

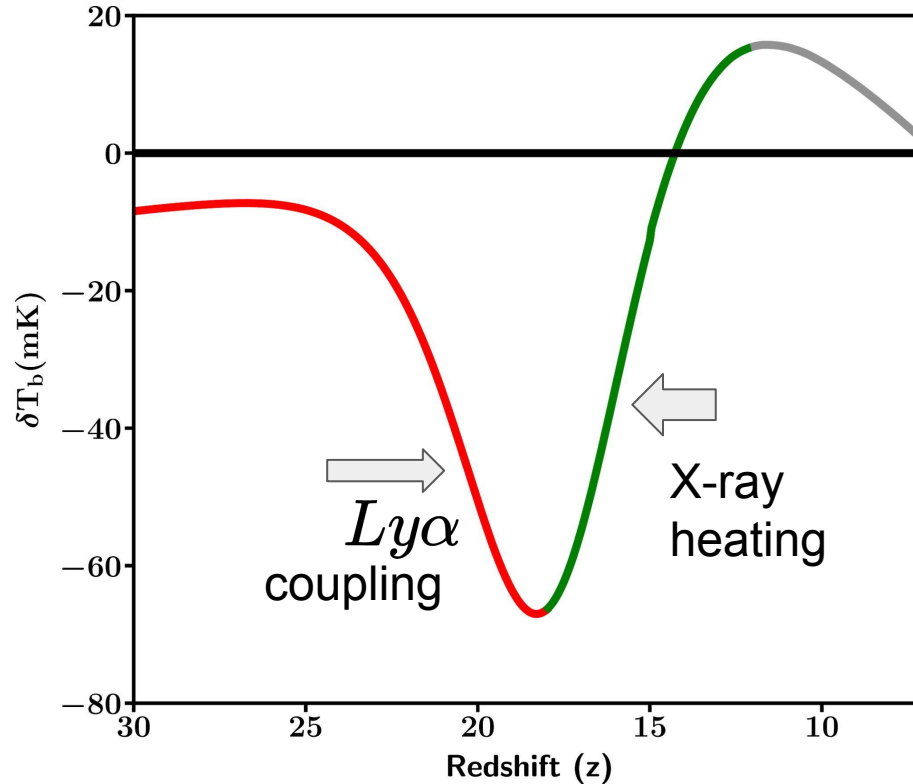
Predictions of the 21cm global signal in the JWST and ALMA era

Atrideb Chatterjee



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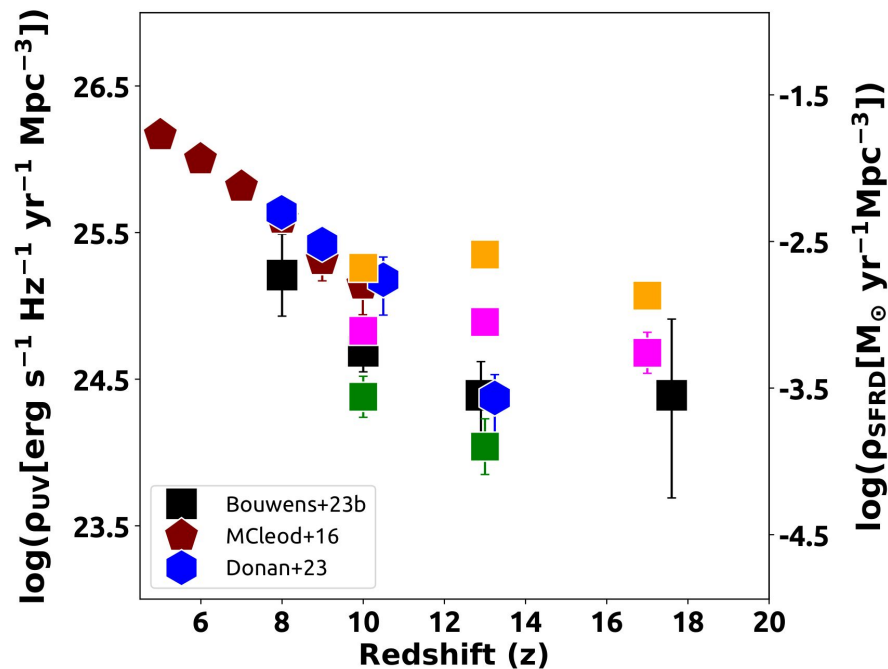
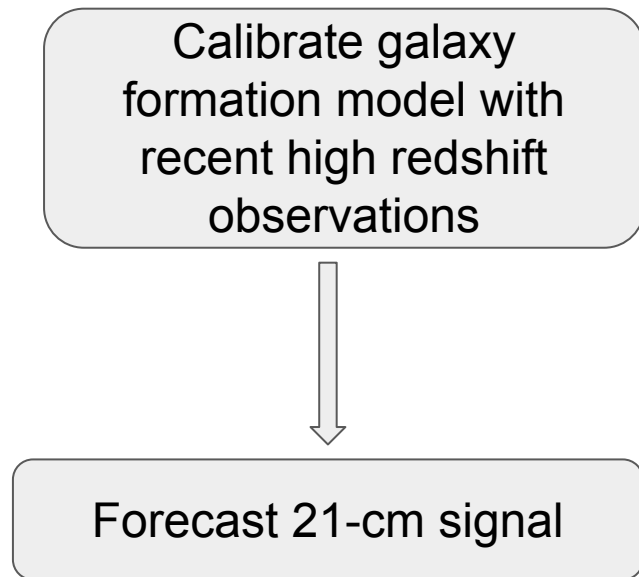
Theory and Debate over 21-cm global signal observation



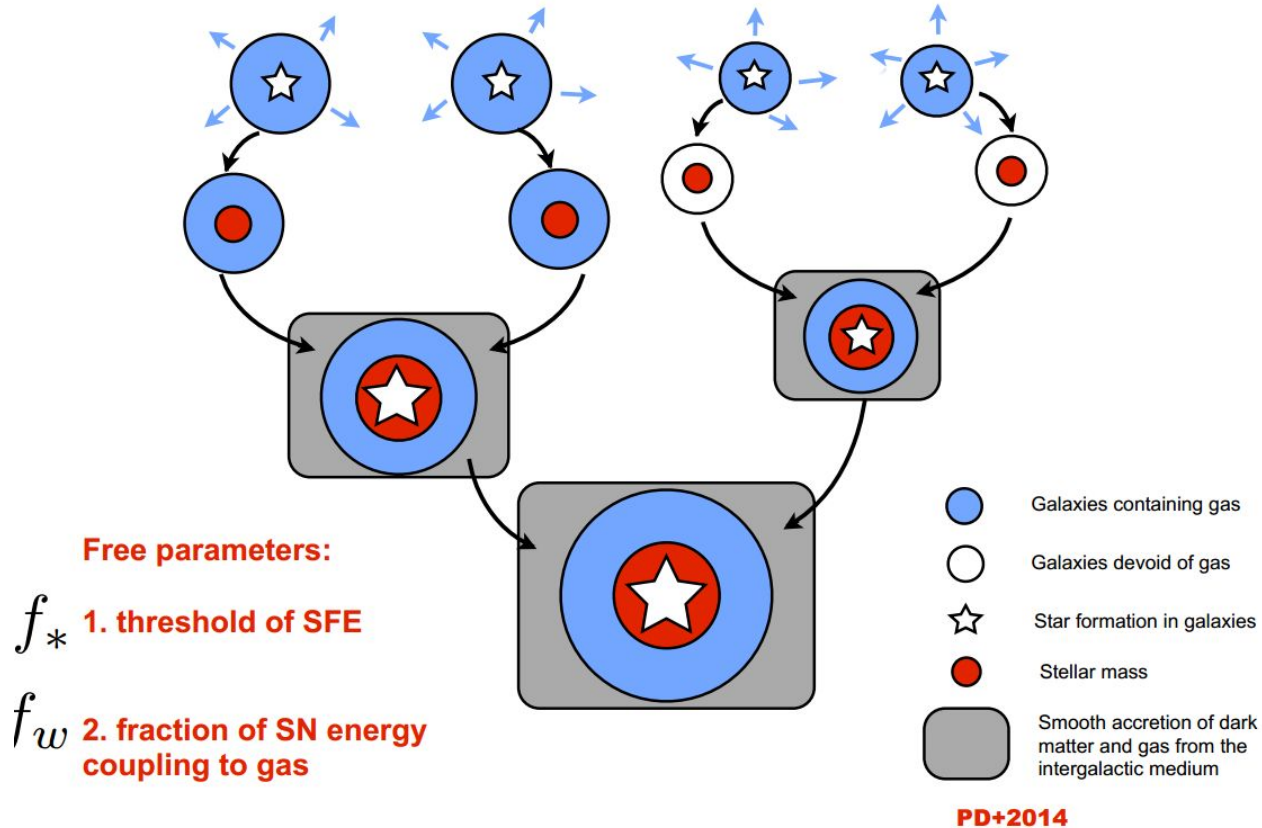
SARAS-3 rejects EDGES claim at 95.3 % level. Singh et al. 2022

Forecasting the 21-cm global signal

JWST & ALMA observes galaxies at $z \sim 6 - 15$



Galaxy Formation model DELPHI



Calibrating DELPHI

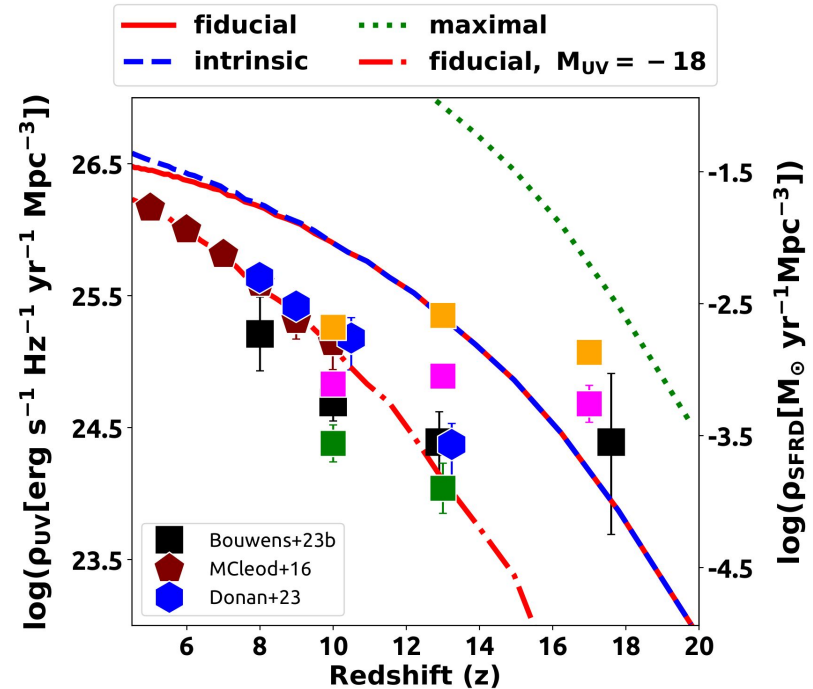
Model Parameters:

$$f_*^{eff}, f_{esc}, f_w$$

Observations used for calibration

SFRD, Stellar Mass Density, Stellar Mass Function, galaxy UVLF, ...

Model	f_{esc}	f_*^{eff}	f_w	Dust
Fiducial	0.1	0.15	0.06	Yes
Intrinsic	0.1	0.15	0.06	No
Maximal	0.003	1.0	0.0	No



Computing 21-cm signal

Outputs of DELPHI \longrightarrow 21-cm signal

Quantities to calculate 21-cm signal	Outputs from DELPHI
ϵ_X	SFRD
J_α	n_α
x_{HI}	n_{ion}

$$\epsilon_X = f_{X,h} \times \left(\frac{\dot{\rho}_*}{\text{M}_\odot \text{yr}^{-1} \text{Mpc}^{-3}} \right)$$

$f_{X,h} \longrightarrow$ X-ray heating parameter

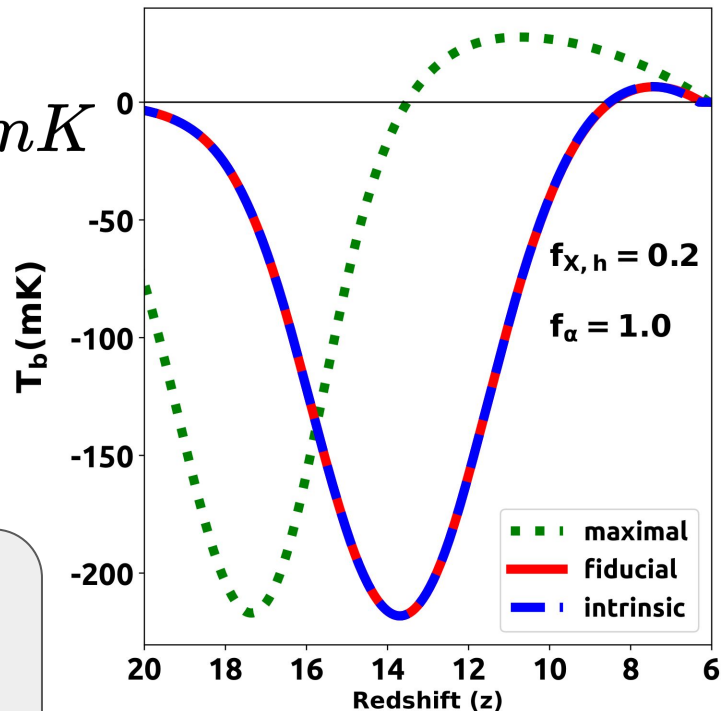
$f_\alpha \longrightarrow Ly\alpha$ escape fraction

Predicted 21 cm signal

Fiducial Model \implies $T_{b,min} = -215 \text{ mK}$
 $z_{min} = 14$

No sensible effect of dust

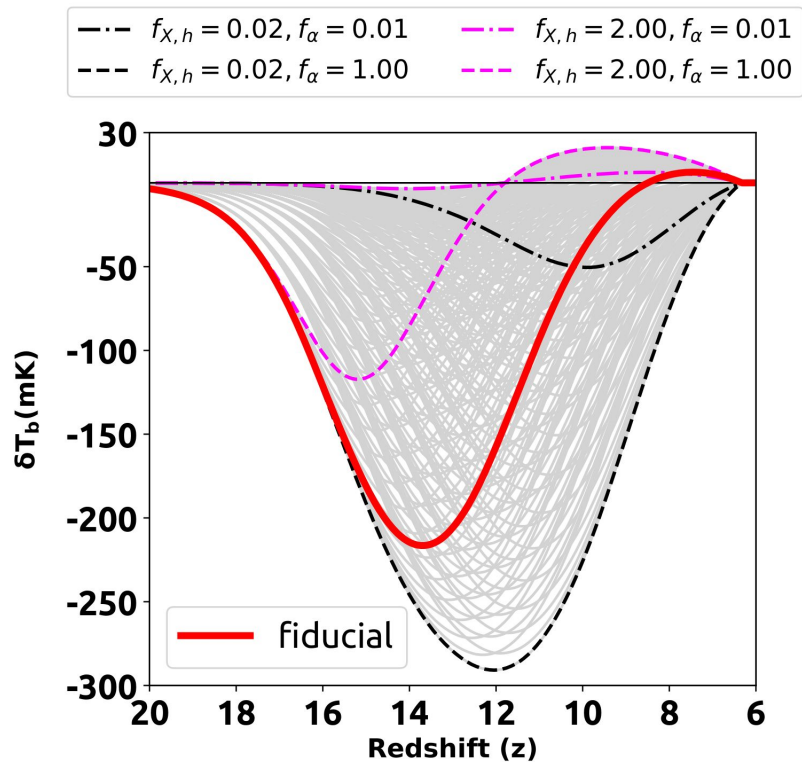
Maximal model predicts very early star formation with $z_{min} = 17$



Predicted 21 cm signal with varying parameters

Vary 21 cm free parameters

$f_{X,h}, f_{\alpha}$



Summary

JWST & ALMA  Unprecedented observation of early Universe.

Galaxy formation model DELPHI calibrated against high redshift observations.



Predict 21cm
Global signal

Fiducial model predict  absorption trough of ~ -215 mK at $z \sim 14$.