



# 6587 - Identifying the fingerprints of r-process heavy metals in a nearby GRB

Cycle: 3, Proposal Category: GO

## INVESTIGATORS

| <i>Name</i>                                 | <i>Institution</i>                                |
|---|---|
| <b>Dr. Eleonora Troja (PI) (ESA Member)</b> | <b>Universita degli Studi di Roma Tor Vergata</b> |

## OBSERVATIONS

| <i>Folder</i>      | <i>Observation</i> | <i>Label</i>      | <i>Observing Template</i> | <i>Science Target</i> |
|--------------------|--------------------|-------------------|---------------------------|-----------------------|
| Observation Folder |                    |                   |                           |                       |
|                    | 1                  | Epoch 1 - imaging | NIRCam Imaging            | (3) XRT               |
|                    | 2                  | Epoch 2 - Spec    | NIRSpec IFU Spectroscopy  | (4) GRB260114A        |
|                    | 3                  | Epoch 3 - Imaging | NIRCam Imaging            | (3) XRT               |

## ABSTRACT

The afterglow of some GRBs display a late-time rebrightening, visible in the near-infrared a few days after the burst. This late-time bump is best explained as kilonova emission, providing a direct link to neutron star mergers, and a compelling proof for the synthesis of heavy nuclei through the rapid neutron capture process (r-process). We propose a multi-wavelength follow-up campaign of a nearby ( $z < 0.7$ ) GRB in order to detect the expected kilonova bump and constrain its properties. Multi-band observations, and in particular X-rays, are critical to pin down the nature of the observed rebrightening, and to distinguish it from the standard afterglow emission.

CXO joint proposal 26500416

## OBSERVING DESCRIPTION

We request three epochs of JWST observations, 7 d, 14 days, and >30 days after the GRB. Only the first epoch is disruptive.

We request imaging in multiple filters using the same setup for all three visits.

No need to coordinate with Chandra or VLA.

==== REQUESTED CHANGE

After the first visit, we have a better localization of the source, which was *\*not\** available at activation

We thus request a second visit with NIRSPEC IFU to acquire spectroscopy

Proposal 6587 - Targets - Identifying the fingerprints of r-process heavy metals in a nearby GRB

| Fixed Targets | #          | Name  | Target Coordinates   | Targ. Coord. Corrections | Miscellaneous |
|---------------|------------|---|--|--------------------------|---------------|
|               | (3)        | XRT   | RA: 04 58 23.4900 (74.5978750d)<br>Dec: -08 00 51.90 (-8.01442d)<br>Equinox: J2000<br><br><i>Comments:</i><br><i>Category=Star</i><br><i>Description=[Neutron stars, X-ray bursters]</i> |                          |               |
| (4)           | GRB260114A | RA: 04 58 23.4837 (74.5978487d)<br>Dec: -08 00 50.93 (-8.01415d)<br>Equinox: J2000<br><br><i>Comments:</i><br><i>Category=Star</i><br><i>Description=[Gamma Ray bursters]</i> |  |                          |               |

Proposal 6587 - Observation 1 - Identifying the fingerprints of r-process heavy metals in a nearby GRB

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|                             |  |                            |                                 |                        |                                 |                             |                           |                      |                            |                           |
|-----------------------------|--|----------------------------|---------------------------------|------------------------|---------------------------------|-----------------------------|---------------------------|----------------------|----------------------------|---------------------------|
| <b>Observation</b>          | <p><b>Proposal 6587, Observation 1: Epoch 1 - imaging</b></p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCam Imaging</p>   |                            |                                 |                        |                                 |                             |                           |                      |                            |                           |
| <b>Diagnostics</b>          | <p>(Epoch 1 - imaging (Obs 1)) Warning (Form): Response time &lt; 14.0 Days is disruptive to the scheduling process. Only a limited number of disruptive ToOs will be accepted.</p> <p>(Visit 1:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.</p> |                            |                                 |                        |                                 |                             |                           |                      |                            |                           |
| <b>Fixed Targets</b>        | <b>#</b>   | <b>Name</b>                | <b>Target Coordinates</b>       |                        | <b>Targ. Coord. Corrections</b> |                             |                           | <b>Miscellaneous</b> |                            |                           |
|                             | (3)  | XRT                        | RA: 04 58 23.4900 (74.5978750d) |                        |                                 |                             |                           |                      |                            |                           |
|                             |  |                            | Dec: -08 00 51.90 (-8.01442d)   |                        |                                 |                             |                           |                      |                            |                           |
|                             |  |                            | Equinox: J2000                  |                        |                                 |                             |                           |                      |                            |                           |
|                             | <p><i>Comments:</i></p> <p><i>Category=Star</i></p> <p><i>Description=[Neutron stars, X-ray bursters]</i></p>  |                            |                                 |                        |                                 |                             |                           |                      |                            |                           |
| <b>Template</b>             | <b>Module</b>  |                            |                                 |                        |                                 | <b>Subarray</b>             |                           |                      |                            |                           |
|                             | B  |                            |                                 |                        |                                 | FULL                        |                           |                      |                            |                           |
| <b>Dithers</b>              | <b>#</b>   | <b>Primary Dither Type</b> |                                 | <b>Primary Dithers</b> |                                 | <b>Subpixel Dither Type</b> |                           | <b>Dither Size</b>   |                            | <b>Subpixel Positions</b> |
|                             | 1  | NONE                       |                                 |                        |                                 | STANDARD                    |                           |                      |                            | 5                         |
| <b>Spectral Elements</b>    | <b>#</b>   | <b>Short Filter</b>        | <b>Long Filter</b>              | <b>Readout Pattern</b> | <b>Groups/Int</b>               | <b>Integrations/Exp</b>     | <b>Total Integrations</b> | <b>Total Dithers</b> | <b>Total Exposure Time</b> | <b>Optional ETC ID</b>    |
|                             | 1  | F070W                      | F444W                           | SHALLOW4               | 8                               | 1                           | 5                         | 5                    | 2093.67                    |                           |
|                             | 2  | F115W                      | F277W                           | SHALLOW4               | 6                               | 1                           | 5                         | 5                    | 1556.832                   |                           |
|                             | 3  | F150W                      | F356W                           | SHALLOW4               | 6                               | 1                           | 5                         | 5                    | 1556.832                   |                           |
|                             | 4  | F200W                      | F444W                           | SHALLOW4               | 6                               | 1                           | 5                         | 5                    | 1556.832                   |                           |
| <b>Special Requirements</b> | <p>Offset -15.0 arcsec, -15.0 arcsec</p> <p>Target Of Opportunity Response Time 7 Days</p> <p>2 After 1 by 4 Days to 10 Days</p>   |                            |                                 |                        |                                 |                             |                           |                      |                            |                           |

Proposal 6587 - Observation 2 - Identifying the fingerprints of r-process heavy metals in a nearby GRB

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|                             |  |                       |  |                   |                         |                                 |               |                         |                      |                           |                            |                        |
|-----------------------------|--|-----------------------|--|-------------------|-------------------------|---------------------------------|---------------|-------------------------|----------------------|---------------------------|----------------------------|------------------------|
| <b>Observation</b>          | <p>Proposal 6587, Observation 2: Epoch 2 - Spec</p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRSpec IFU Spectroscopy</p> |                       |  |                   |                         |                                 |               |                         |                      |                           |                            |                        |
| <b>Diagnostics</b>          | (Visit 2:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.  |                       |  |                   |                         |                                 |               |                         |                      |                           |                            |                        |
| <b>Fixed Targets</b>        | <b>#</b>   | <b>Name</b>           | <b>Target Coordinates</b>  |                   |                         | <b>Targ. Coord. Corrections</b> |               |                         | <b>Miscellaneous</b> |                           |                            |                        |
|                             | (4)  | GRB260114A            | RA: 04 58 23.4837 (74.5978487d)<br>Dec: -08 00 50.93 (-8.01415d)<br>Equinox: J2000 |                   |                         |                                 |               |                         |                      |                           |                            |                        |
|                             | <p><i>Comments:</i><br/> <i>Category=Star</i><br/> <i>Description=[Gamma Ray bursters]</i></p>   |                       |  |                   |                         |                                 |               |                         |                      |                           |                            |                        |
| <b>Template</b>             | <b>TA Method</b>   |                       |  |                   |                         | <b>HFF Readout Mode</b>         |               |                         |                      |                           |                            |                        |
|                             | NONE   |                       |  |                   |                         | false                           |               |                         |                      |                           |                            |                        |
| <b>Dithers</b>              | <b>#</b>   | <b>Dither Type</b>    |  | <b>Size</b>       | <b>Starting Point</b>   |                                 |               | <b>Number of Points</b> | <b>Points</b>        |                           |                            |                        |
|                             | 1  | CYCLING               |  | MEDIUM            | 1                       |                                 |               | 14                      |                      |                           |                            |                        |
| <b>Spectral Elements</b>    | <b>#</b>   | <b>Grating/Filter</b> | <b>Readout Pattern</b>   | <b>Groups/Int</b> | <b>Integrations/Exp</b> | <b>Leakcal</b>                  | <b>Dither</b> | <b>Autocal</b>          | <b>Total Dithers</b> | <b>Total Integrations</b> | <b>Total Exposure Time</b> | <b>Optional ETC ID</b> |
|                             | 1  | PRISM/CLEAR           | NRSIRS2RAPID   | 34                | 1                       | false                           | true          | NONE                    | 14                   | 14                        | 7148.556                   |                        |
| <b>Special Requirements</b> | 2 After 1 by 4 Days to 10 Days   |                       |  |                   |                         |                                 |               |                         |                      |                           |                            |                        |

Proposal 6587 - Observation 3 - Identifying the fingerprints of r-process heavy metals in a nearby GRB

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|                             |   |                            |  |                        |                                 |                             |                           |                      |                            |                        |
|-----------------------------|---|----------------------------|--|------------------------|---------------------------------|-----------------------------|---------------------------|----------------------|----------------------------|------------------------|
| <b>Observation</b>          | <p>Proposal 6587, Observation 3: Epoch 3 - Imaging</p> <p><b>Diagnostic Status: Warning</b></p> <p>Observing Template: NIRCam Imaging</p> |                            |  |                        |                                 |                             |                           |                      |                            |                        |
| <b>Diagnostics</b>          | (Visit 3:1) Warning (Form): Overheads are provisional until the Visit Planner has been run.   |                            |  |                        |                                 |                             |                           |                      |                            |                        |
| <b>Fixed Targets</b>        | <b>#</b>  | <b>Name</b>                | <b>Target Coordinates</b>  |                        | <b>Targ. Coord. Corrections</b> |                             |                           | <b>Miscellaneous</b> |                            |                        |
|                             | (3)   | XRT                        | RA: 04 58 23.4900 (74.5978750d)<br>Dec: -08 00 51.90 (-8.01442d)<br>Equinox: J2000 |                        |                                 |                             |                           |                      |                            |                        |
|                             | <p><i>Comments:</i><br/> <i>Category=Star</i><br/> <i>Description=[Neutron stars, X-ray bursters]</i></p>                                 |                            |  |                        |                                 |                             |                           |                      |                            |                        |
| <b>Template</b>             | <b>Module</b>   |                            |  |                        | <b>Subarray</b>                 |                             |                           |                      |                            |                        |
|                             | B   |                            |  |                        | FULL                            |                             |                           |                      |                            |                        |
| <b>Dithers</b>              | <b>#</b>  | <b>Primary Dither Type</b> |  | <b>Primary Dithers</b> |                                 | <b>Subpixel Dither Type</b> |                           | <b>Dither Size</b>   | <b>Subpixel Positions</b>  |                        |
|                             | 1   | NONE                       |  |                        |                                 | STANDARD                    |                           |                      | 5                          |                        |
| <b>Spectral Elements</b>    | <b>#</b>  | <b>Short Filter</b>        | <b>Long Filter</b>   | <b>Readout Pattern</b> | <b>Groups/Int</b>               | <b>Integrations/Exp</b>     | <b>Total Integrations</b> | <b>Total Dithers</b> | <b>Total Exposure Time</b> | <b>Optional ETC ID</b> |
|                             | 1   | F070W                      | F444W  | SHALLOW4               | 8                               | 1                           | 5                         | 5                    | 2093.67                    |                        |
|                             | 2   | F115W                      | F277W  | SHALLOW4               | 6                               | 1                           | 5                         | 5                    | 1556.832                   |                        |
|                             | 3   | F150W                      | F356W  | SHALLOW4               | 6                               | 1                           | 5                         | 5                    | 1556.832                   |                        |
|                             | 4   | F200W                      | F444W  | SHALLOW4               | 6                               | 1                           | 5                         | 5                    | 1556.832                   |                        |
| <b>Special Requirements</b> | <p>Offset -15.0 arcsec, -15.0 arcsec</p> <p>Target Of Opportunity Response Time 21 Days</p>   |                            |  |                        |                                 |                             |                           |                      |                            |                        |