFORM STELLAR FEEDBACK MODELING

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BACKGROUND

- THE SCATTER ABOUT THE MASS METALLICITY RELATION (MZR) IS CORRELATED WITH STAR FORMATION RATE (SFR) IN THE GAS-PHASE (ELLISON+2008; MANNUCCI+2010, ETC)
- STELLAR METALLICITY IS INHERITED FROM THE GAS IN WHICH IT FORMS
- THERE ARE TWO MAIN STELLAR FEEDBACK TYPES IN MODERN SIMULATIONS: BURSTY (E.G., FIRE) AND NON-BURSTY (E.G., ILLUSTRIS/TNG AND EAGLE)

METHODS

- WE USE (100 MPC)³ BOX RUNS OF ILLUSTRIS, ILLUSTRISTNG, AND EAGLE.
- EACH SIMULATION MODEL HAS EQUATION OF STATE SUB-GRID ISM MODEL (NON-BURSTY FEEDBACK)
- SELECT STAR-FORMING CENTRAL GALAXIES

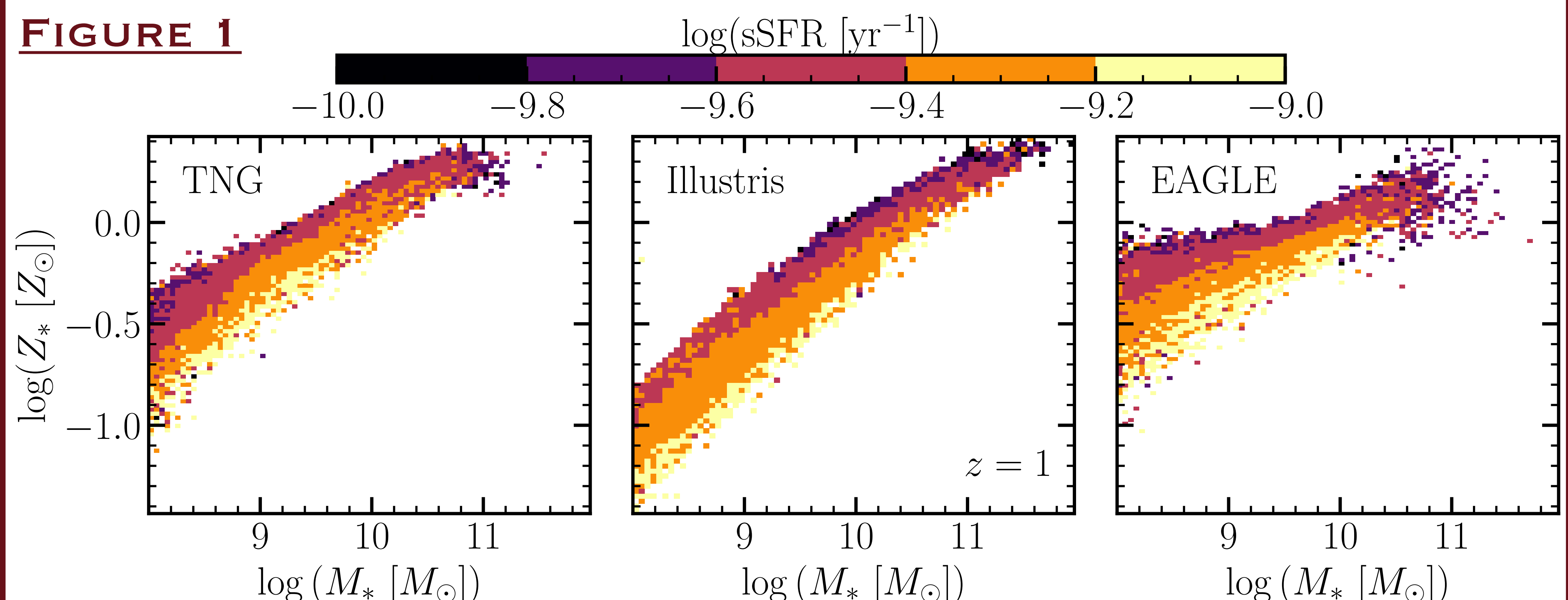


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RESULTS

- THE SCATTER ABOUT THE STELLAR MZR CORRELATES WITH SSFR, SIMILAR TO GAS MZR (FIGURE 1)
- OFFSETS FROM STELLAR MZR CORRELATE WITH OFFSETS FROM GAS MZR (FIGURE 2)

FIGURE 1



DISCUSSION

- WE CREATE A TOY MODEL DESCRIBING WHY THE OFFSETS IN STELLAR METALLICITIES CORRELATE WITH SSFR:

$$\frac{d(\Delta Z_*)}{dt} = \frac{1}{M_*} \frac{dM_*}{dt} (\Delta Z_{\text{gas}} - \Delta Z_*)$$

CONTROLLED BY

$$\Gamma = \frac{\tau_c}{\tau_{\text{SF}}}$$

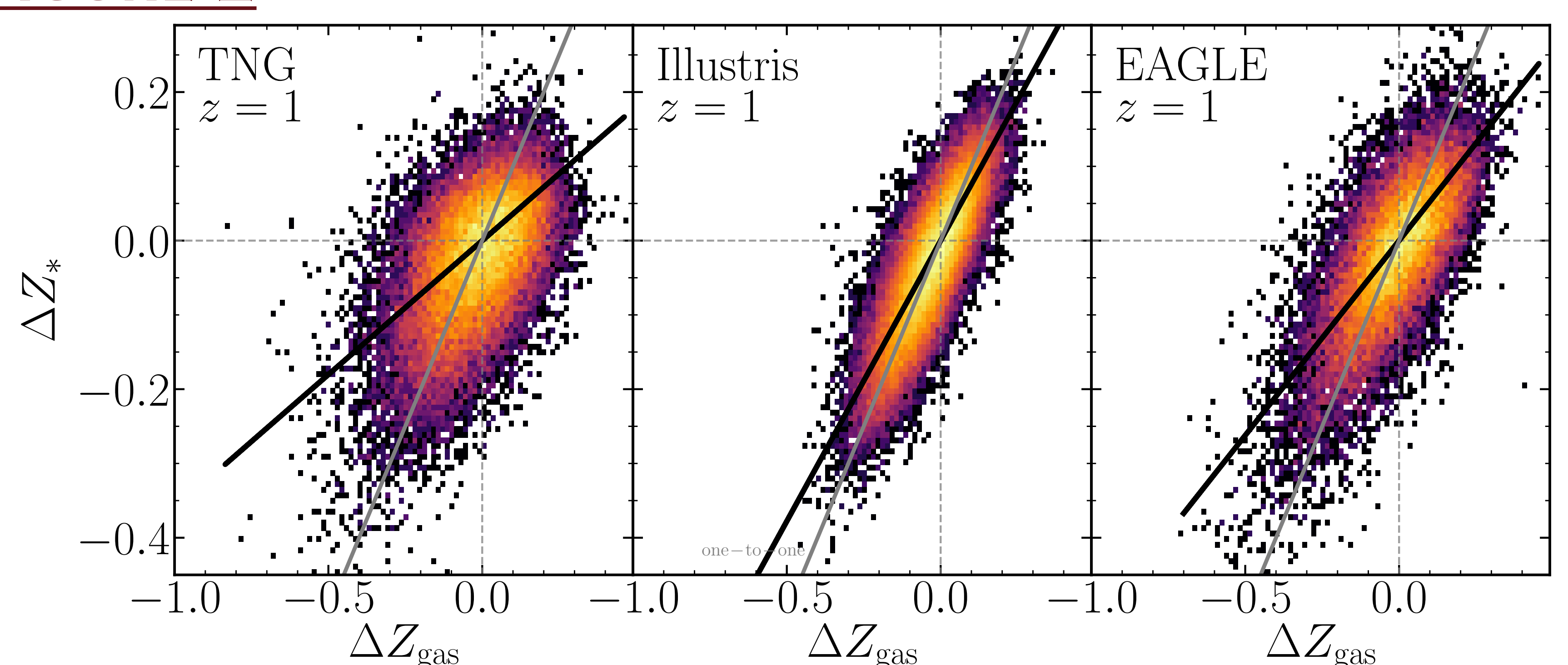
HOW OFTEN GAS METALLICITY CHANGES

HOW LONG FOR STARS TO "CATCH-UP"

- WITH THE MODEL WE CAN PREDICT THE STRENGTH OF CORRELATION IN OFFSETS FROM MZRS (FIGURE 3)

- **BUT** THESE MODELS ALL HAVE EQUATION OF STATE. BURSTY FEEDBACK MIGHT "INTERRUPT" STARS

FIGURE 2



CONCLUSIONS

1. SIMULATIONS PREDICT THAT THE STELLAR MZR CORRELATES WITH SSFR (FIGURE 1)
2. THE OFFSETS IN THE GAS-PHASE MZR ARE CORRELATED WITH OFFSETS IN THE STELLAR MZR (FIGURE 2)
3. WE CONSTRUCT A TOY MODEL TO DESCRIBE THE STRENGTH OF CORRELATED OFFSETS. WITH THIS TOY MODEL WE CAN PREDICT THE STRENGTH OF THE CORRELATION (FIGURE 3).
4. WE BELIEVE THAT THE MODEL WOULD BREAK DOWN IN A "BURSTY" FEEDBACK MODEL. ADDITIONAL TESTING IS NEEDED IN THESE MODELS

FIGURE 3

