Uncovering Early Galaxy Evolution in the ALMA and JWST Era
Proceedings IAU Symposium No. 352, 2019
E. da Cunha, J. Hodge, J. Afonso, L. Pentericci & D. Sobral, eds.

doi:10.1017/S1743921319008408

Guitarra, a Simulator for the JWST/NIRCam

Christopher N. A. Willmer[1], Kevin N. Hainline[1], Emma Curtis-Lake[2] and JADES Team

[1]Steward Observatory, University of Arizona
933 N Cherry Avenue, Tucson, AZ 85721, USA
emails: cnaw@as.arizona.edu, kevinhainline@email.arizona.edu

[2]Kavli Institute for Cosmology Cambrigde, University of Cambridge, Madingley Road, Cambridge CB3 0HA, UK
email: curtis@iap.fr

Abstract. We present an overview of *Guitarra*, a simulator for the Near Infrared Camera that creates scenes from catalogues of mock or real sources using the current best estimates of the instrument characteristics and the pattern on the sky of the observations.

Keywords. techniques: image processing, methods: numerical

1. Introduction

The (*James Webb Advanced Deep Extragalactic Survey* JADES, Rieke, this volume) will observe both GOODS fields taking data simultaneously with the JWST NIRSpec and NIRCam instruments or NIRCam and MIRI (Alberts, this volume) as part of the Guaranteed Time Observations. Most JADES observations will be carried out during JWST Cycle 1, and one of the challenges faced by the team will be providing a vetted list of galaxies for NIRSpec follow-up in the time span of about 45 days from the downlink of raw data. This poster presents a brief description of *Guitarra*, a suite of programmes that generates scenes designed to test the pipeline that will ultimately provide the spectroscopic sample.

2. Description

Guitarra† is a collection of *fortran* routines with *perl* and *python* wrapper scripts that creates astronomical scenes. These use the instrument footprint measured during ground-based cryogenic tests at Goddard Space Flight Center, point spread function models calculated by WebbPSF (Perrin *et al.* 2014), and the JWST positions on the sky output by the Astronomer's Proposal Tool (APT) used to prepare the observations. The catalogues used to create scenes contain positions, magnitudes in the NIRCam and MIRI bands and shapes described by Sersic parameters. For the realisation shown in Fig. 1 we used a combination of the mock catalogue of Williams *et al.* (2018) with a subsample of CANDELS data (van der Wel *et al.* 2012), processed using *BEAGLE* (Chevallard & Charlot (2016) to generate NIRCam fluxes (Curtis-Lake *et al.* in preparation). The images are then processed as the real data will be and mosaiced. The detection of sources on these mosaics uses *Sextractor* (Bertin & Arnouts 1996) and the fluxes are used by Hainline *et al.* (in preparation), to calculate photometric redshifts using *EAZY* (Brammer *et al.*

† Available at https://github.com/cnaw/guitarra

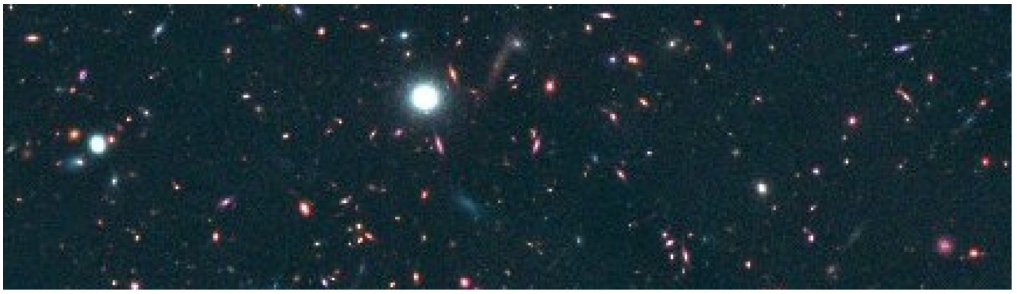

Figure 1. Part of a scene created by *Guitarra* using a merger of the CANDELS van der Wel *et al.* (2012) and JAGUAR Williams *et al.* (2018) catalogues. The field simulates the JADES deep observations in GOODS-S in the F115W, F200W and F356W NIRCam filters.

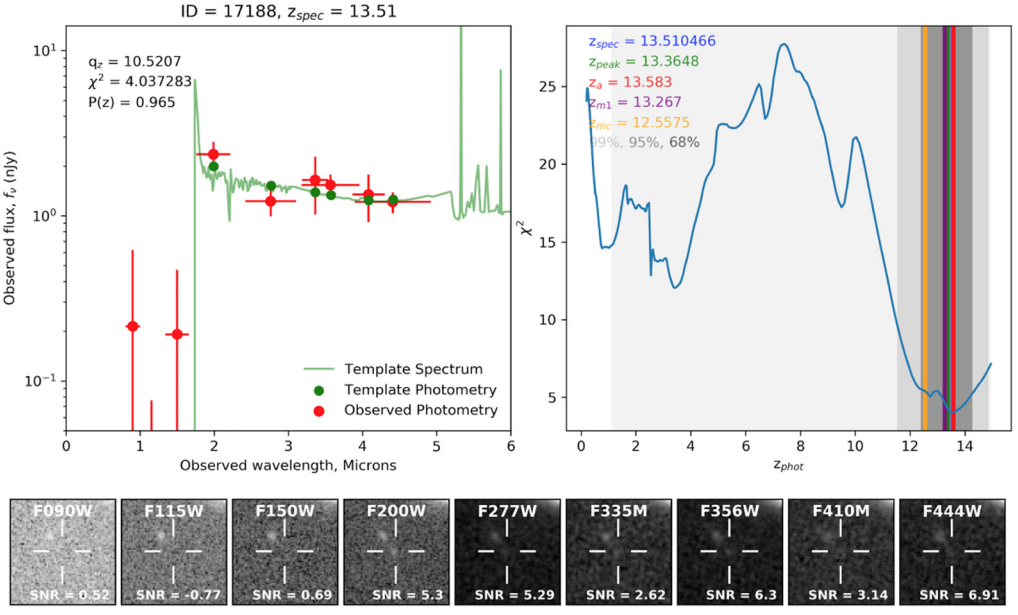

Figure 2. Reconstructed spectrum of a simulated high redshift galaxy detected in the simulated GOODS field. *Guitarra* allows testing the object detection and photometric redshift calculation algorithms (Hainline *et al.* in preparation).

2008) and *BEAGLE* (Chevallard & Charlot 2016). Fig. 2 shows a very high redshift galaxy detected in the simulated deep GOODS-S field. In addition to testing the pipeline from processing raw data to providing source catalogues, the simulations generated by *Guitarra* will be used to identify and quantify the completeness and selection functions that will affect the JADES survey, an essential step for all statistical analyses of these data (e.g., Bouwens *et al.* 2015; Finkelstein *et al.* 2015).

We gratefully acknowledge funding from the JWST/NIRCam contract to the University of Arizona, NAS5-02015.

References

Bertin, E. & Arnouts, S. 1996, *AAS*, 117, 393
Brammer, G. B., van Dokkum, P. G., & Copi, P. 2008, *ApJ*, 686, 1503
Bouwens, R. J., Illingworth, G. D., Oesch., P. A., *et al.* 2015, *ApJ*, 803, 34

https://doi.org/10.1017/S1743921319008408 Published online by Cambridge University Press

Finkelstein, S. L., Ryan, R. E., Papovich, C., *et al.* 2015, *ApJ* 810, 71
Perrin, M. D., Sivaramakrishnan, A., Lajoie, C.-P., *et al.* 2014, *Proceedings SPIE* 9143, 91433X
van der Wel, A., Bell, E. F., Häussler, B., *et al.* 2012, *ApJS* 203, 24
Williams, C. C., Curtis-Lake, E., Hainline, K. N. *et al.* 2012, *ApJS* 236, 33

https://doi.org/10.1017/S1743921319008408 Published online by Cambridge University Press