Grism Simulations - Exploiting Roman Data Archives

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+ Roman Archive SIT

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Unlocking the power of RST imaging and spectroscopic surveys

- Accurate redshifts based on H-alpha, and [OIII] emission lines
- Star formation rates, and metallicities for statistically significant galaxy samples selected by mass and redshifts
- Extreme emission line galaxies: low-metallicity dwarf star-forming galaxies
- Unique discovery space by dispersing every source across the FOV
- Roman Archives will enable science beyond key projects and proposed GO science programs

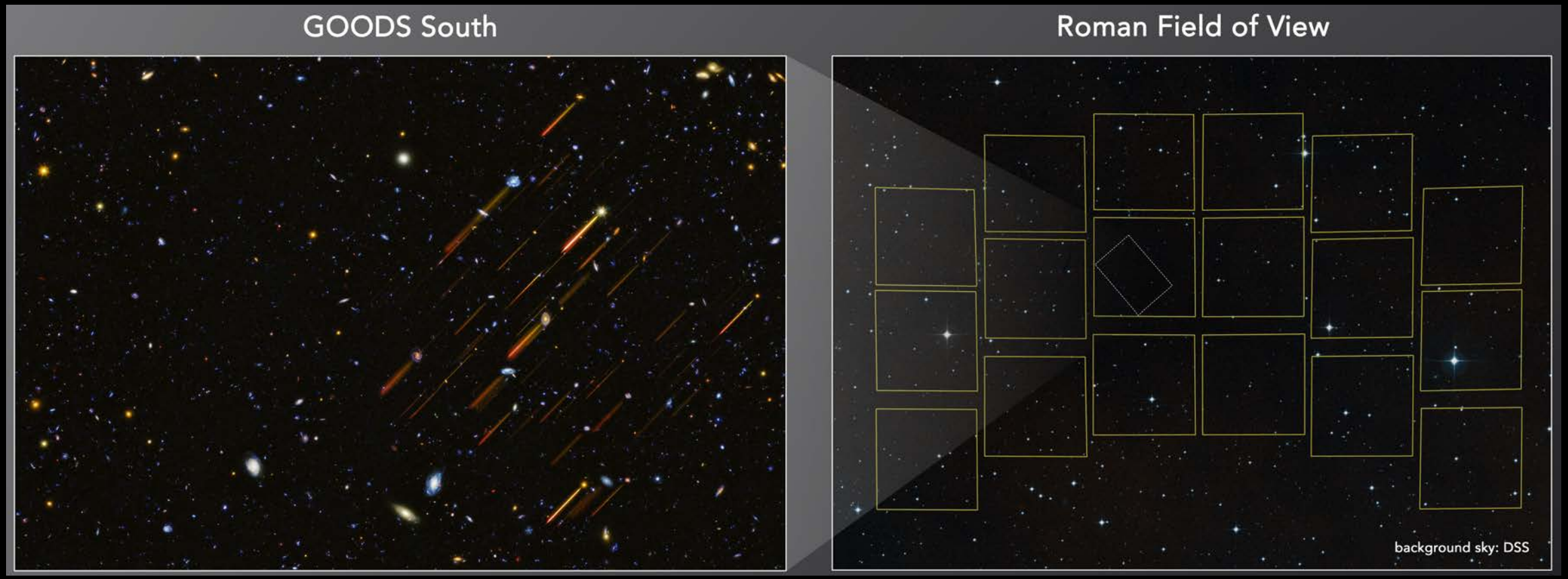


Figure credit: STScI OPO

Grism simulations for Roman Archive Database

- define the format for ingestion of direct and dispersed images into the archive
- design the output products that will be made available via the archive
- develop and test the sample query for the spectroscopic data

The proposed work involved creation of an initial set of large area simulations as a representative sample of the data from the Roman surveys, and also to ensure archive readiness for future simulations and observed data that will be made available by the science teams. The simulations would be used to set up sample queries for Roman and ancillary data in any given survey field.

Grism simulations for Roman Archive Database

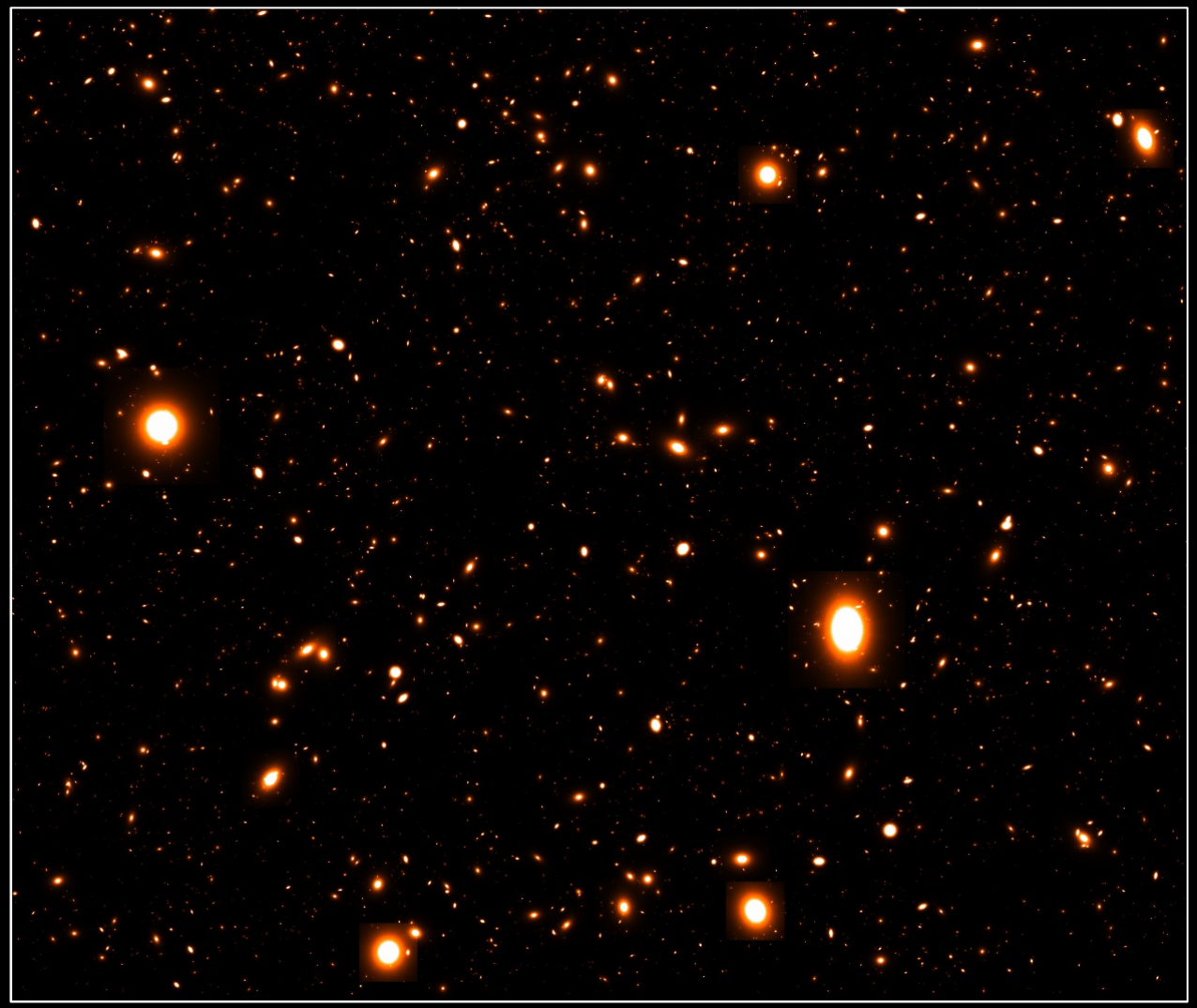
- We developed the machinery to do Roman grism simulations to create the archive database expected from Roman surveys. Using a large catalog of galaxy properties, Roman PSFs, and the grism configuration files as inputs, the code can generate the direct (reference) and dispersed images.

- For input parameters we generated a catalog with redshift distribution, magnitudes and number densities that are representative of the galaxies in the HST COSMOS (for realistic clustering and luminosity function). The code can be used to generate simulations for any field including the mock data from cosmological simulations (eg; Illustris).

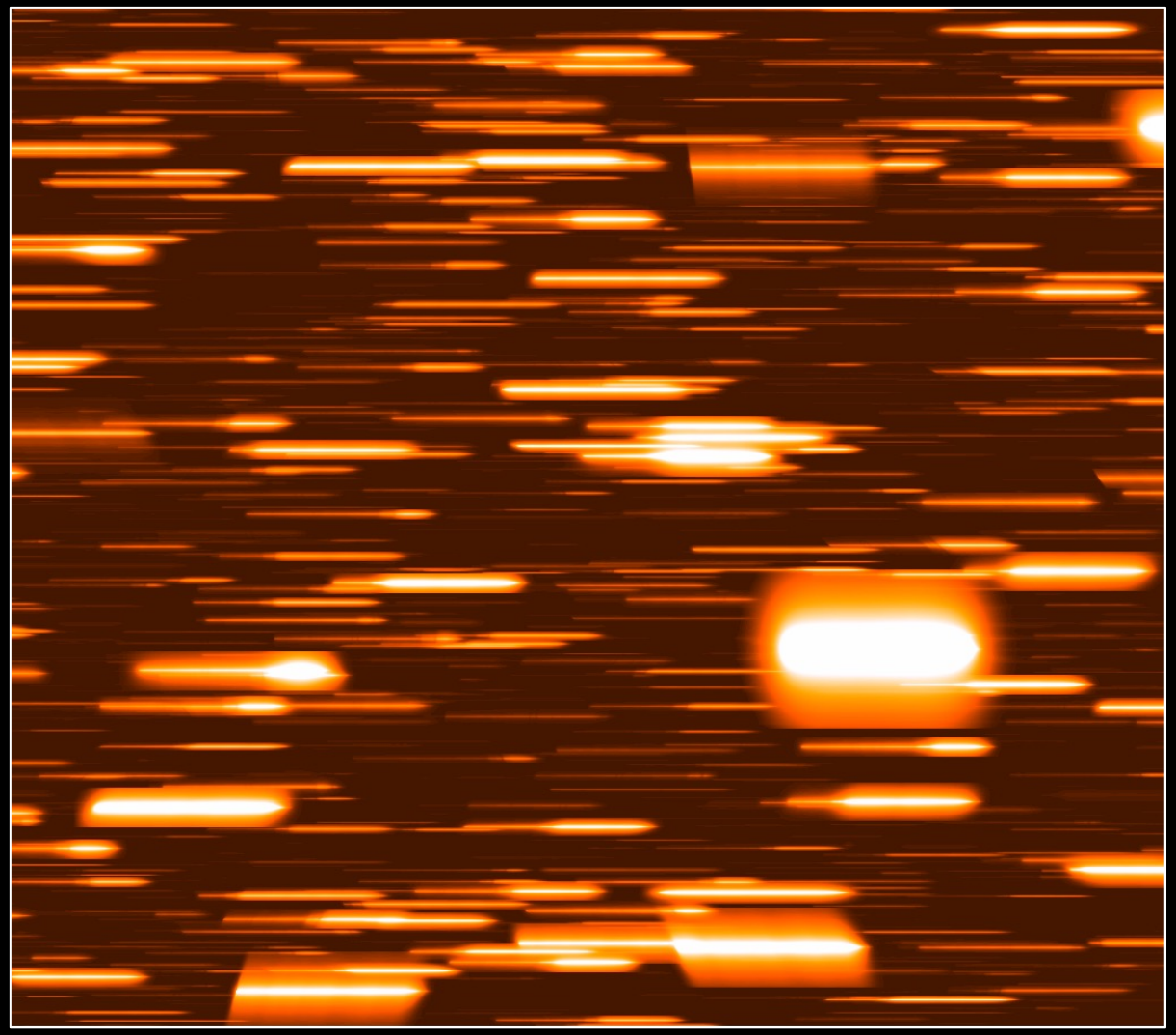
- Test simulations were done for SCA01 but can be extended to do simulations for all other SCAs with the appropriate configuration files.

Grism simulations for Roman Archive Database

F158



Grism



Credits for simulations: Brian York

Grism simulations for Roman Archive Database

Figure shows the grism simulation for 7100+ sources

~ 28.0 AB magnitude cutoff

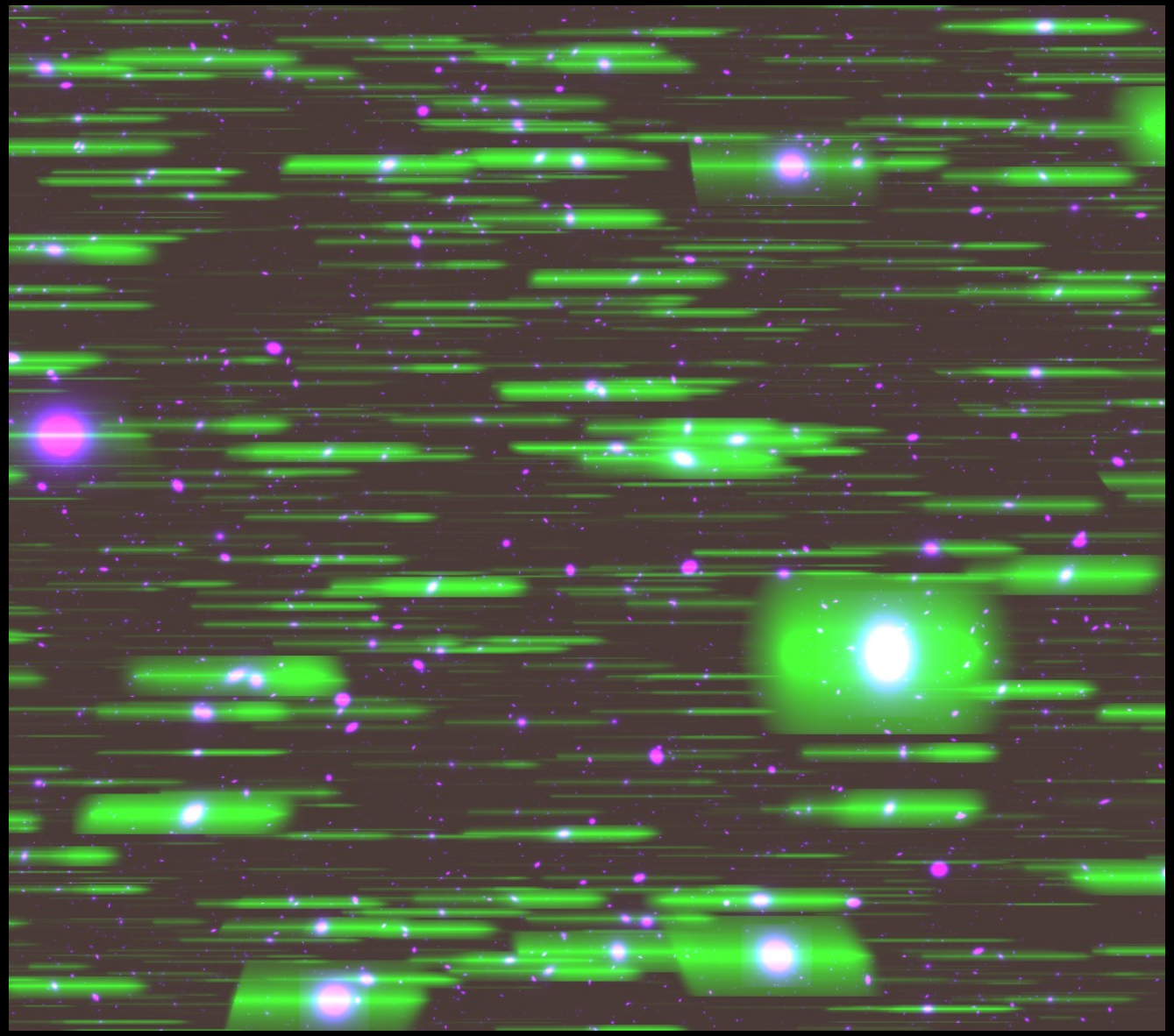
galaxy profiles: Sersic models (n=4,1)

SEDs: galaxy templates E, Sbc, Scd, Irr (from Brown et al. 2014)

detectors: SCA01, FOV ~ 7.5’ x 7.5’

Computation time: ~ 5hrs or ~3s per source

F158+Grism



Grism simulations for Roman Archive Database

- Outputs from the simulations include : (1) reference image, (2) segmentation image, (3) table of source parameters, (4) dispersed image, and (5) a .pkl file that contains the 1-d spectrum for every source in the simulated field. The spectra in the .pkl file can be used as an example science product for the purpose of generating the framework for archive query.

- The code and example Jupyter notebook are available through the SciServer and simulations can be run using the compute jobs application directly on the SciServer to populate the grism database.

- The code is a resource available for the community to do Roman grism simulations for any field of choice to populate the database or to plan observations. In addition, the infrastructure on the SciServer can also ingest grism simulations generated by other Roman-SITs to grow the database and develop tools for the archive query.

Integration into the SciServer and API

SciServer Compute | Interactive Notebooks | Jobs | swarar

Containers

Created At	Name	Domain	Image	Status	
2021-10-15 11:27:02.0	WFIRST Archive-SIT Grism Simulation	Interactive	SciServer Essentials 2.0	stopped	

Create container

Important Information about Compute Container File Storage

File System Most of the folders in a Container's file system should not be used to store your files. Your initial container view is of /home/idies/workspace, which may contain volumes under the Storage and Temporary folders. Any user volumes you choose to add to the container at creation will be present within these folders. Do not store your files in workspace, or in any other folder except as described here. If a Compute node fails, your incorrectly stored files will be *lost permanently*.

Storage Use Storage volumes for long term storage of your scripts and small data files. The volumes in the Storage folder are backed up. These volumes are mounted according to the username of the user who created them under the path /home/idies/workspace/Storage/*username/user volume name/* . Files saved to this folder persist between your containers, even in the event that a container fails. Other files and folders cannot be placed in any intermediate paths, i.e., under the Storage/*username* or Storage/ folders. Your Storage volumes are subject to size limitations described in the **SciServer Compute Data Storage Policy**.

persistent By default, all users start with a Storage volume named persistent. The files in this volume correspond to the same persistent folder used in previous versions of Compute.

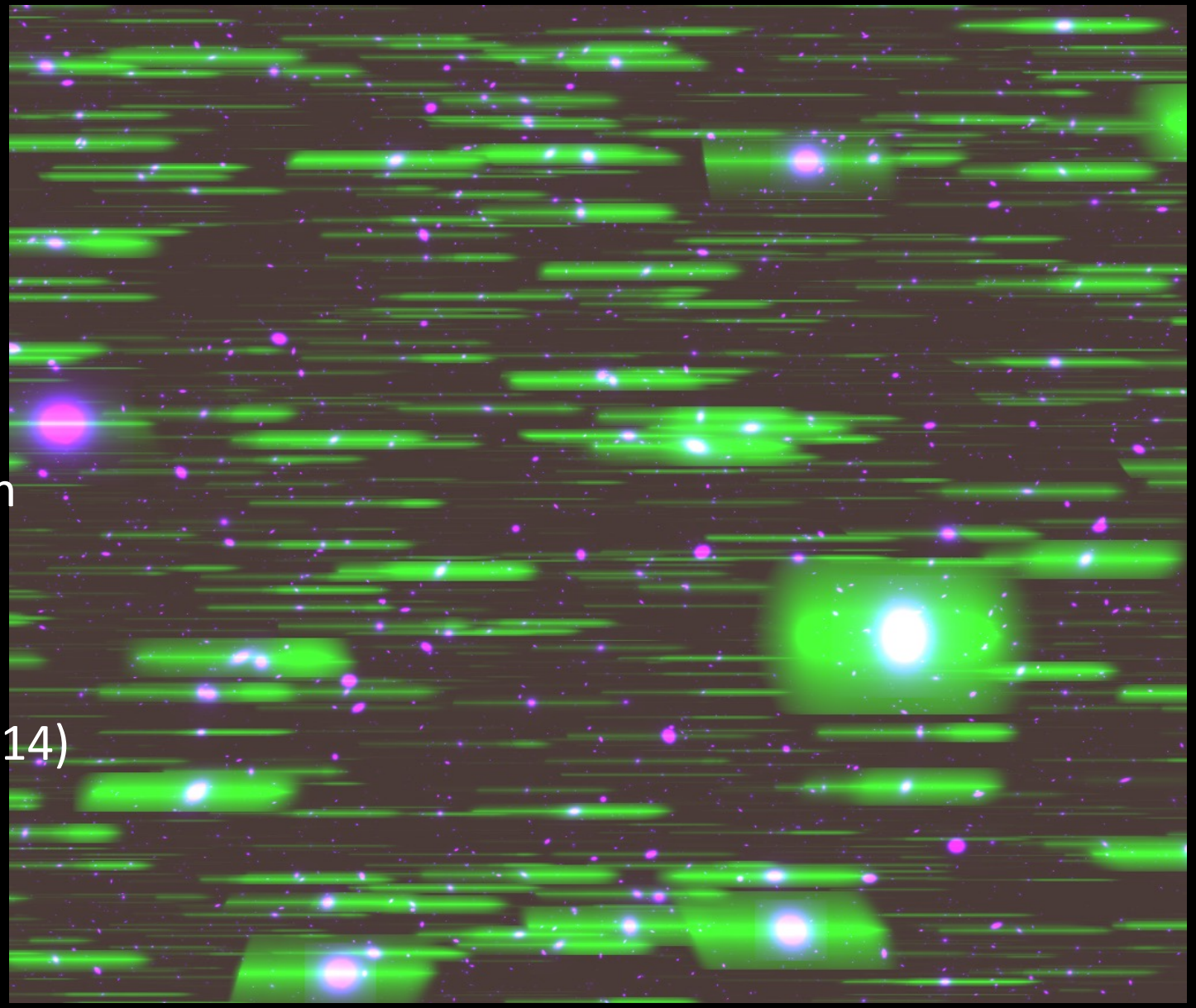
Running the simulations on the SciServer

Create roman_grism env for the simulations using the .yml file

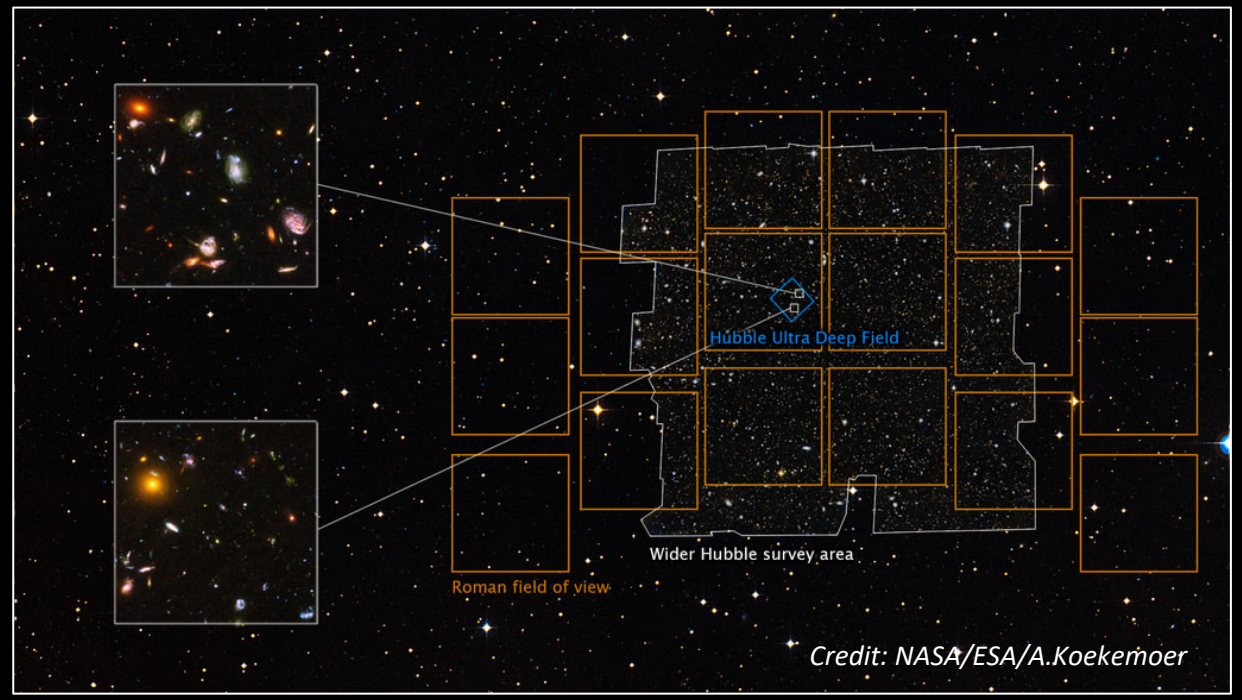
Dependencies:

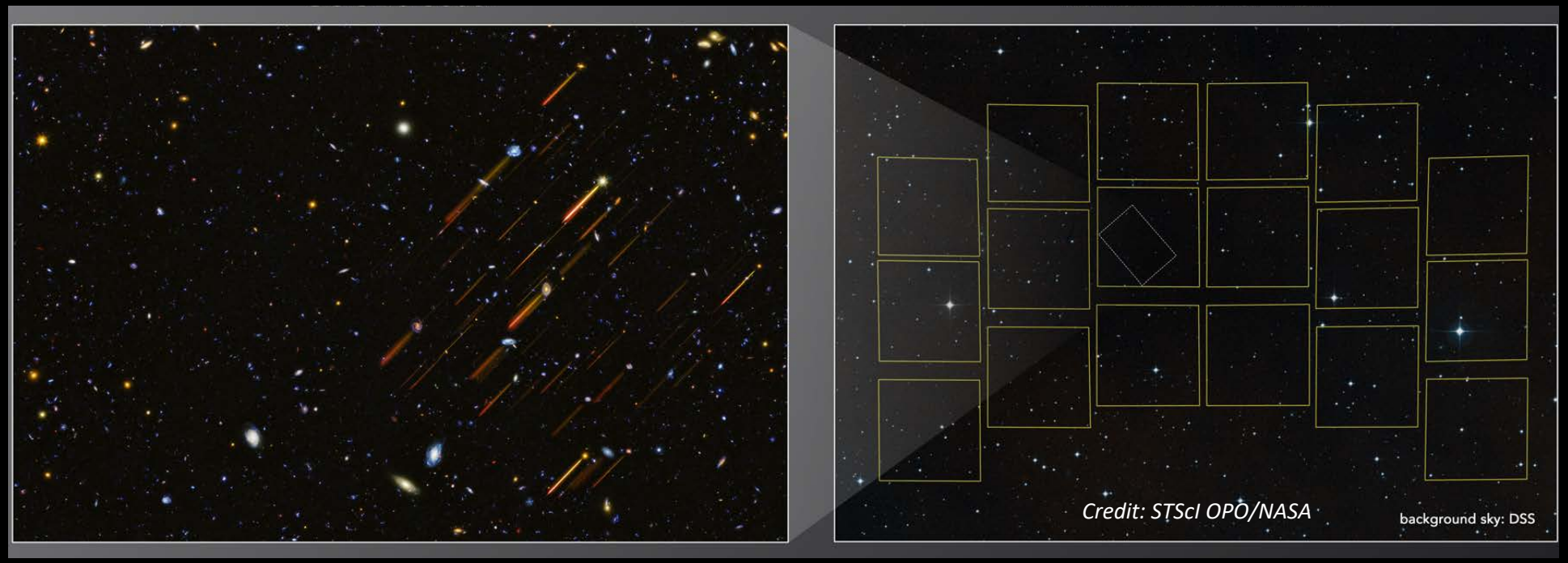
- Grizli – dispersing spectra
- Photutils – catalogs, segmentation
- Galsim – create galaxy models
- WebbPSF (Roman) – PSF convolution
- Pandeia – generate WFI filter bandpasses
- astropy – assign WCS parameters
- SEDs – galaxy templates (Brown+ 2014)

Run the Jupyter Notebook



Thanks!!


Hubble Ultra Deep Field
Wider Hubble survey area
Roman field of view
Credit: NASA/ESA/A.Koekemoer


Credit: STScI OPO/NASA
background sky: DSS