# 13411 - Dissecting the intensely star-forming clumps in a z ~ 2 Einstein Ring

Cycle: 21, Proposal Category: GO

(Availability Mode: SUPPORTED)

**INVESTIGATORS**


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|---|---|---|
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**VISITS**

| *Visit* | *Targets used in Visit* | *Configurations used in Visit* | *Orbits Used* | *Last Orbit Planner Run* | *OP Current with Visit?* |
|---|---|---|---|---|---|
| 01 | (1) A611RING | WFC3/IR | 2 | 19-Jun-2013 22:31:54.0 | yes |
| 03 | (1) A611RING | WFC3/IR | 2 | 19-Jun-2013 22:32:06.0 | yes |

4 Total Orbits Used

**ABSTRACT**

Clumps of star formation spreading widely in galactic disks are common features of star-forming galaxies at 1 < z < 3. This is the epoch when galaxy assembly activities peaked. These clumps could represent a pathway through which a majority of the stellar mass in the Universe was formed; understanding their formation and evolution is central to our understanding of galaxy evolution. However, the intensely star-forming clumps in disk galaxies at z ~ 2 have rarely been studied. Each of these clumps is forming stars in situ at a rate comparable to the most luminous merger-triggered starbursts in the local Universe. They are thus unique test cases to study the mechanism that drives intense star formation at z ~ 2. We propose WFC3 near-IR imaging and spatially-resolved spectroscopy of a gravitationally lensed, kinematically ordered, vigorously star-forming galaxy at z = 1.885 with physical resolutions up to 40 pc. This galaxy contains two luminous clumps that are forming stars at the rates of 100 solar mass/yr/clump. Spatially-resolved map of star formation from HST provides the most critical missing piece to interpret our existing observations of this galaxy in far-IR, CO emission lines, and radio continuum. We will probe the frontier research areas in z ~ 2 star formation, particularly the spatially-resolved star formation laws and dynamics of cold and ionized gases, which have never been probed at this spatial resolution. Our proposed observations will provide a benchmark against which to interpret the structures of vigorous star-forming clumps in general. This object can therefore have a unique impact on our understanding of the star-forming modes that dominate at z ~ 2.

**OBSERVING DESCRIPTION**

We are observing a 2" Einstein ring image of a star-forming galaxy at z ~ 2 using WFC3 imaging and grism spectroscopy to obtain spatially-resolved color and H-beta/[OIII] variations, respectively. We set up this observation in two different ORIENT angles, each with 4.8 ks of G141 spectroscopy divided into 4 exposures (2 per orbit, 8 grism exposures total). Each G141 exposure is preceded by either F105W (6 exposures) or F140W (2 exposures) direct imaging (the target is fainter in F105W).

We follow dithering strategy of program# 12177 (3D-HST, PI: van Dokkum), i.e.,
POS-TARG: (0, 0) (1.355, 0.424) (0.881, 1.212) (-0.474, 0.788)

The narrow ORIENT requests (ORIENT-A = 237-249 deg, ORIENT-B = 165-185 deg) are to (1) avoid the 0th and 1st-order images from nearby bright objects, (2) avoid dispersing the elliptical lens galaxy onto the bright regions of the Einstein ring, and (3) avoid dispersing the bright regions of the Einstein ring onto themselves.

## Visit

**Proposal 13411, ORIENT-A, F105W/F140W (01), implementation** Thu Jun 20 02:32:14 GMT 2013

**Diagnostic Status: Warning**

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 237D TO 249 D

## Diagnostics

(ORIENT-A, F105W/F140W (01)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

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(ORIENT-A, F105W/F140W (01)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

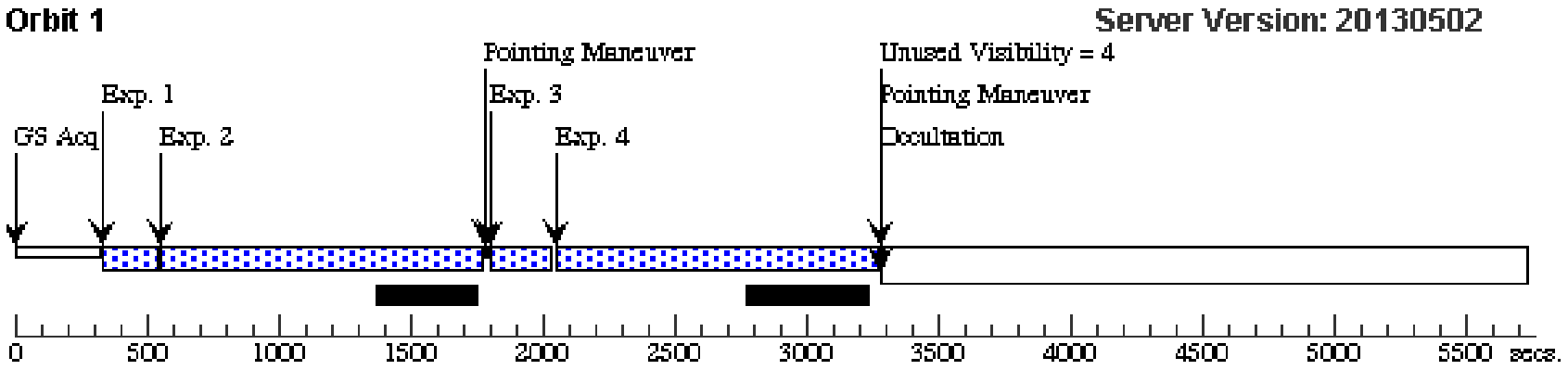
## Fixed Targets

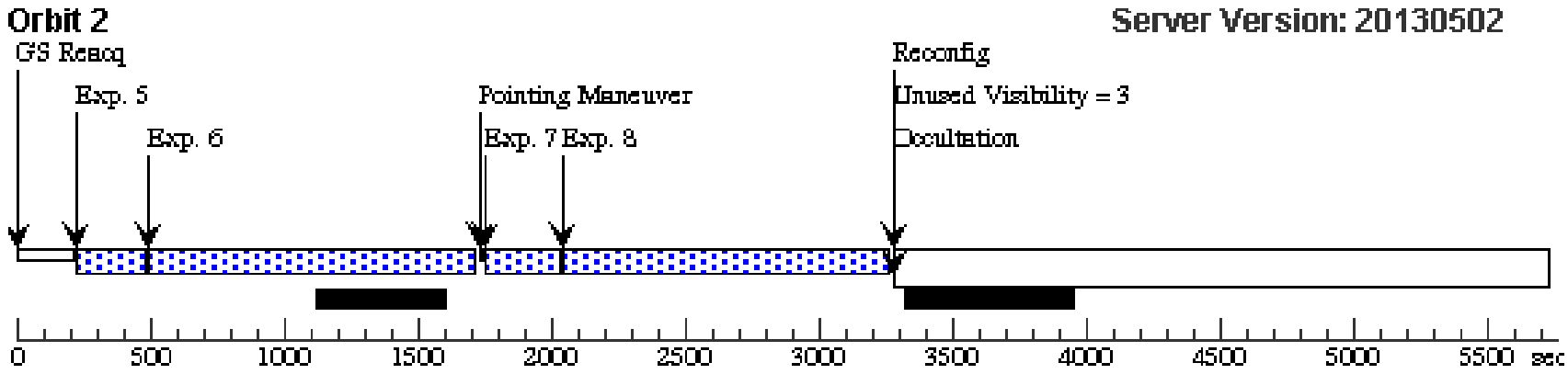
| # | Name | Target Coordinates | Targ. Coord. Corrections | Fluxes | Miscellaneous |
|---|---|---|---|---|---|
| (1) | A611RING | RA: 08 00 57.8600 (120.2410833d)<br>Dec: +36 14 13.35 (36.23704d)<br>Equinox: J2000 | | V=24<br>F140W = 23.1 mag,<br>F105W = 23.7 mag | Reference Frame: ICRS |

## Exposures

| # | Label | Target | Config,Mode,Aperture | Spectral Els. | Opt. Params. | Special Reqs. | Groups | Exp. Time (Total)/[Actual Dur.] | Orbit |
|---|---|---|---|---|---|---|---|---|---|
| 1 | F105W Direct Image | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | F105W | SAMP-SEQ=SPARS25; NSAMP=8 | POS TARG 0.0,0.0; GS ACQ SCENARIO BASE1B3 | | 177.935896 Secs (177.936 Secs)<br>*[==>]* | ***[1]*** |
| 2 | G141 Grism | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | G141 | SAMP-SEQ=SPARS100; NSAMP=13 | SAME POS AS 1 | | 1202.936167 Secs (1202.936 Secs)<br>*[==>]* | ***[1]*** |
| 3 | F105W Direct Image | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | F105W | SAMP-SEQ=SPARS25; NSAMP=9 | POS TARG 1.355,0.424 | | 202.936411 Secs (202.936 Secs)<br>*[==>]* | ***[1]*** |
| 4 | G141 Grism | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | G141 | SAMP-SEQ=SPARS100; NSAMP=13 | SAME POS AS 3 | | 1202.936167 Secs (1202.936 Secs)<br>*[==>]* | ***[1]*** |
| 5 | F140W Direct Image | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | F140W | SAMP-SEQ=SPARS25; NSAMP=10 | POS TARG 0.881,1.212 | | 227.936926 Secs (227.937 Secs)<br>*[==>]* | ***[2]*** |
| 6 | G141 Grism | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | G141 | SAMP-SEQ=SPARS100; NSAMP=13 | SAME POS AS 5 | | 1202.936167 Secs (1202.936 Secs)<br>*[==>]* | ***[2]*** |
| 7 | F140W Direct Image | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | F140W | SAMP-SEQ=SPARS25; NSAMP=11 | POS TARG -0.474,0.788 | | 252.937441 Secs (252.937 Secs)<br>*[==>]* | ***[2]*** |
| 8 | G141 Grism | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | G141 | SAMP-SEQ=SPARS100; NSAMP=13 | SAME POS AS 7 | | 1202.936167 Secs (1202.936 Secs)<br>*[==>]* | ***[2]*** |

Orbit Structure



## Visit

**Proposal 13411, ORIENT-B, F105W (03), implementation** Thu Jun 20 02:32:17 GMT 2013

**Diagnostic Status: Warning**

Scientific Instruments: WFC3/IR

Special Requirements: ORIENT 165D TO 185 D

## Diagnostics

(ORIENT-B, F105W (03)) Warning (Orbit Planner): SAME POS MAY NOT BE APPROPRIATE

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| 4 | G141 Grism | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | G141 | SAMP-SEQ=SPARS100; NSAMP=13 | SAME POS AS 3 | | 1202.936167 Secs (1202.936 Secs)<br>*[==>]* | *[1]* |
| 5 | F105W Direct Image | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | F105W | SAMP-SEQ=SPARS25; NSAMP=10 | POS TARG 0.881,1.212 | | 227.936926 Secs (227.937 Secs)<br>*[==>]* | *[2]* |
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| 7 | F105W Direct Image | (1) A611RING | WFC3/IR, MULTIACCUM, GRISM1024 | F105W | SAMP-SEQ=SPARS25; NSAMP=11 | POS TARG -0.474,0.788 | | 252.937441 Secs (252.937 Secs)<br>*[==>]* | *[2]* |
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Orbit Structure