l'Observatoire de Paris | LESIA

Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique

PSL RESEARCH UNIVERSITY PARIS

cnrs

Calibration des données spectrales Rosetta/VIRTIS-H

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LEISA, Observatoire de Paris

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Outline:

Introduction

- VIRTIS-H design and data
- Stray light

Stray light correction: easy case

- Correction in backup mode
- First corrections in nominal mode

Stray light variability

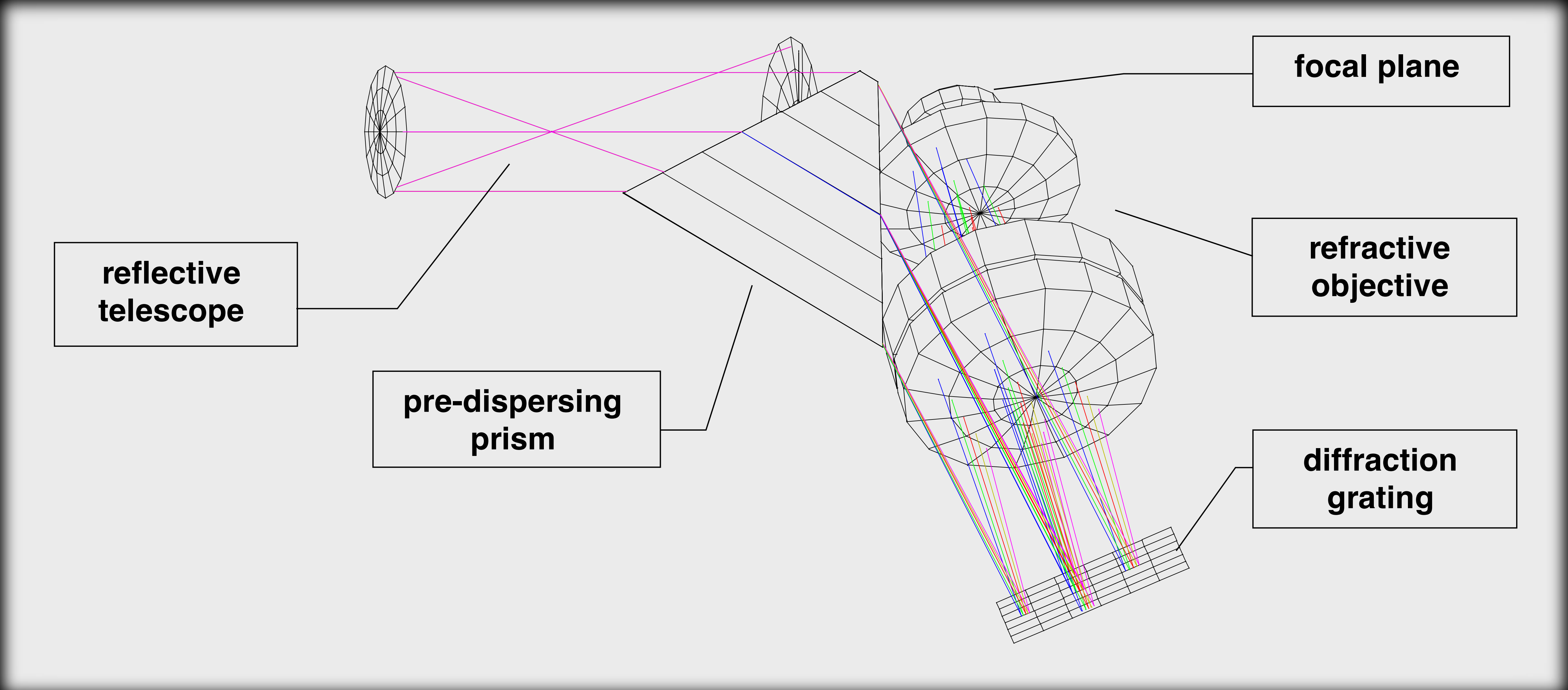
- Geometrical variations
- Stray light in the darks

Stray light correction in nominal mode

- Models of stray light
- Final correction

Conclusions

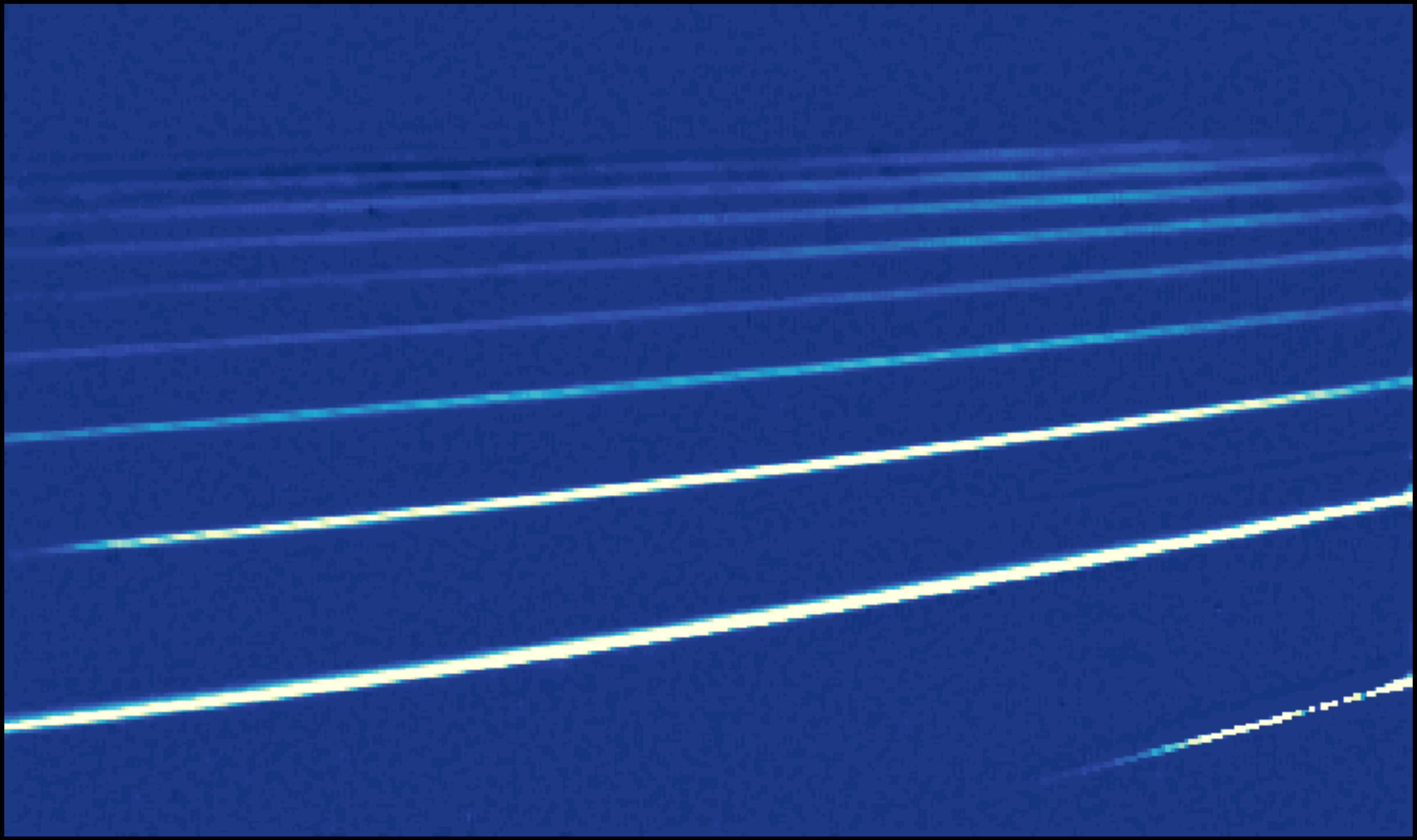
Virtis-H design



from Bonsignori et al. 1997

Virtis-H detector

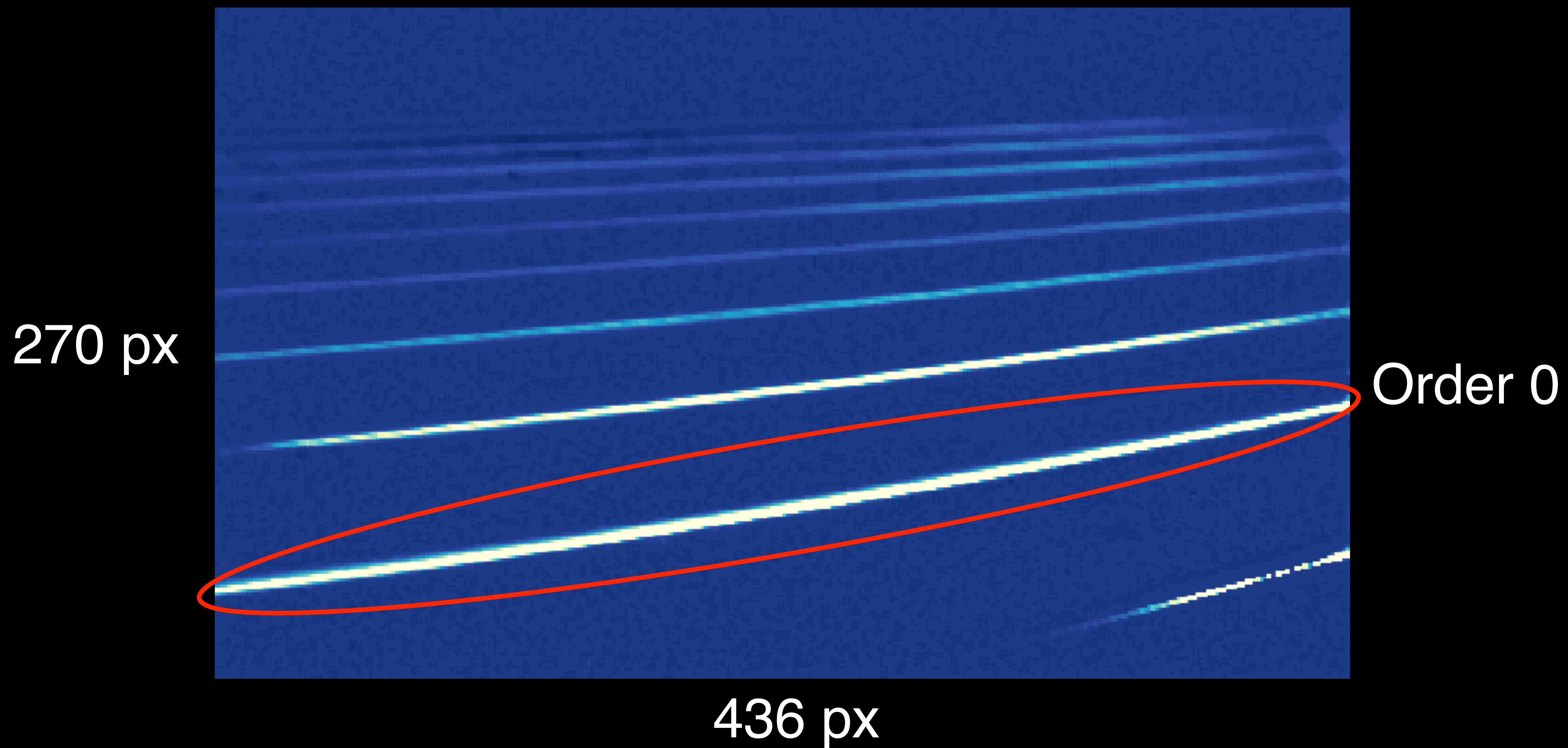
270 px



436 px

HgCdTe Raytheon/IRCOE matrix

Virtis-H detector



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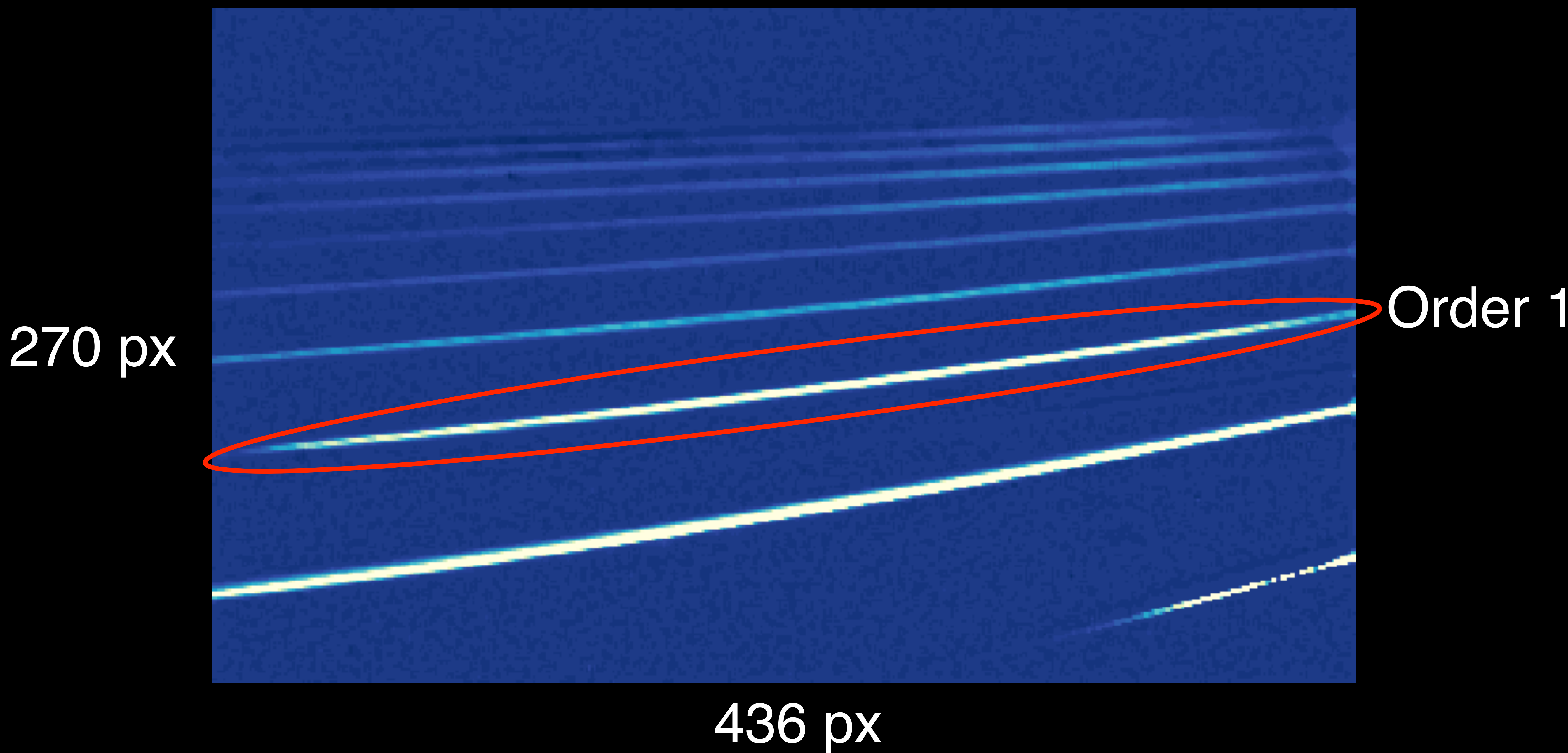

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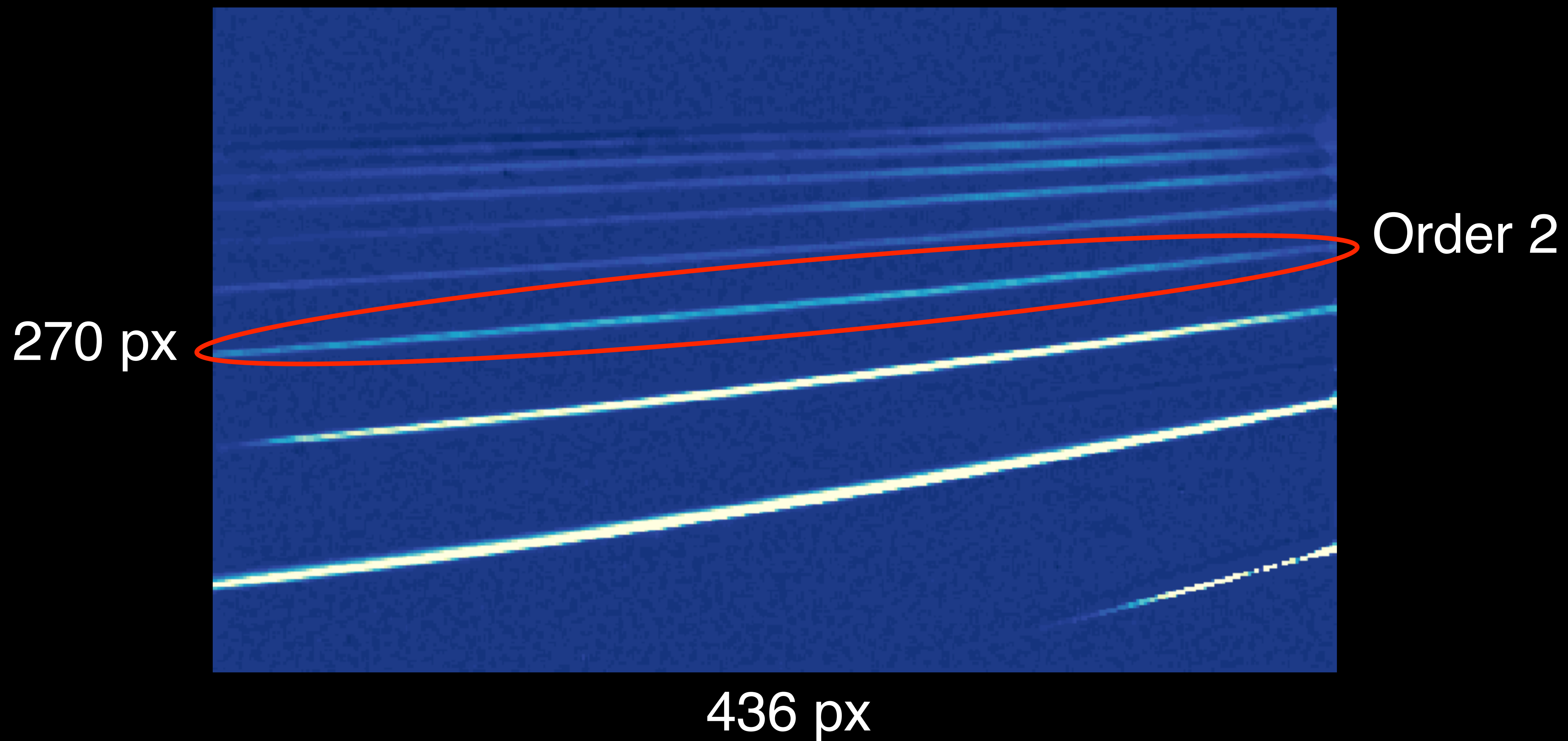

HgCdTe Raytheon/IRCOE matrix

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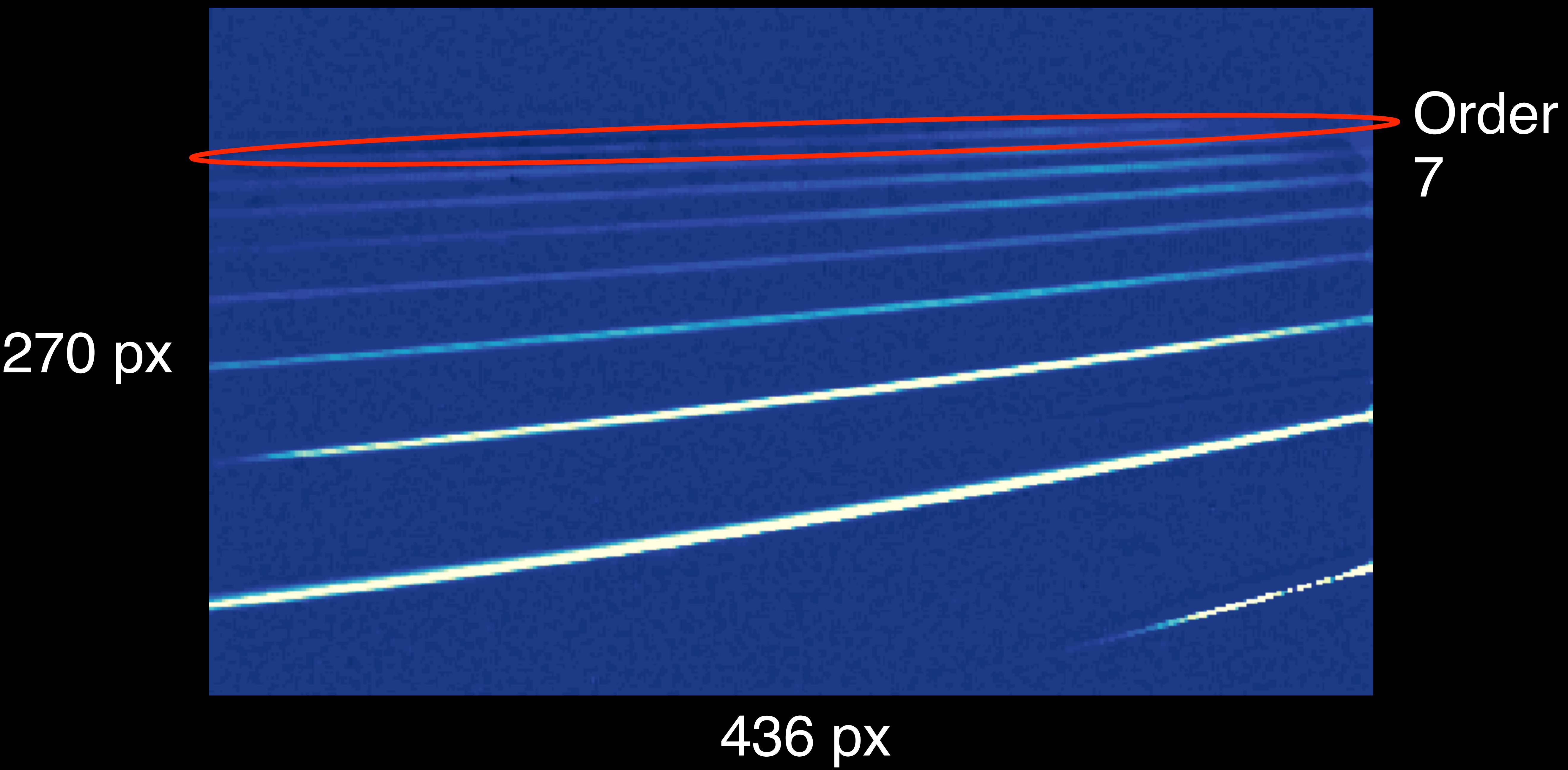
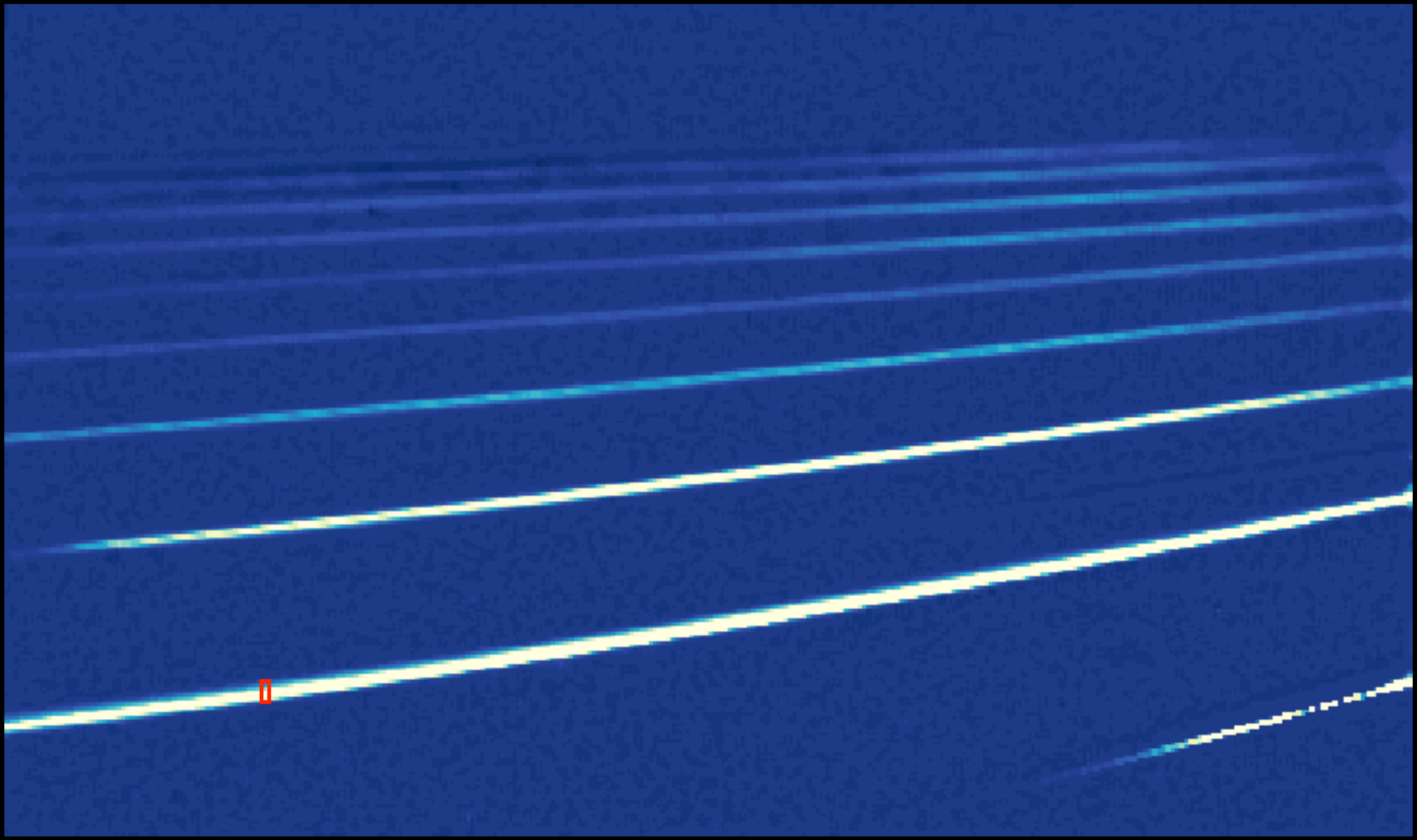


HgCdTe Raytheon/IRCOE matrix

Building a spectrum

270 px



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HgCdTe Raytheon/IRCOE matrix

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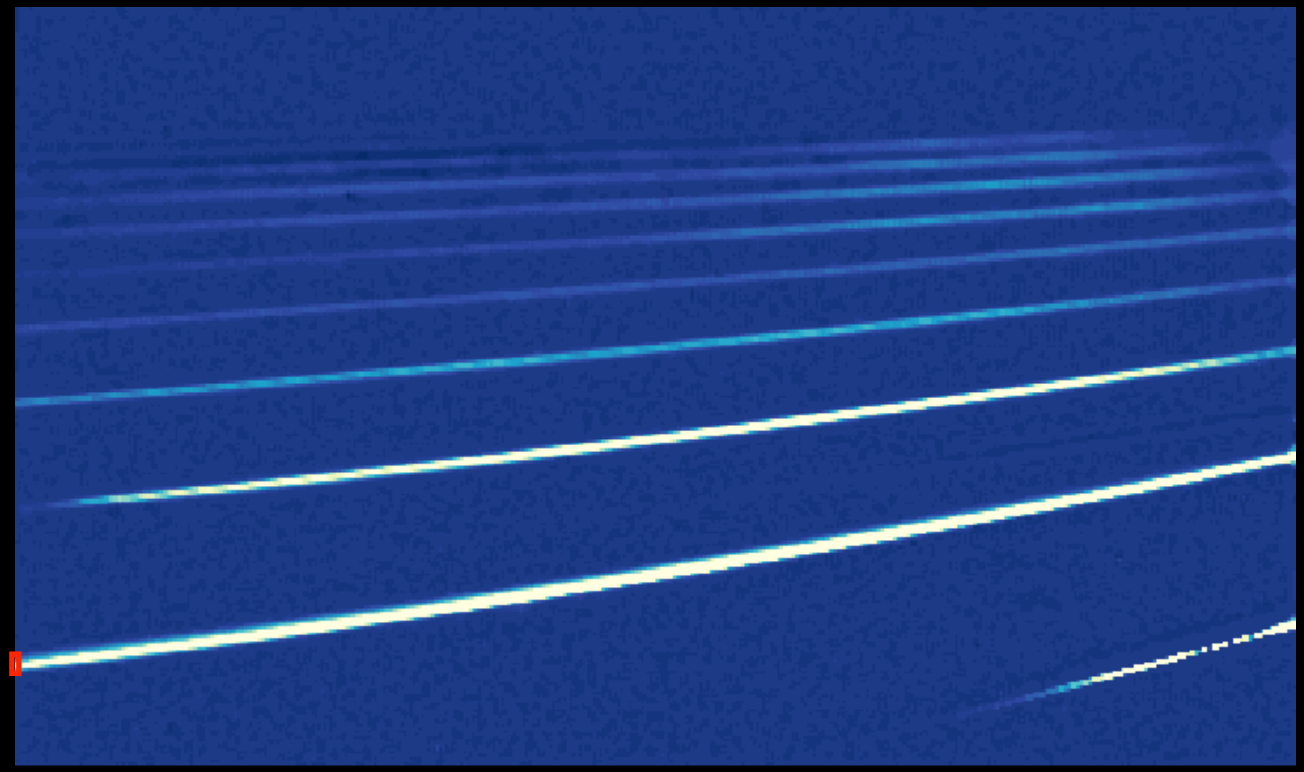

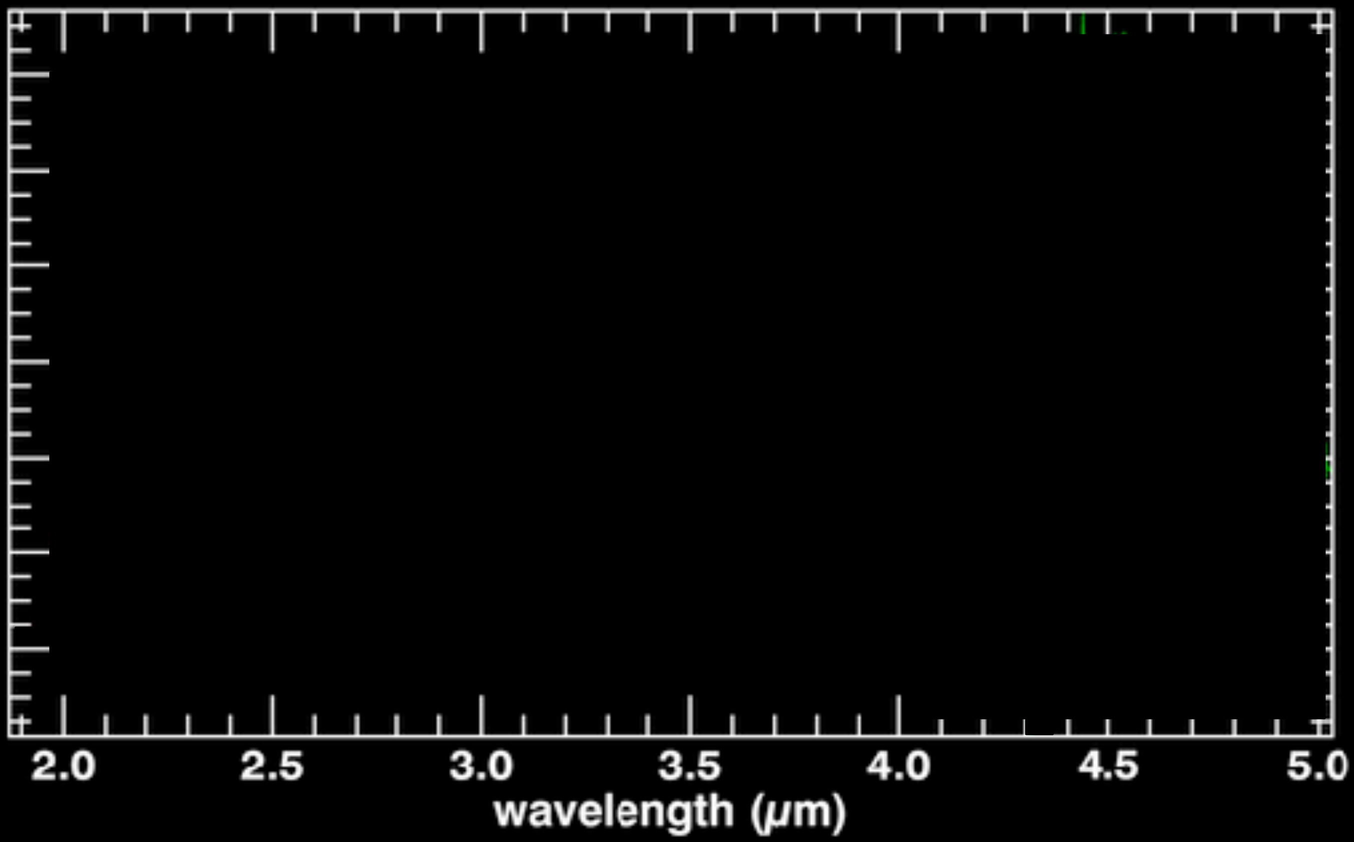

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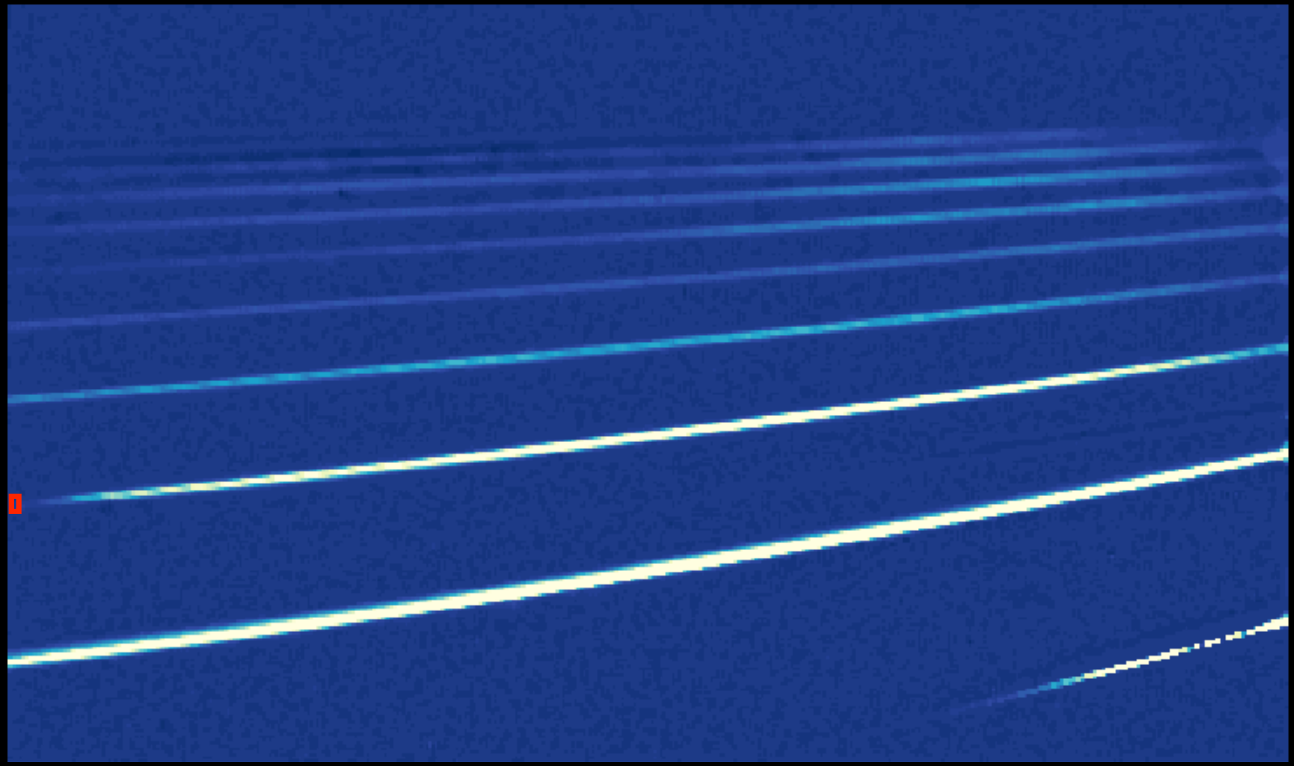

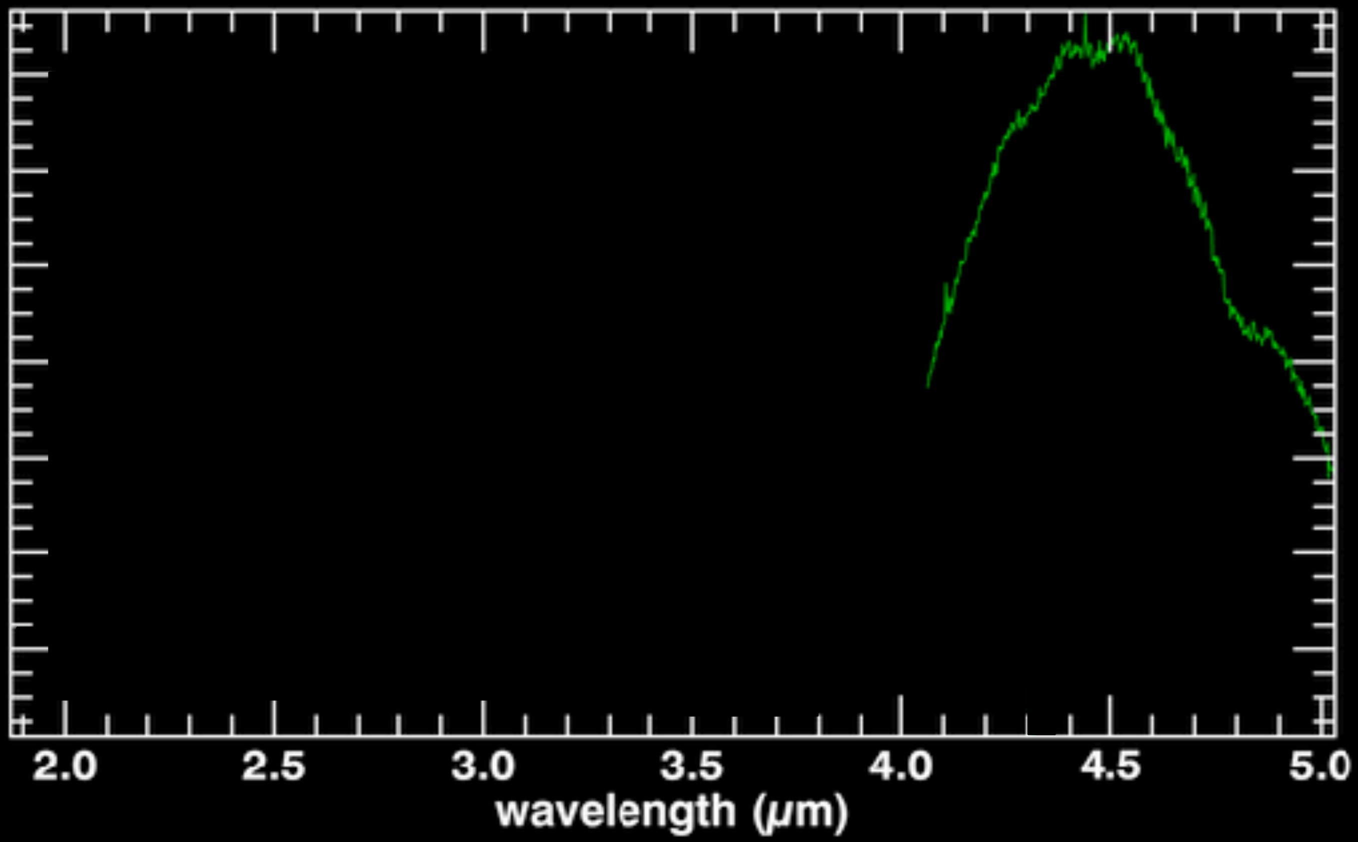

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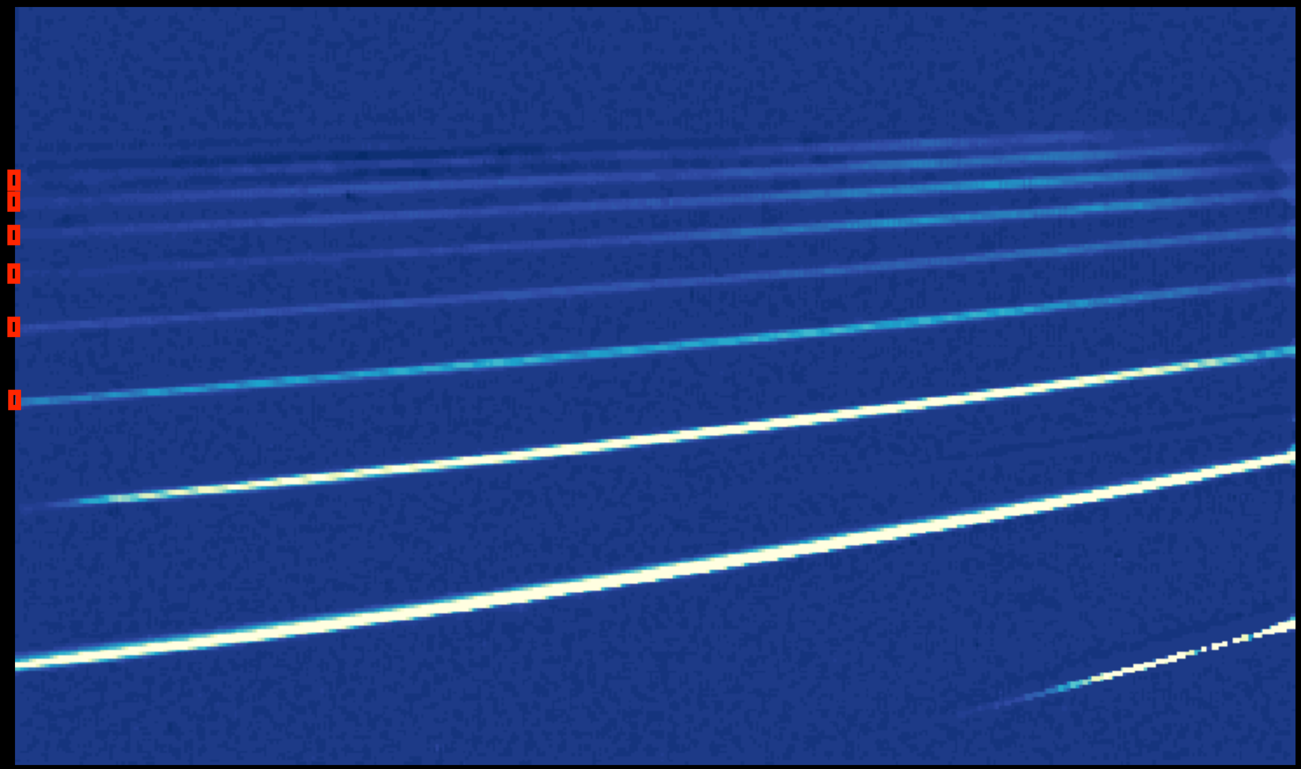
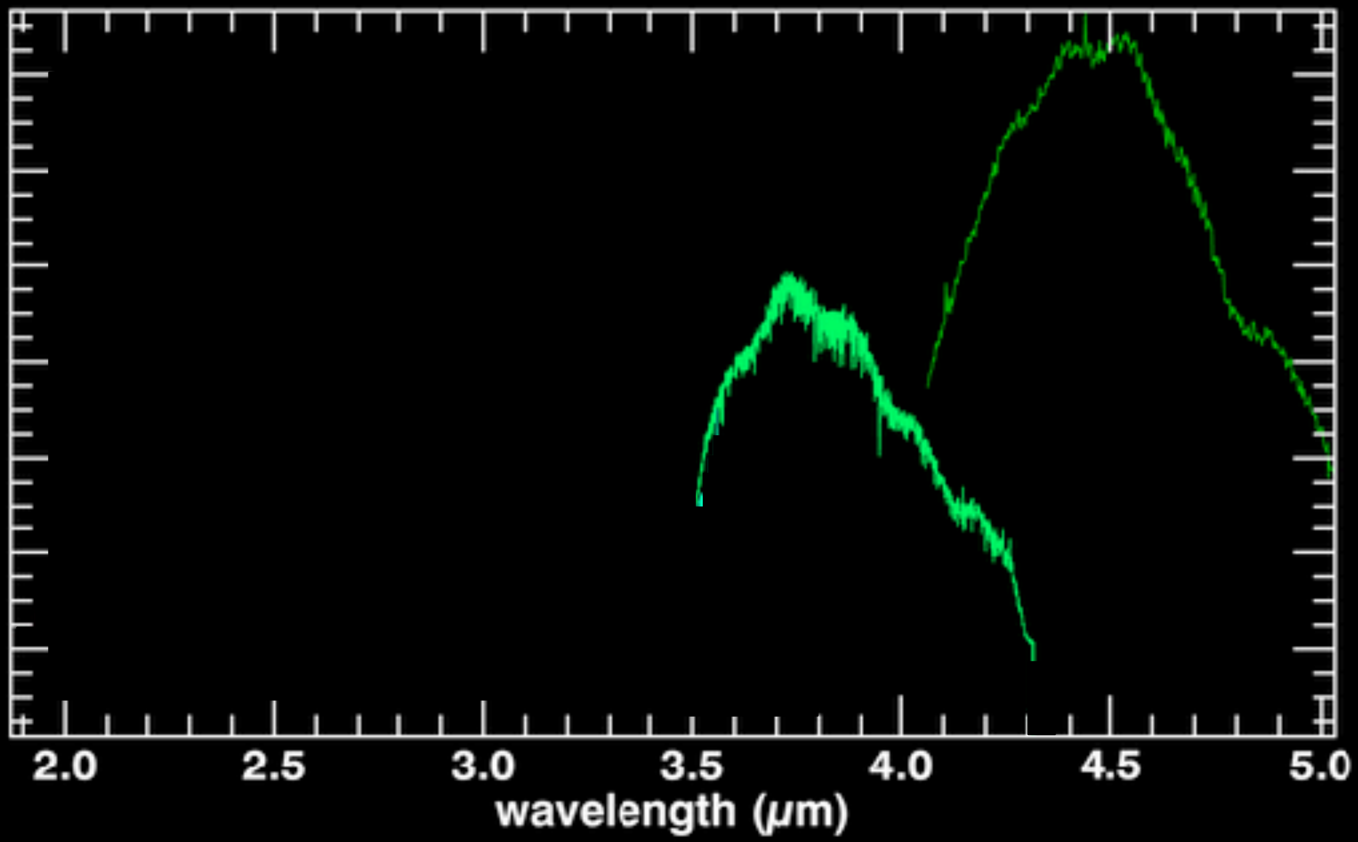
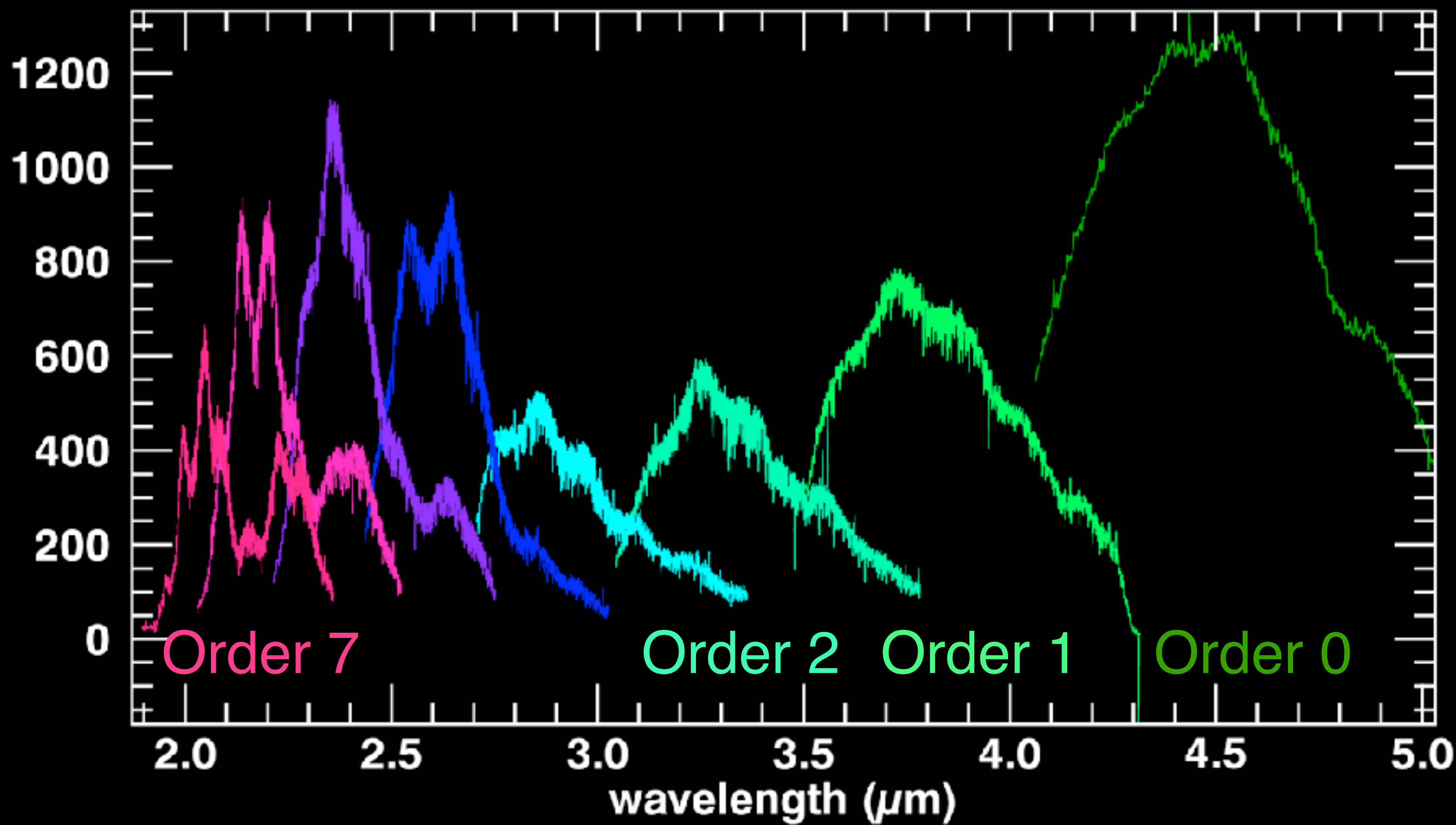


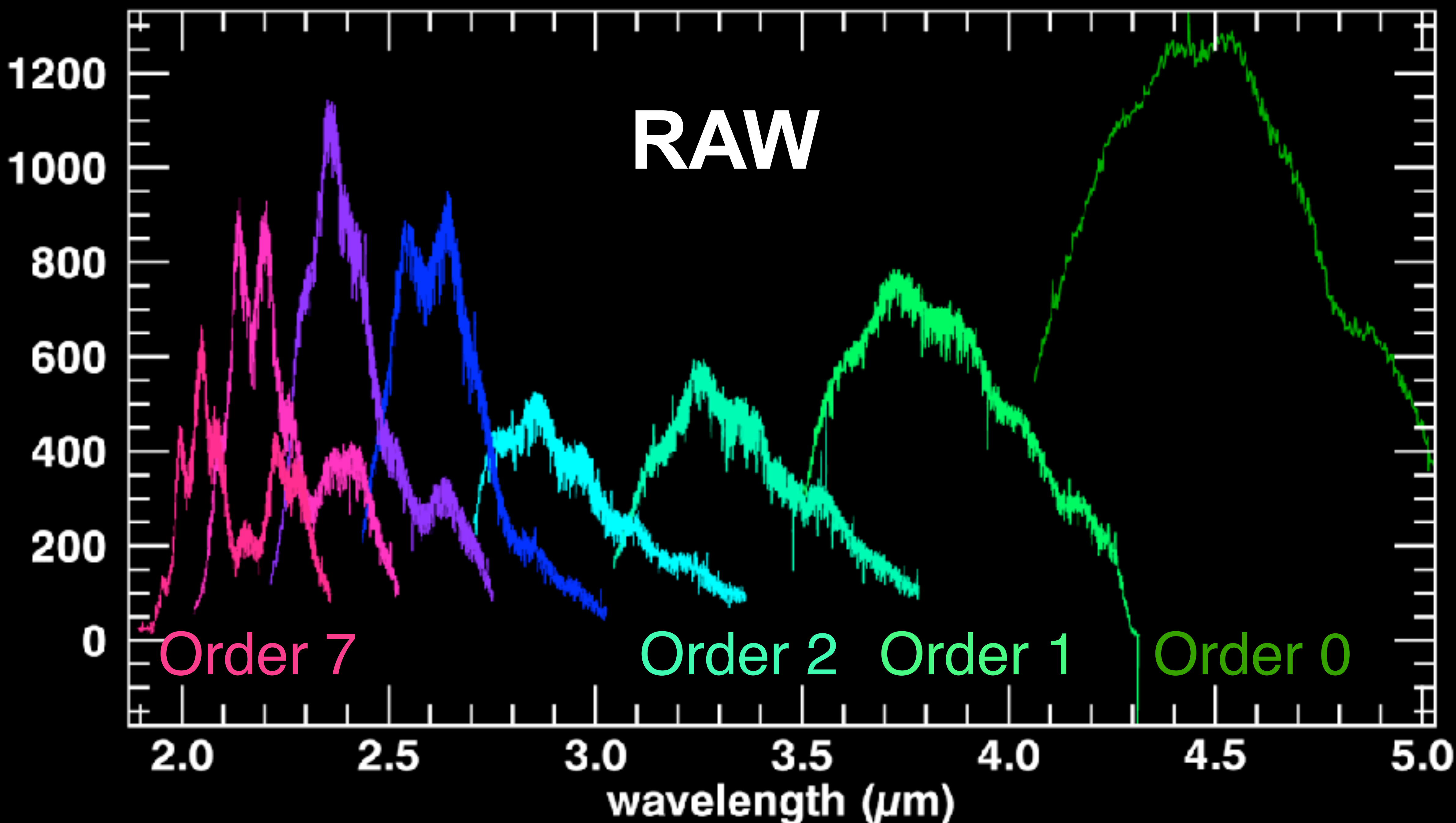


Building a spectrum: hopes & dreams



AST2/RAW/H1_00237396920.QUB

Building a spectrum: hopes & dreams



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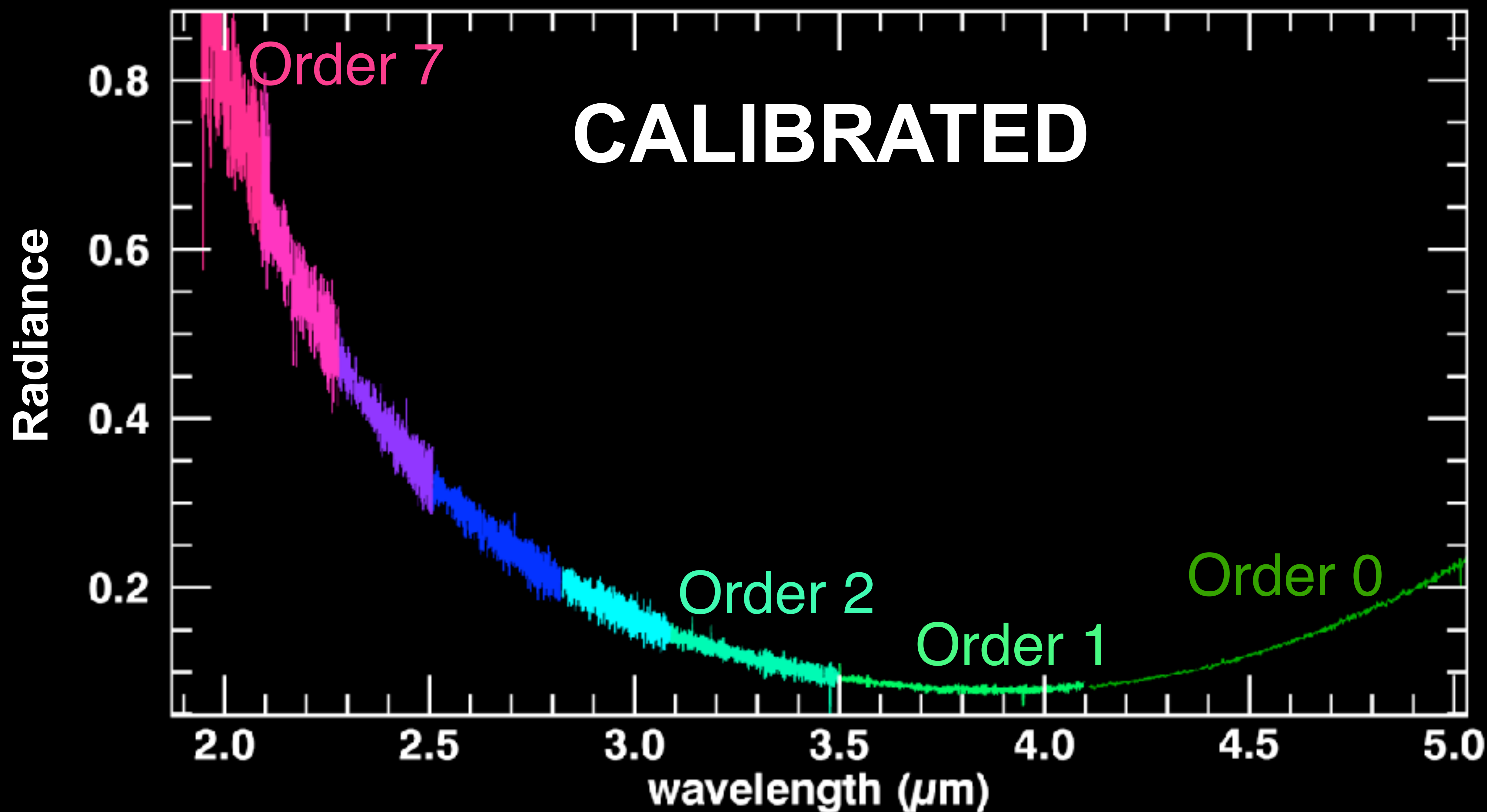
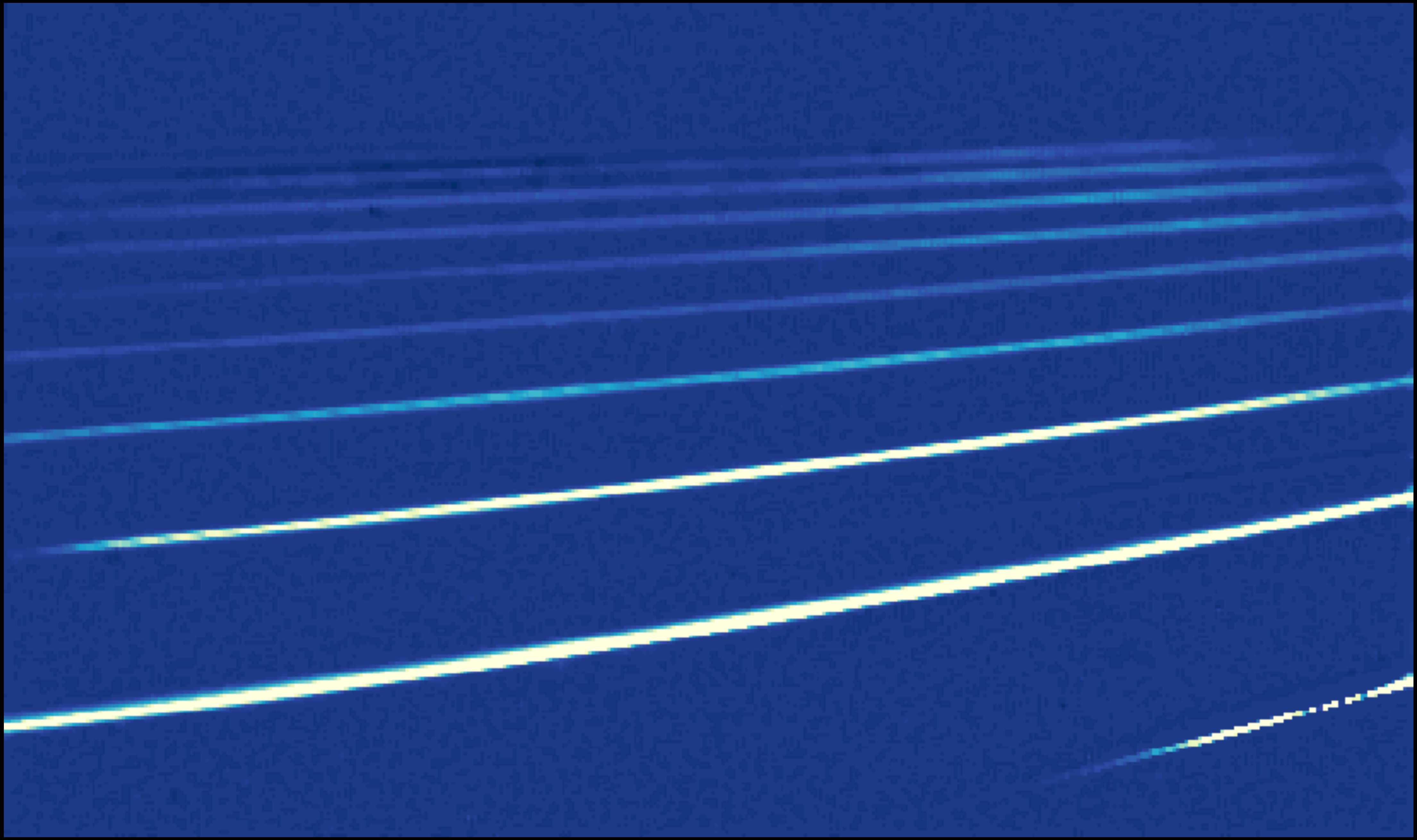
Building a spectrum: hopes & dreams



AST2/RAW/H1_00237396920.QUB

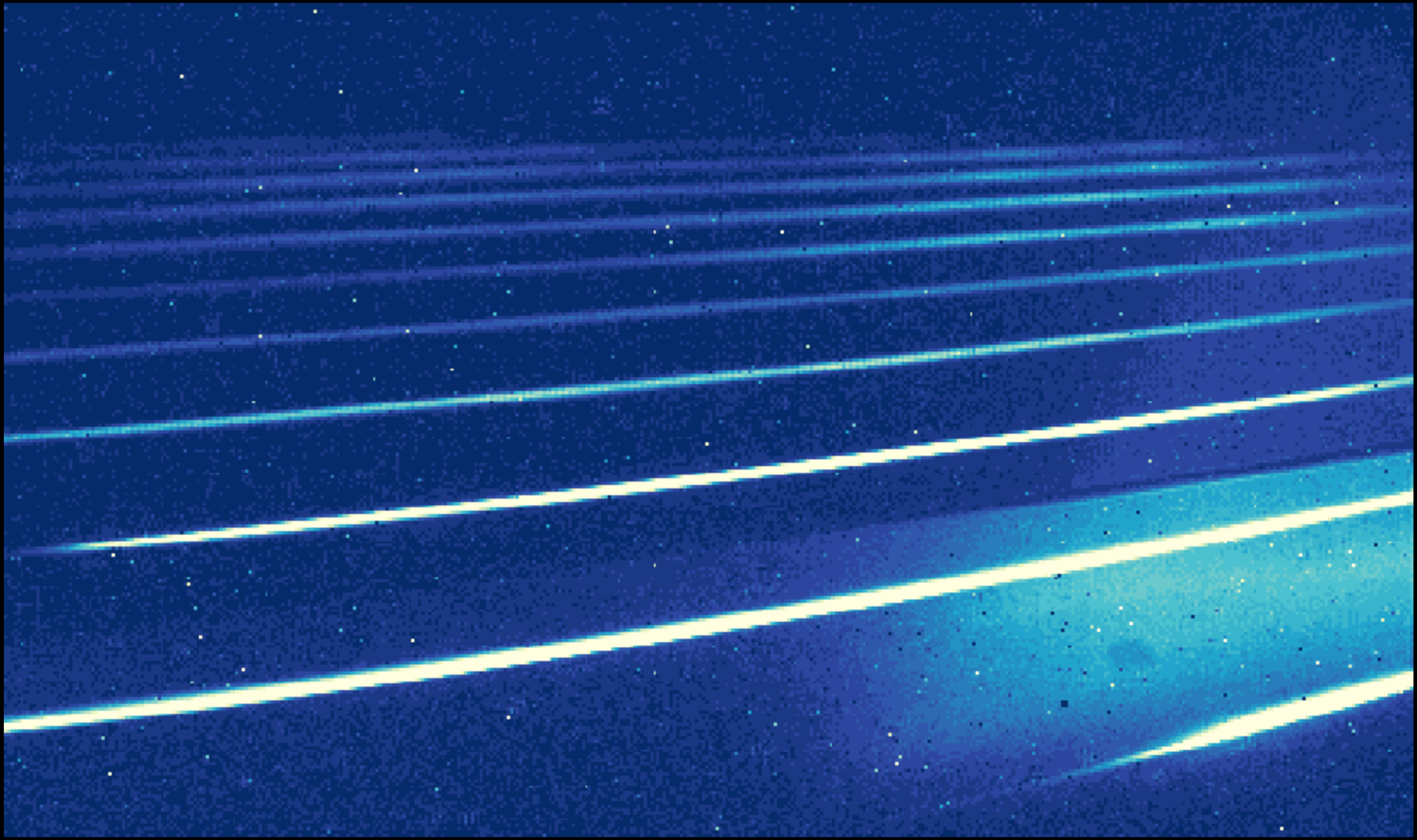
The hard truth:

The illuminated matrix does not look like this...



The hard truth:

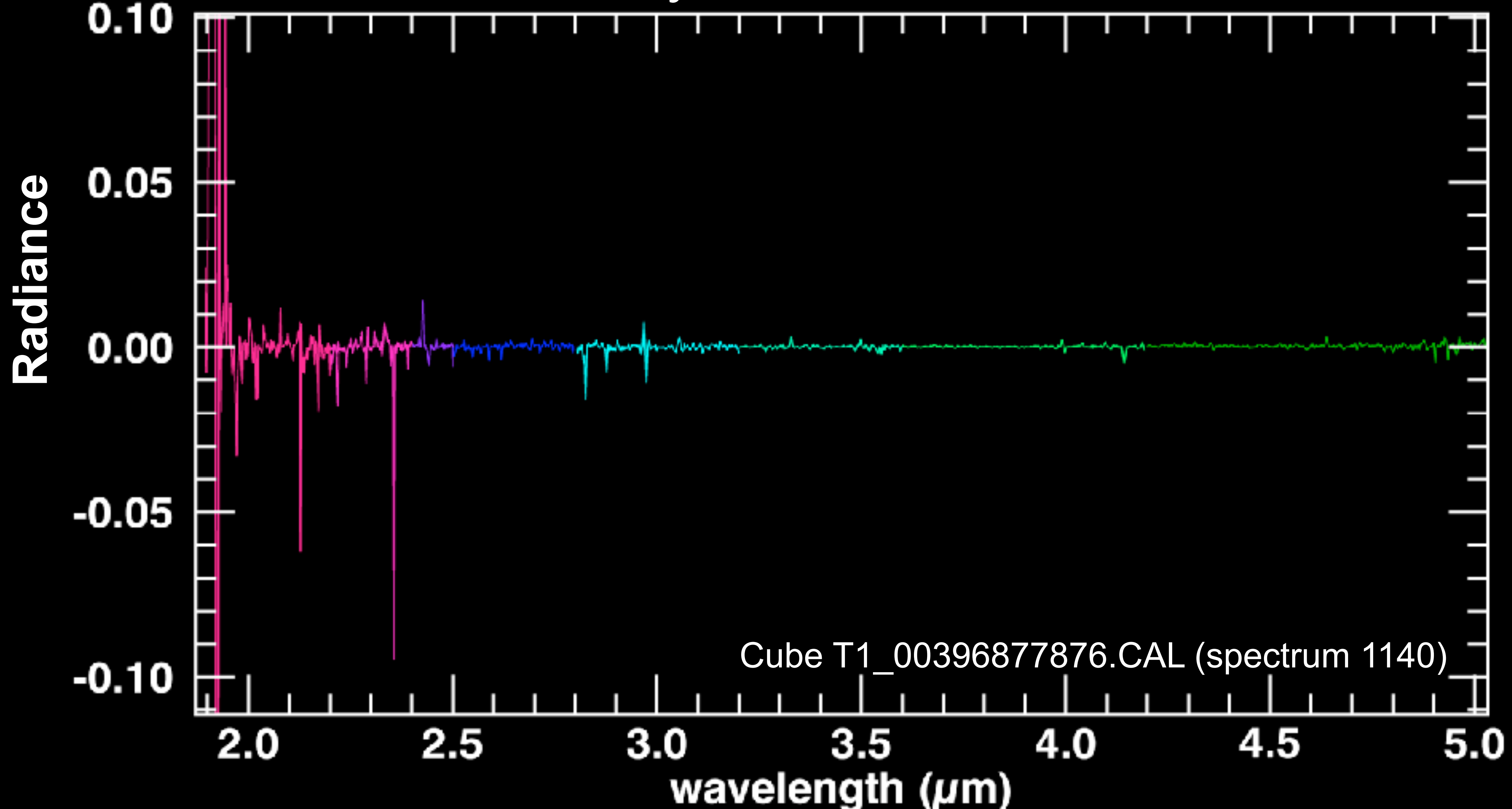
... But like this



MTP015/STP054/RAW/H1_00389083498

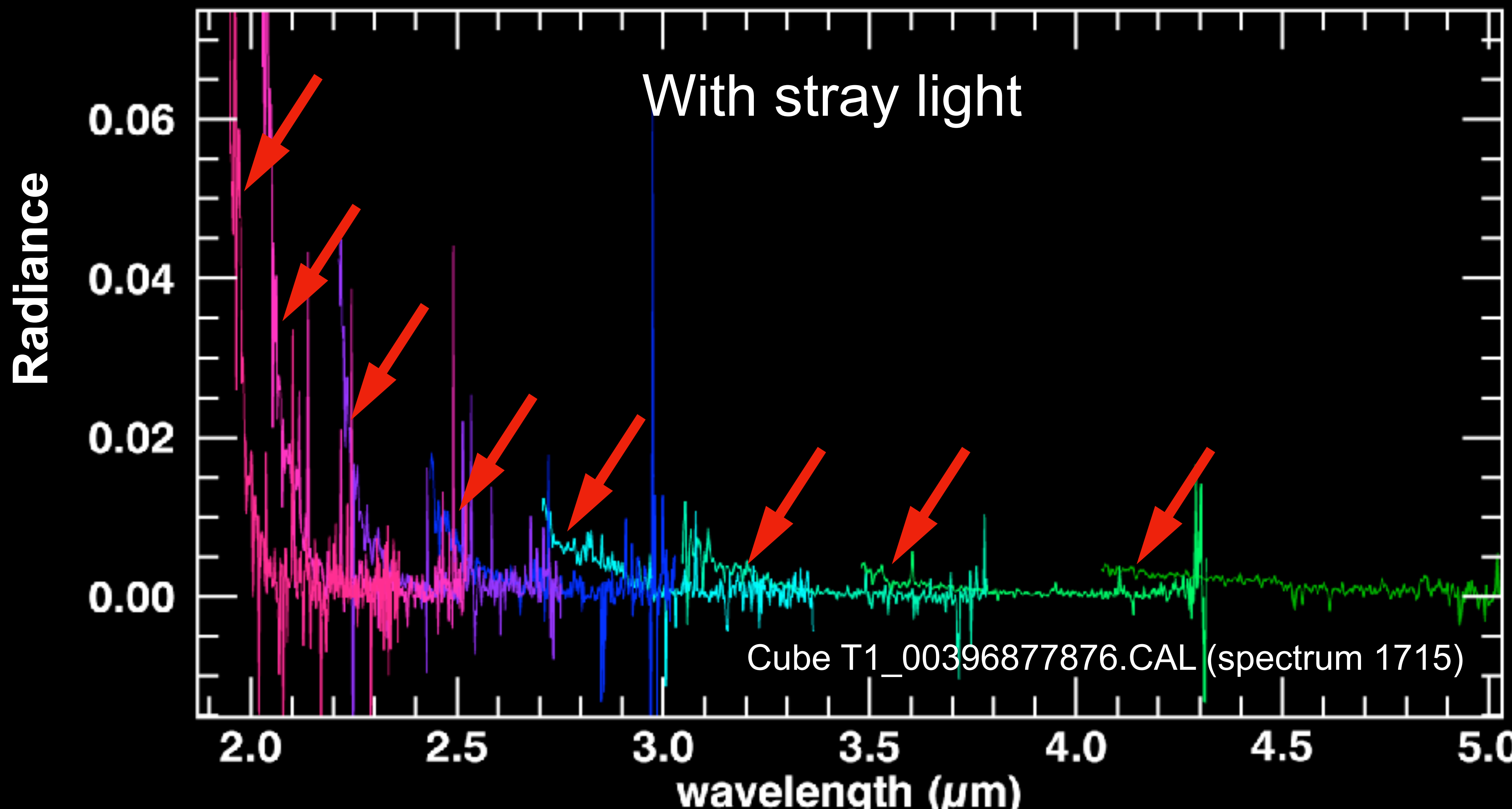
The hard truth:

A calibrated spectrum with no signal does not always look like this...



The hard truth:

But sometimes like this...



Stray light removal:

Best solution so far:

1) Extracting typical straylight pattern:
masking & nearest neighbors filling in a backup cube

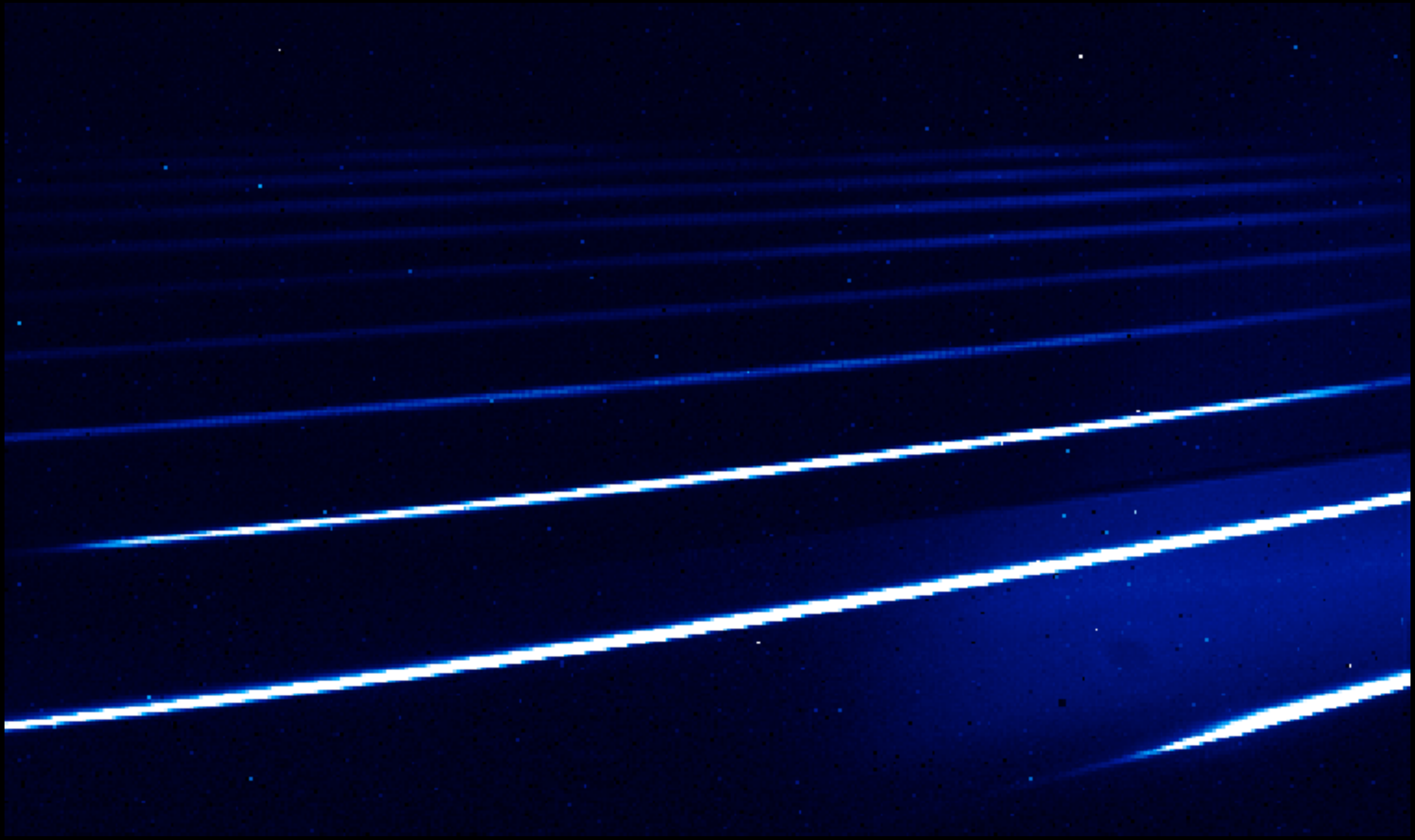
2) Convert to a spectrum

3) Scale the straylight spectrum to remove it from the measure

Stray light removal:

1) Extracting typical straylight pattern:
masking & nearest neighbors filling in a backup cube

As is

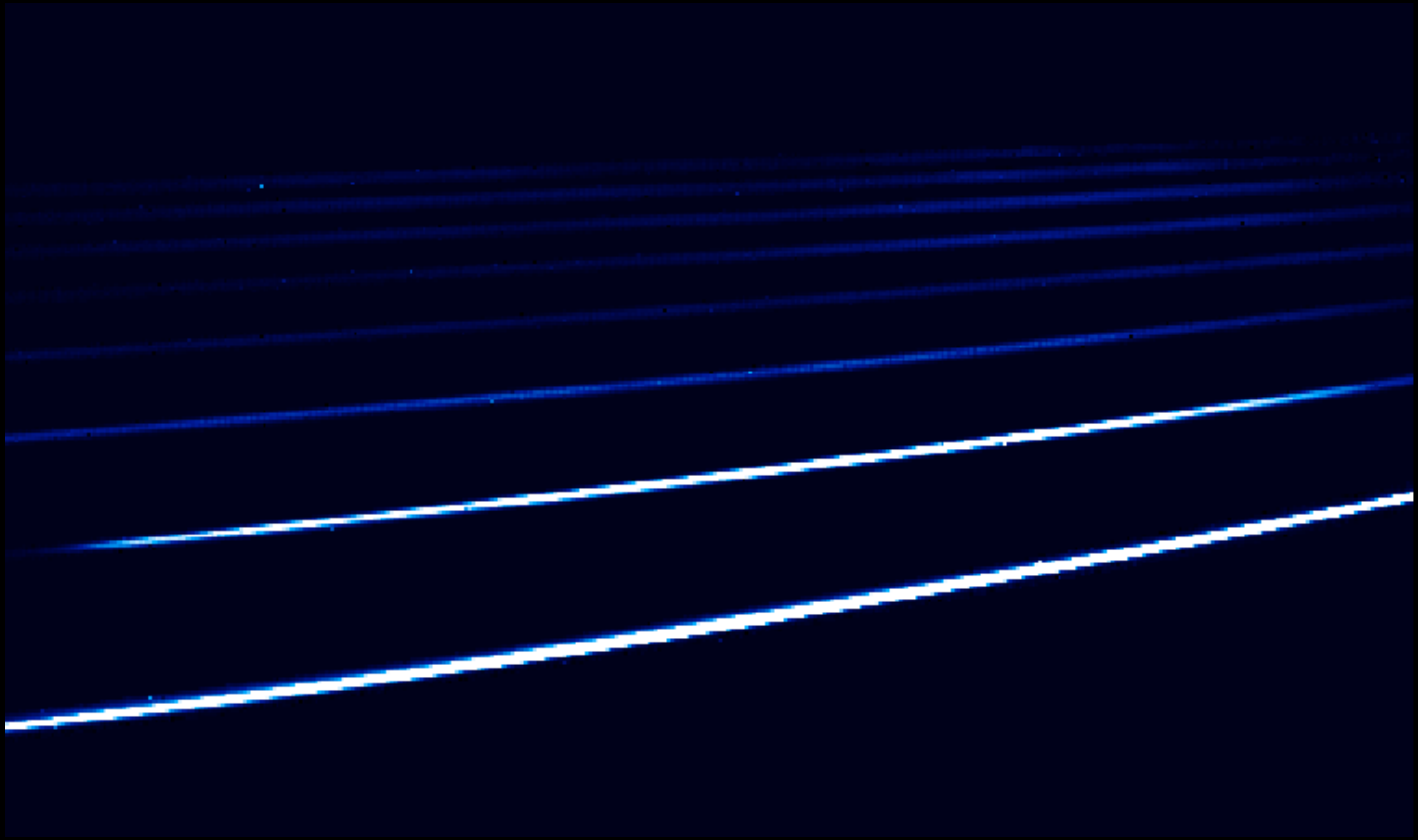


MTP015/STP054/RAW/H1_00389083498

Stray light removal:

1) Extracting typical straylight pattern:
masking & nearest neighbors filling in a backup cube

Corrected



MTP015/STP054/RAW/H1_00389083498

Stray light removal:

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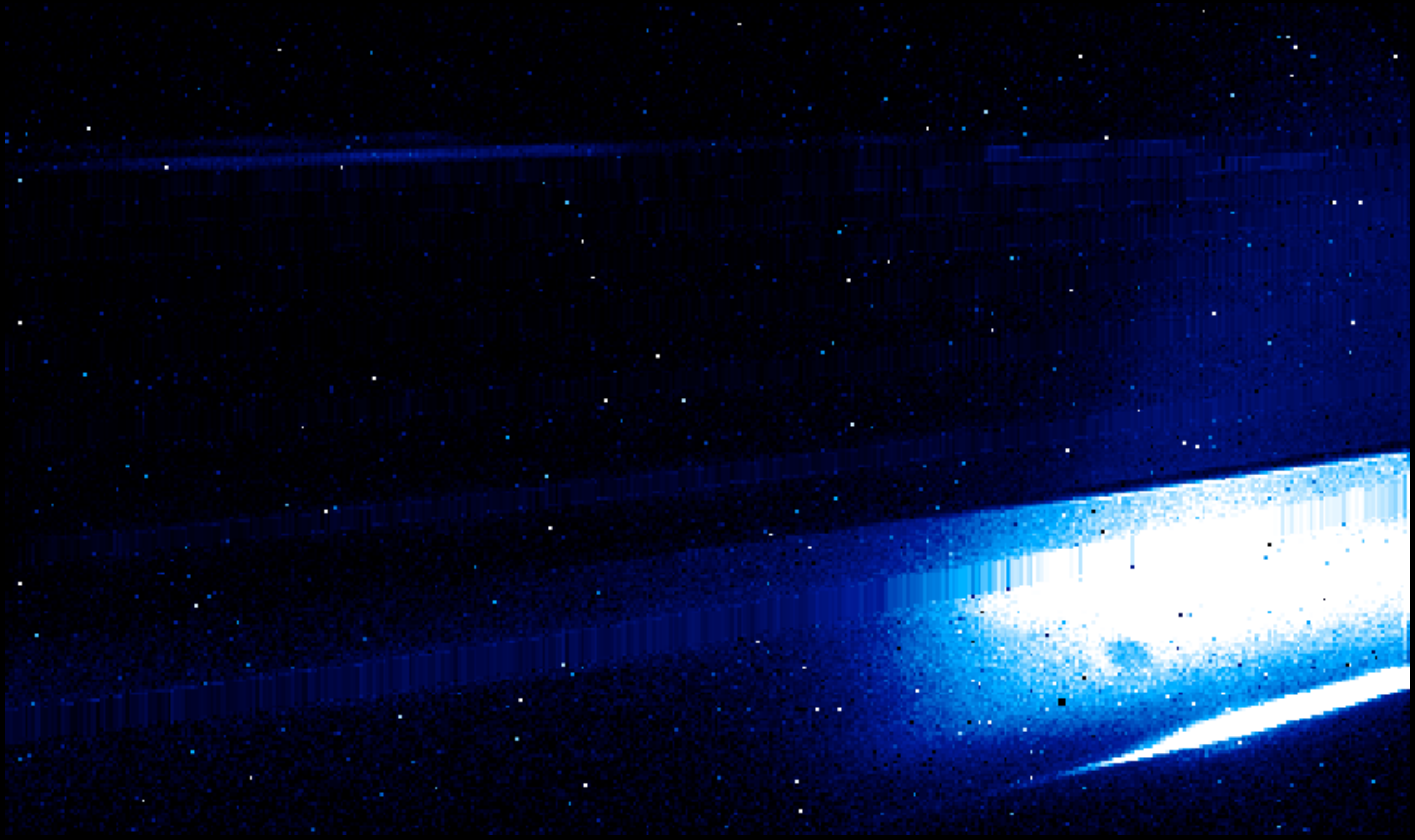
Strayligth

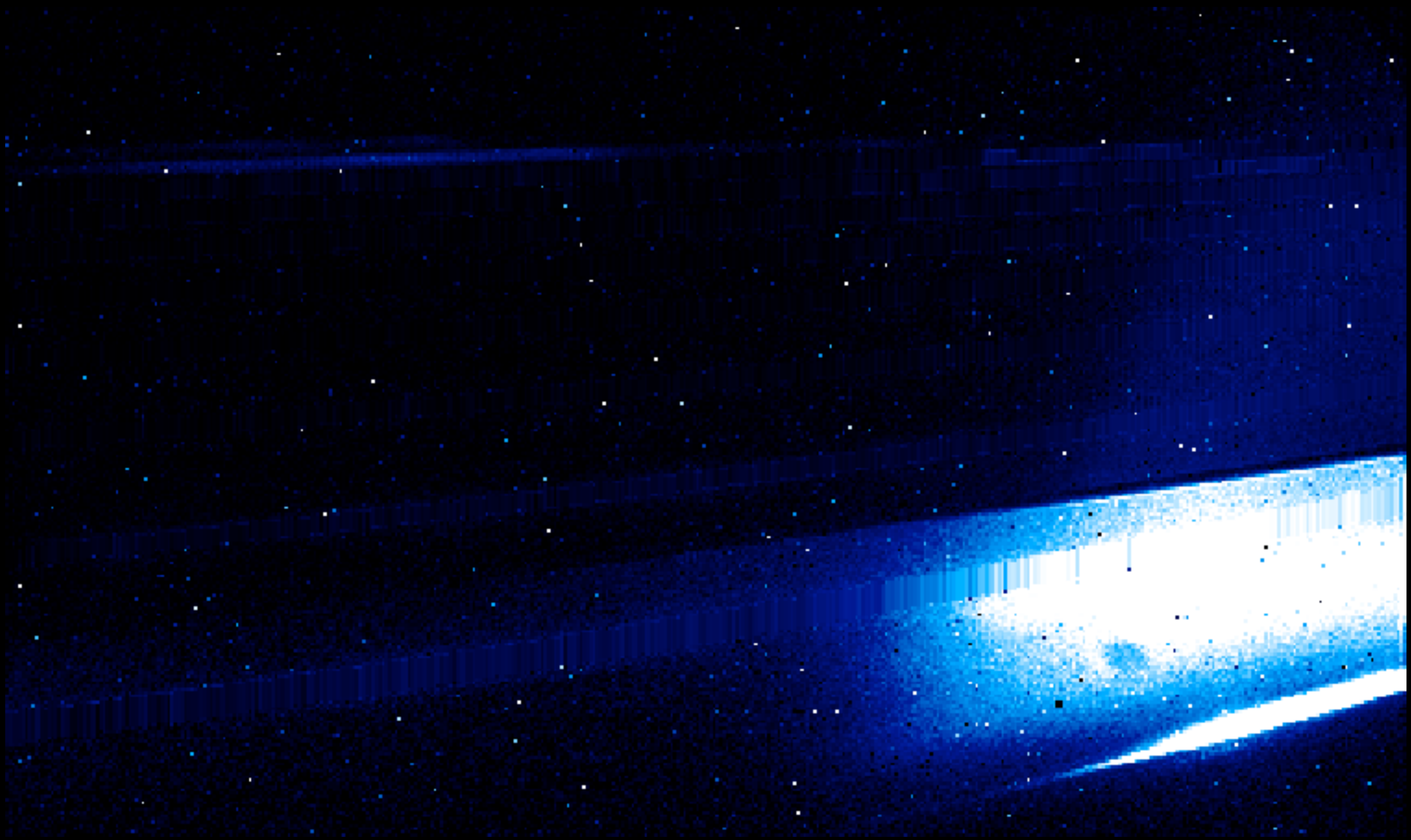


MTP015/STP054/RAW/H1_00389083498

Stray light removal:

2) Convert this straylight into a spectrum:

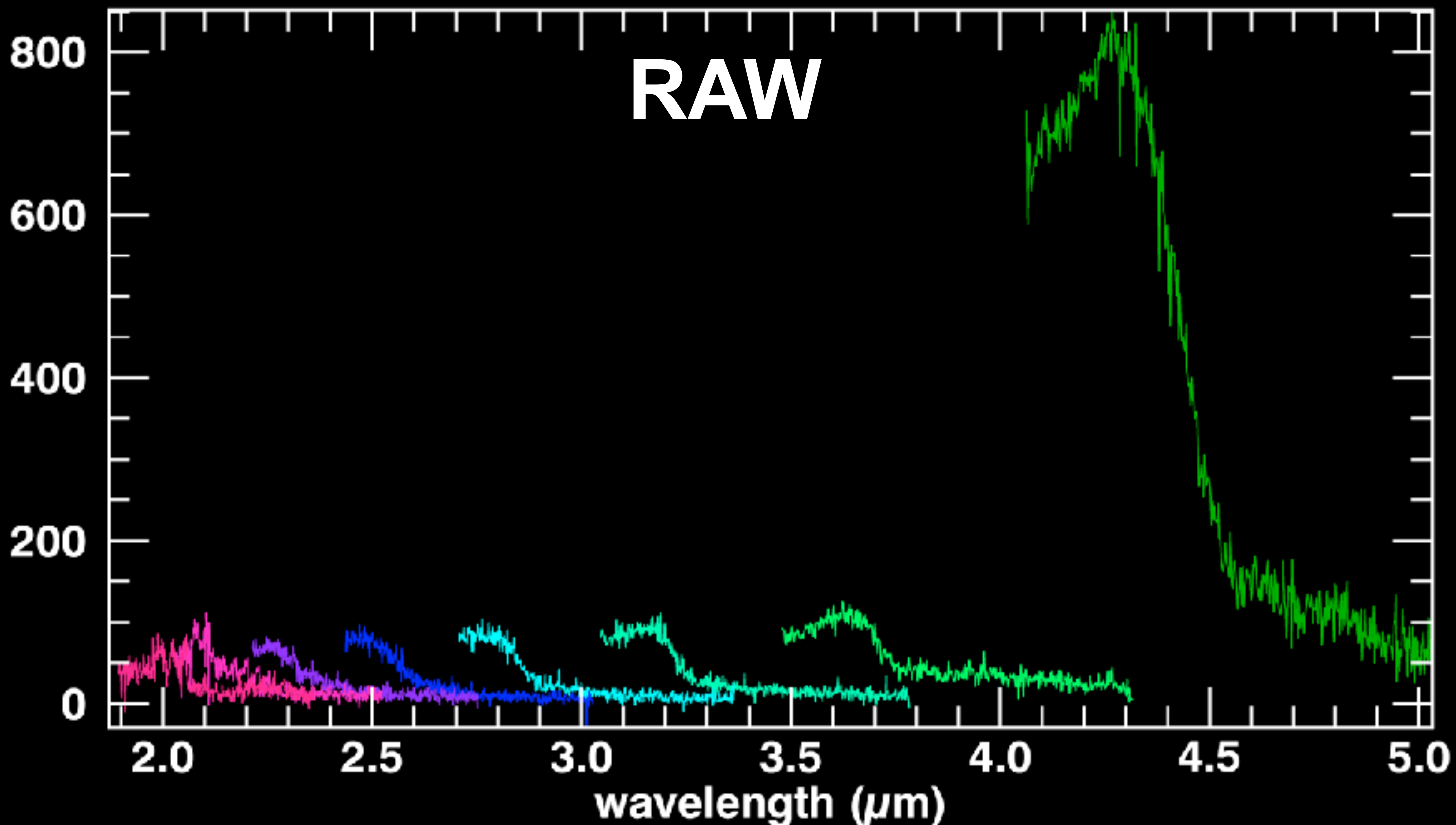
Straylight



MTP015/STP054/RAW/H1_00389083498

Stray light removal:

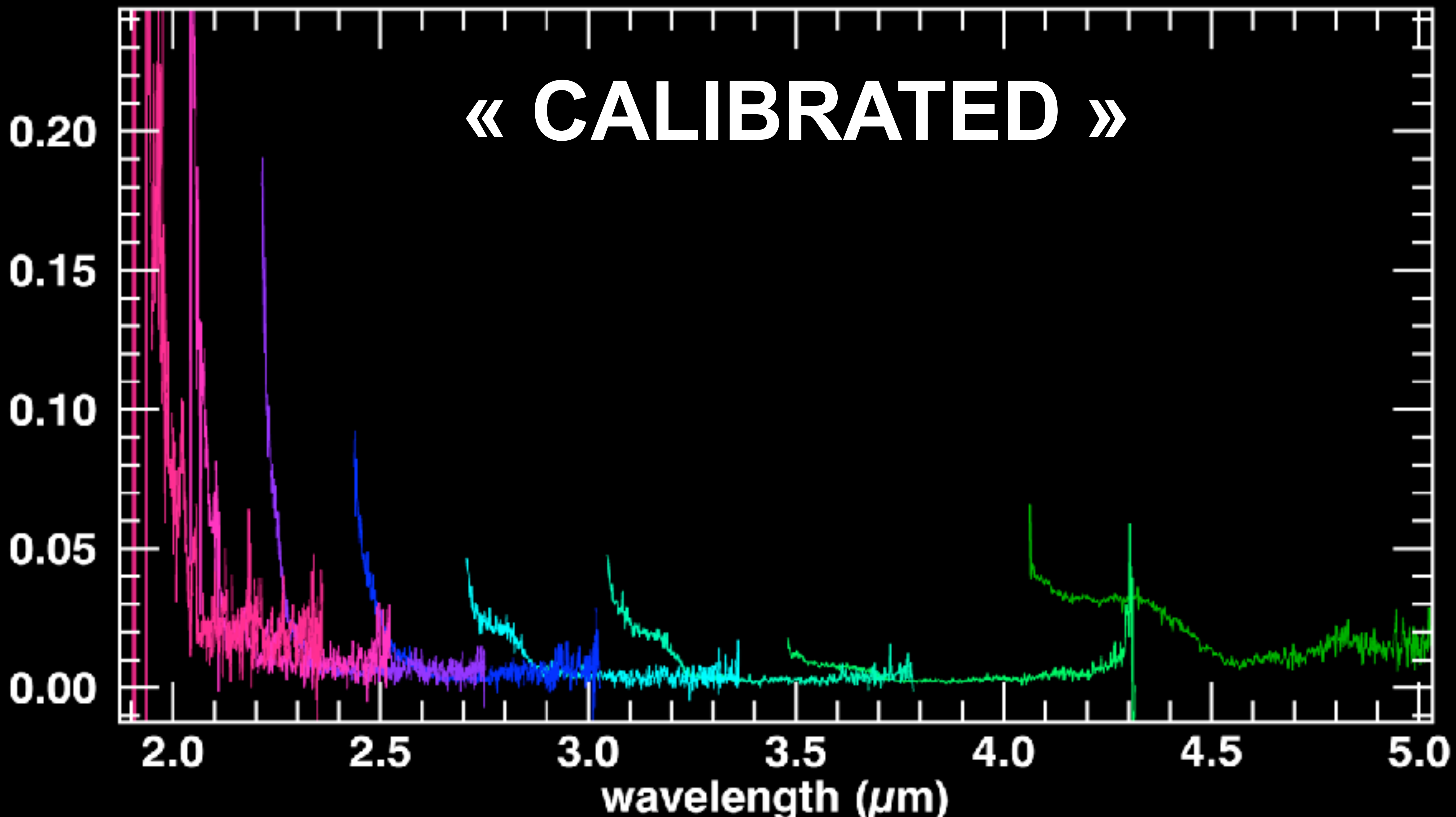
2) Convert this straylight into a spectrum:



MTP015/STP054/RAW/H1_00389083498

Stray light removal:

2) Convert this straylight into a spectrum:

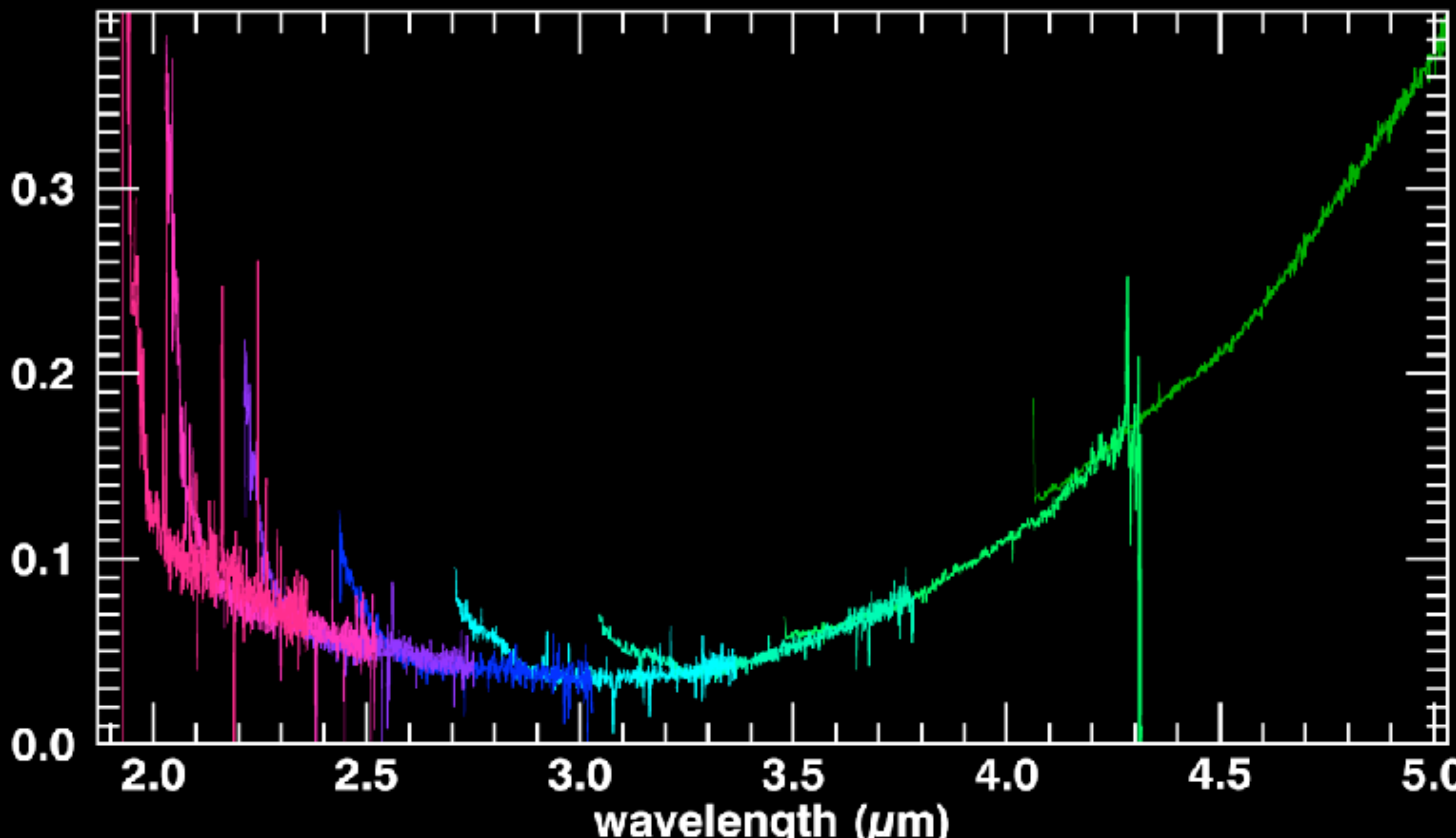


MTP015/STP054/RAW/H1_00389083498

Stray light removal:

3) Scale the straylight spectrum and remove it from the measure

As is

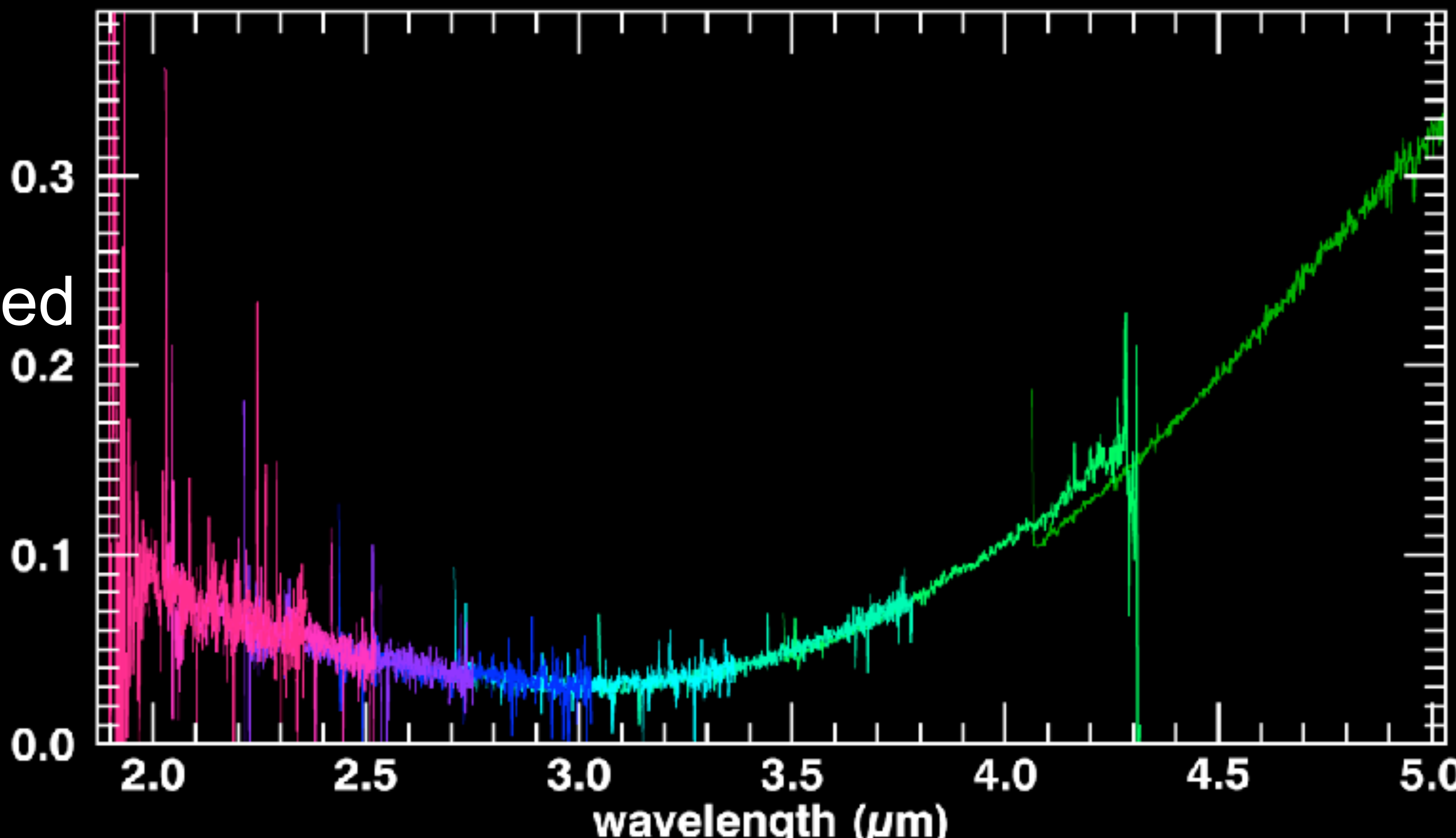


MTP015/STP054/RAW/H1_00389083498M

Stray light removal:

3) Scale the straylight spectrum and remove it from the measure

Corrected

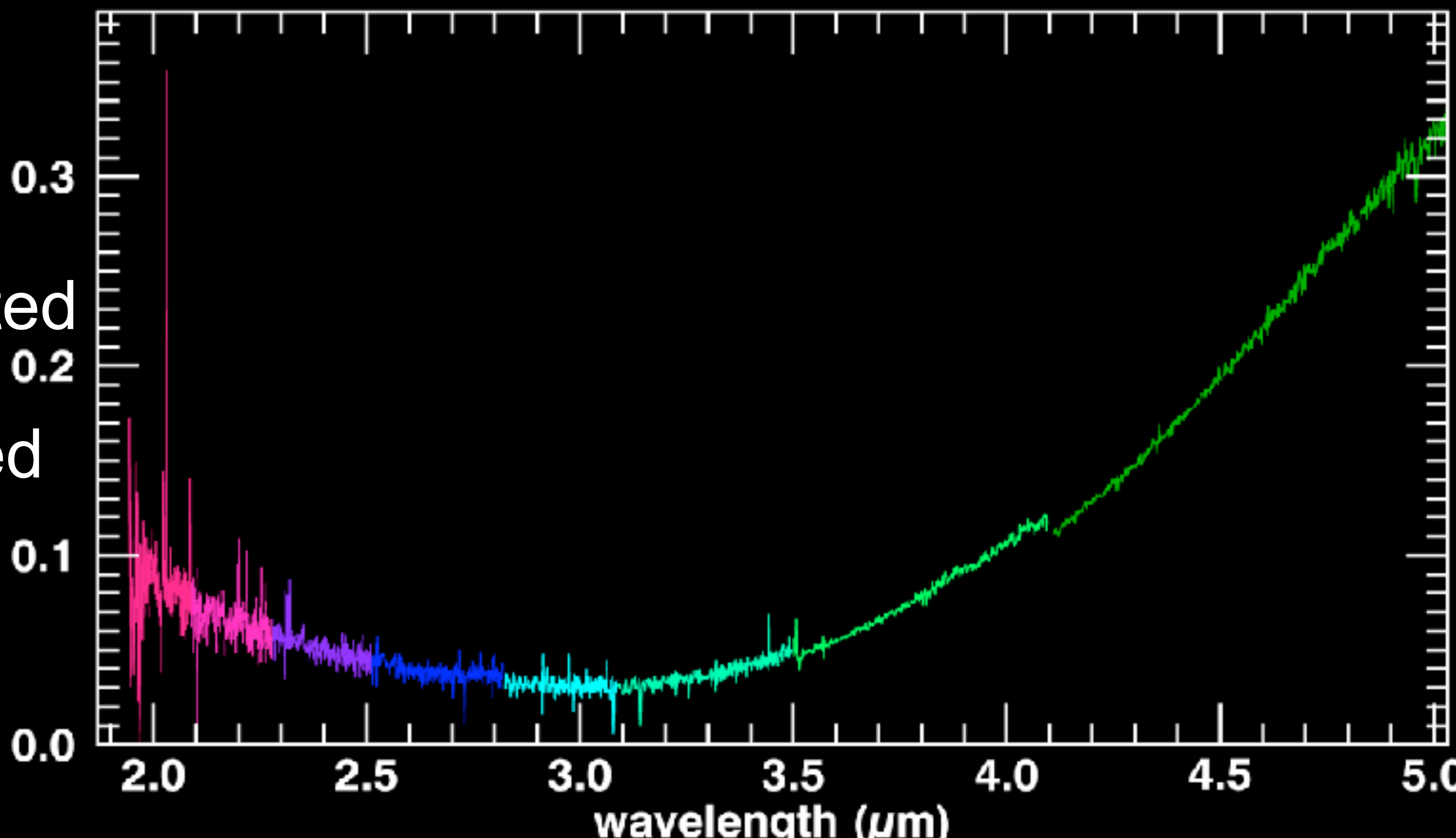


MTP015/STP054/RAW/H1_00389083498M

Stray light removal:

3) Scale the straylight spectrum and remove it from the measure

Corrected
+
merged



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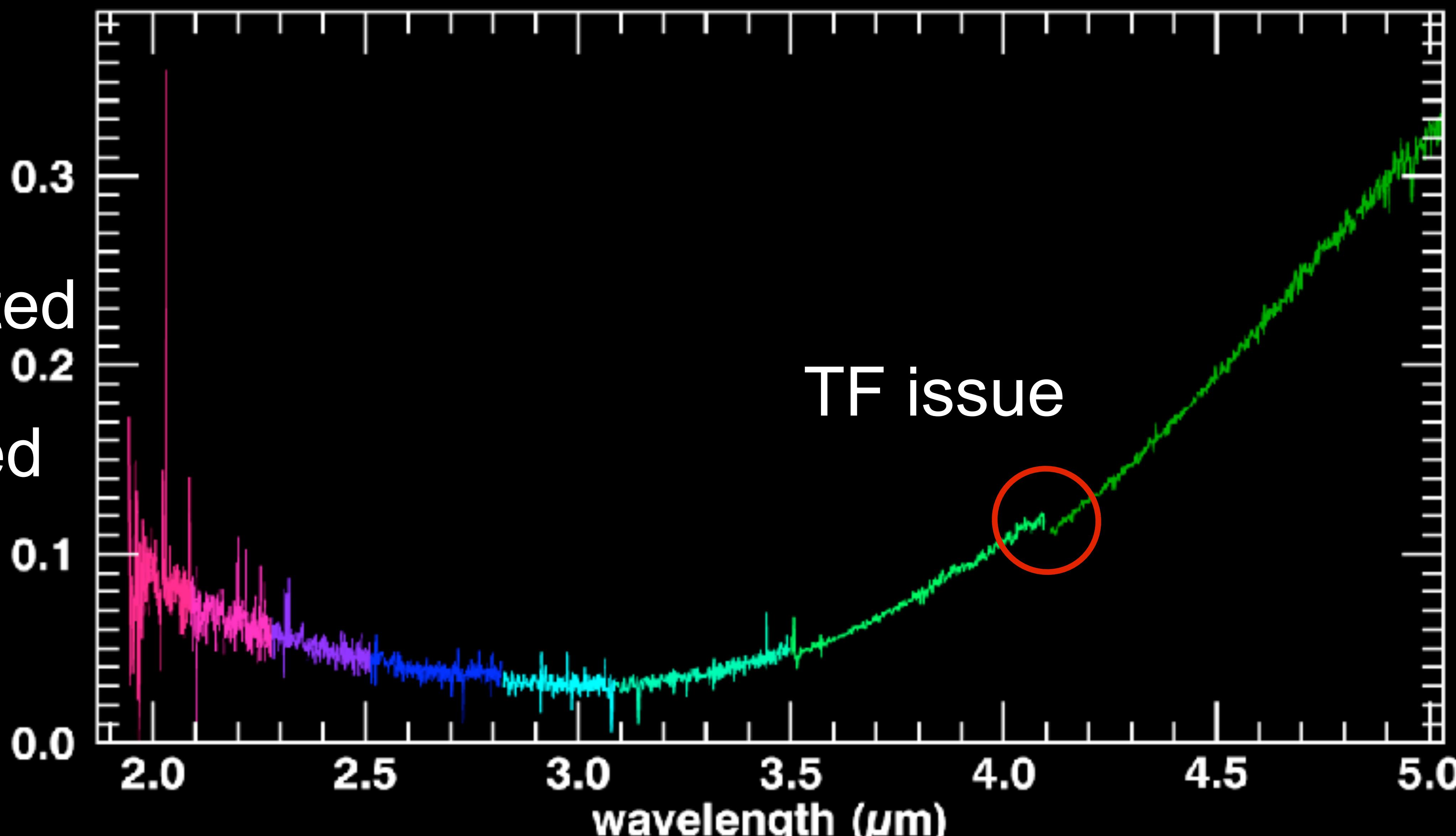

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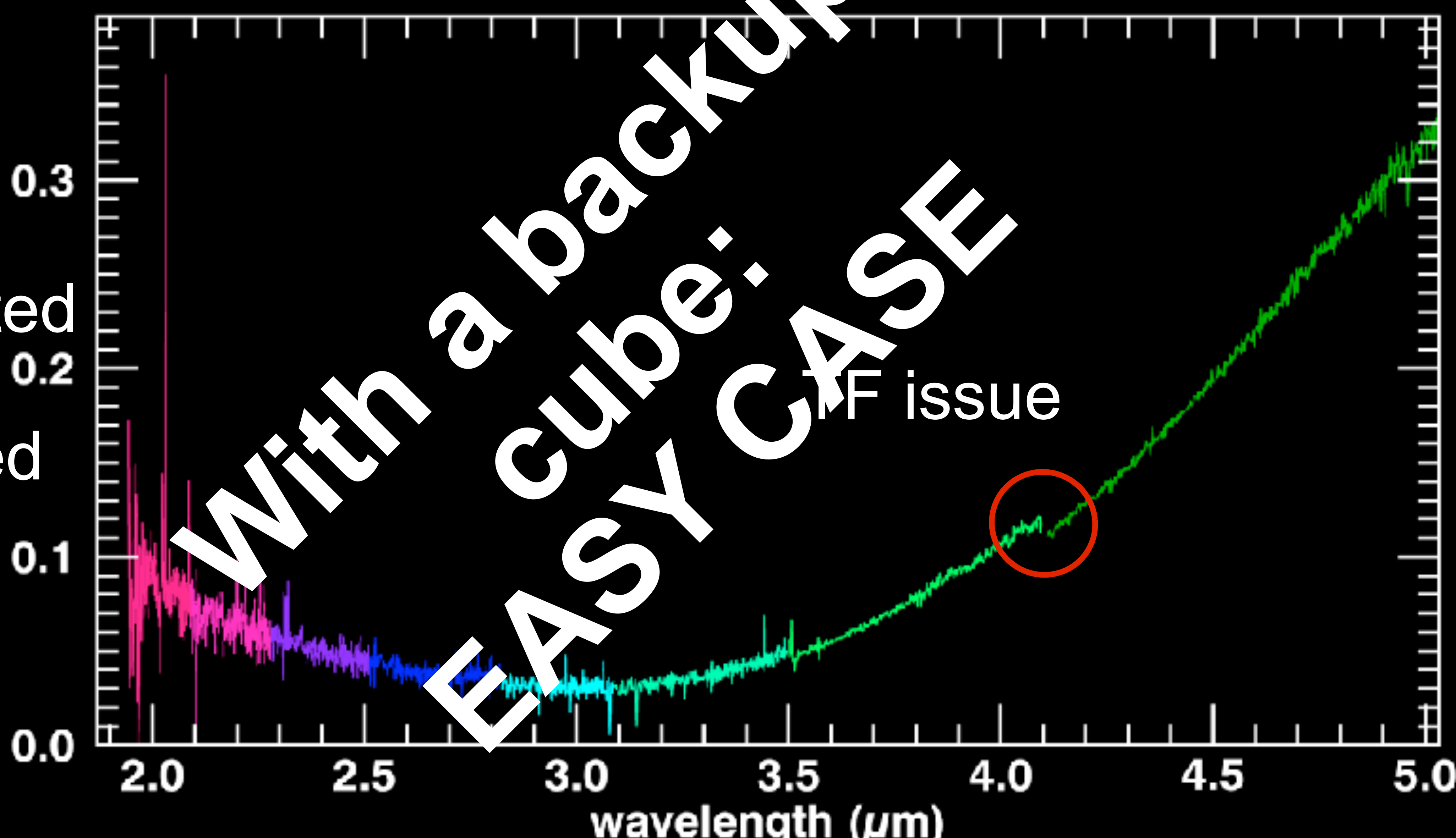


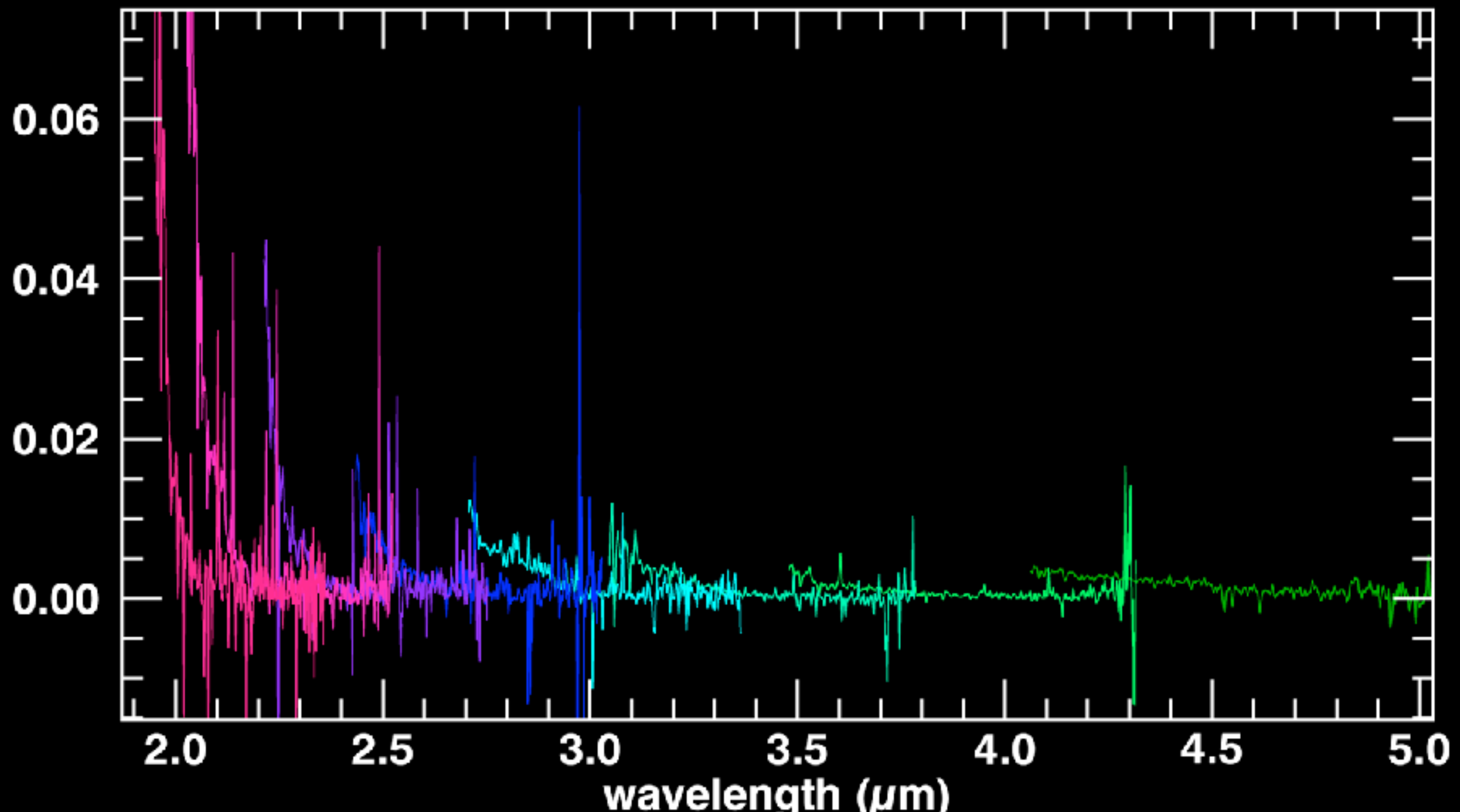
With a backup cube:
EASY CASE

MTP015/STP054/RAW/H1_00389083498M

Stray light removal:

Without a backup cube (most of the time):

As is

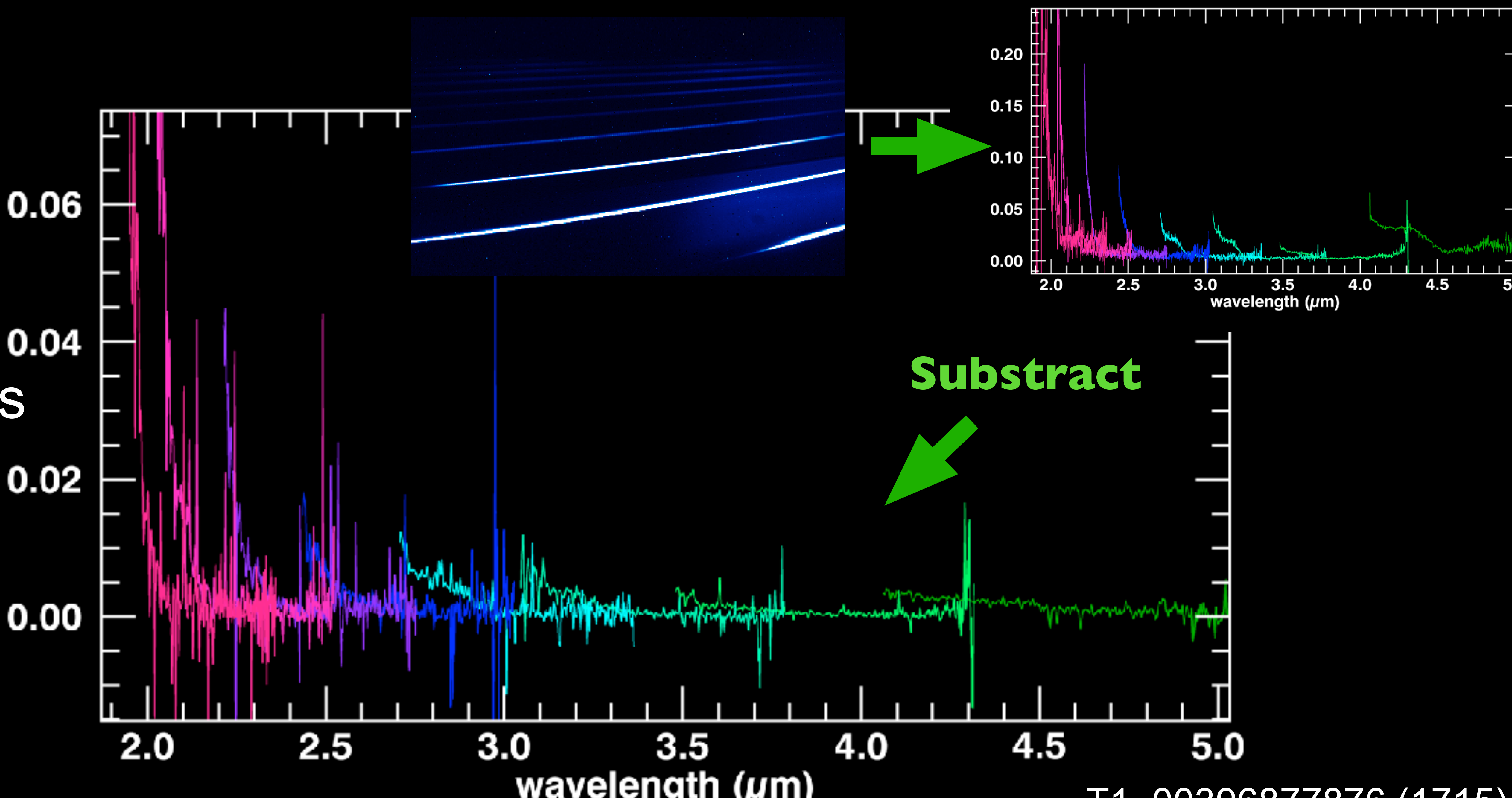


T1_00396877876 (1715)

Stray light removal:

Without a backup cube (most of the time):

As is

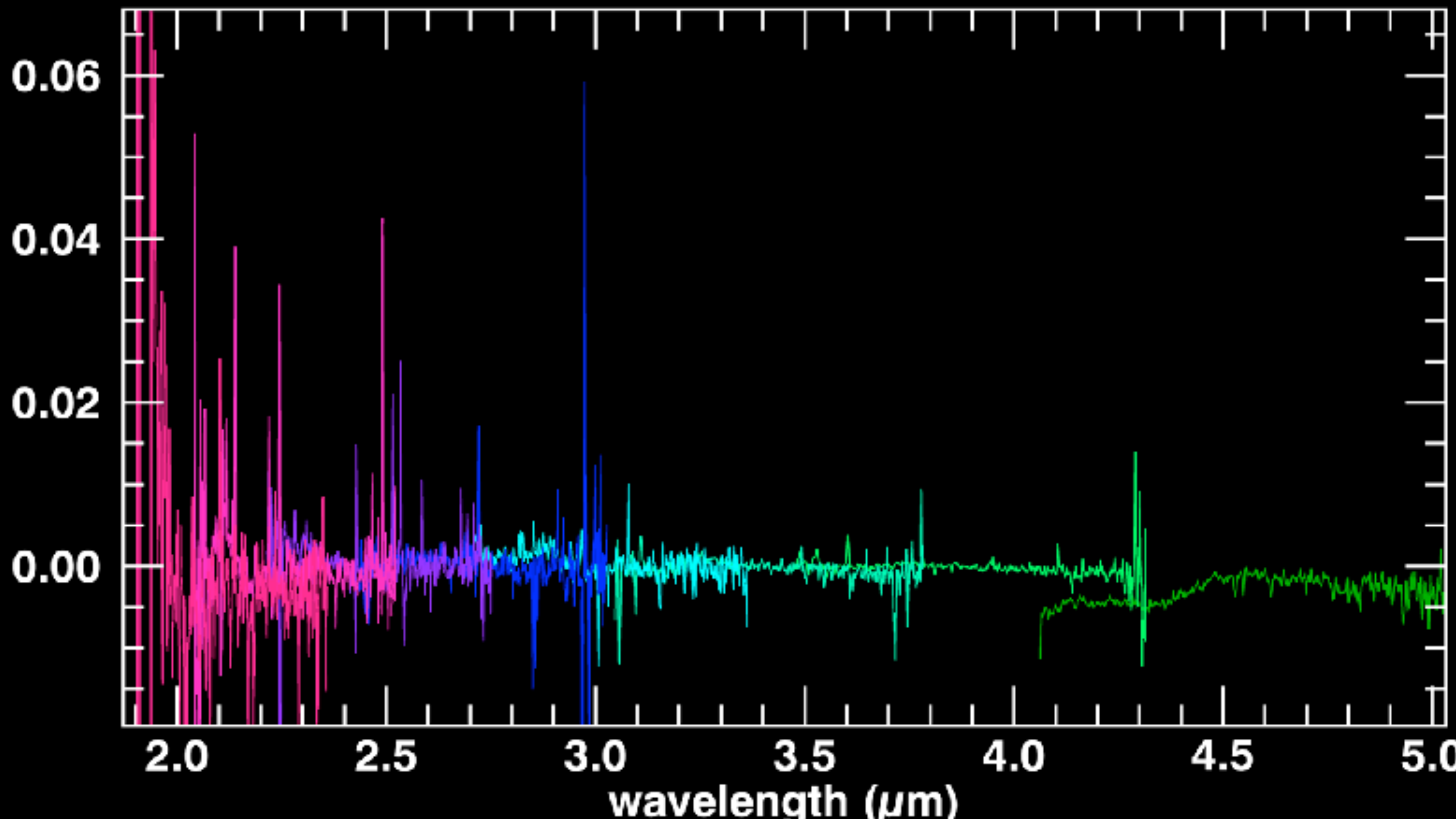


T1_00396877876 (1715)

Stray light removal:

Without a backup cube (most of the time):

As is



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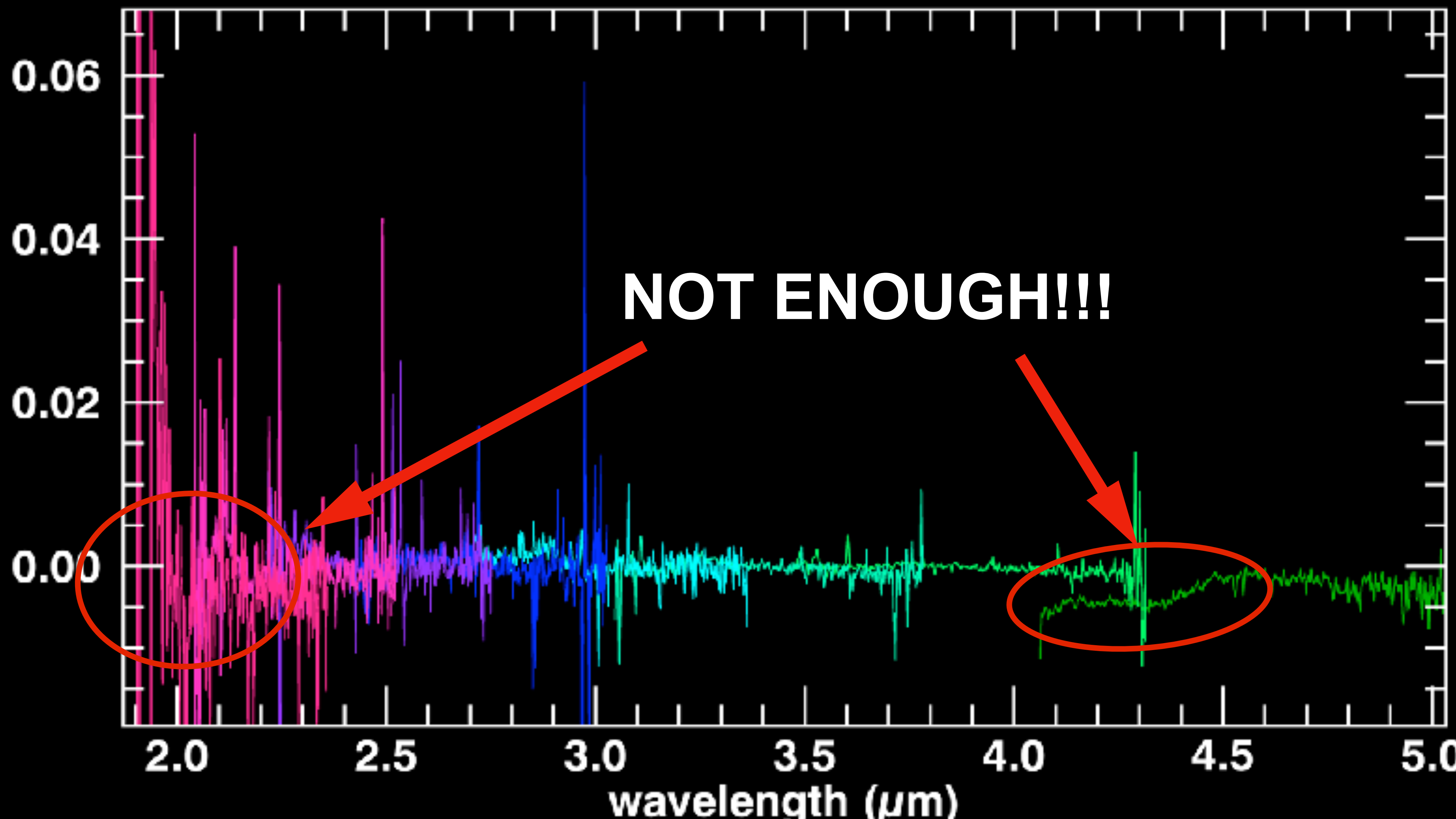
Stray light removal:

Without a backup cube (most of the time):

As is



T1_00396877876 (1715)

Preliminary conclusions:

- From backup cube, straylight can be well corrected

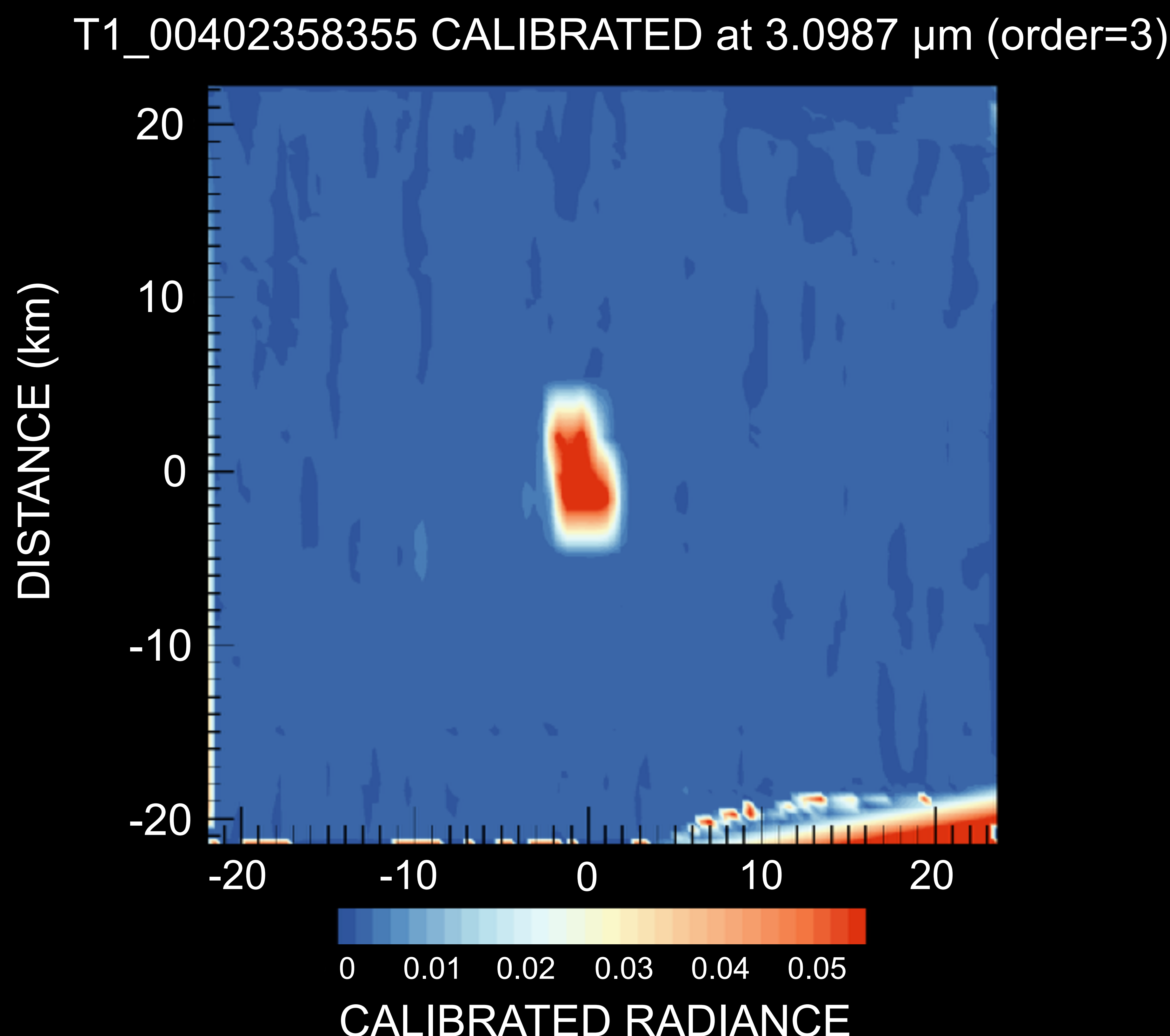
- BUT: not so many backup cubes with straylight available

- Without backup a scaling of a typical straylight is NOT enough

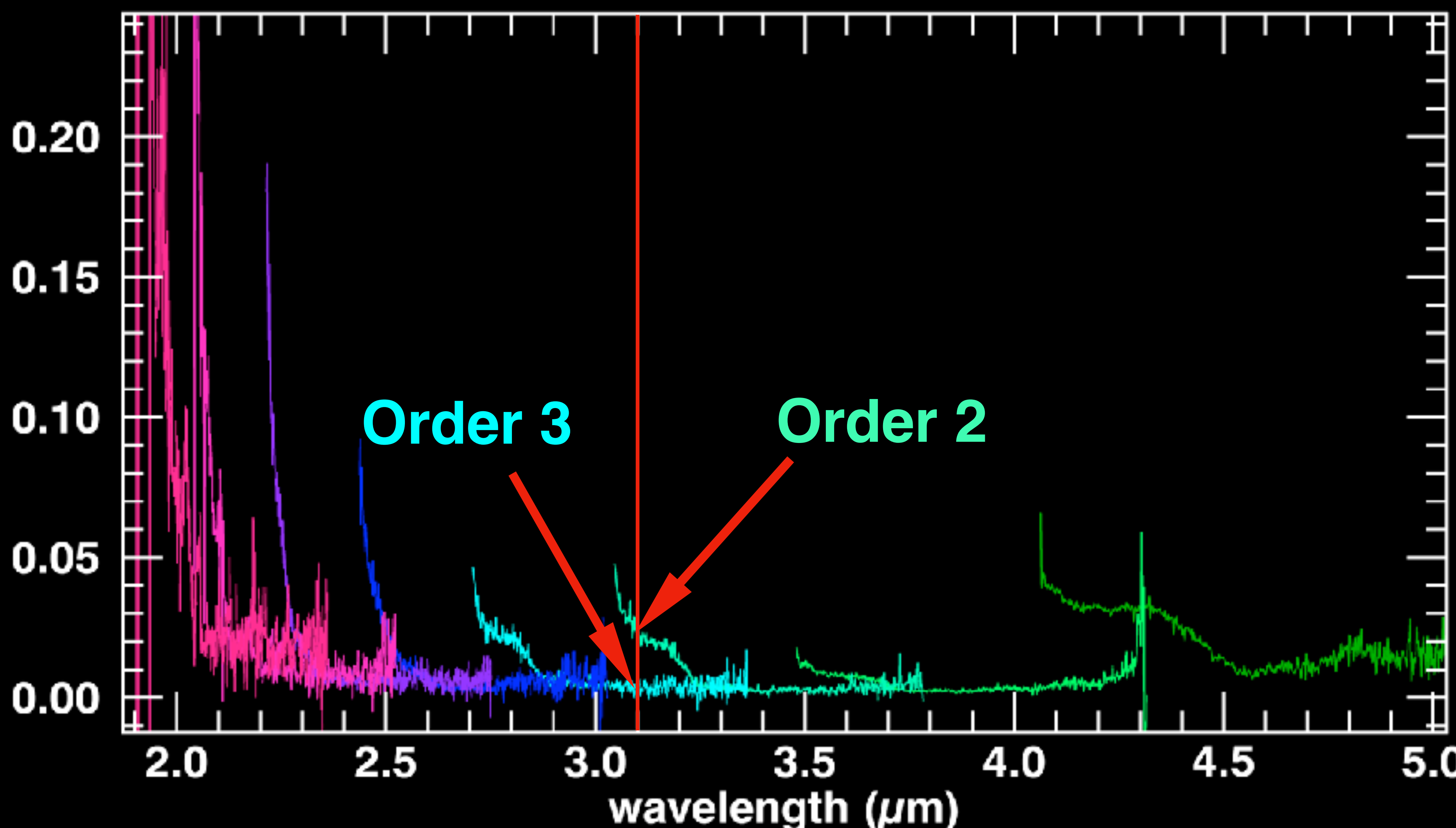
- Backup and nominal cubes from different mission phases are need to be studied to get the evolution of stray light with time and geometry.

- finer scaling methods may be necessary

Stray light: geometrical variations

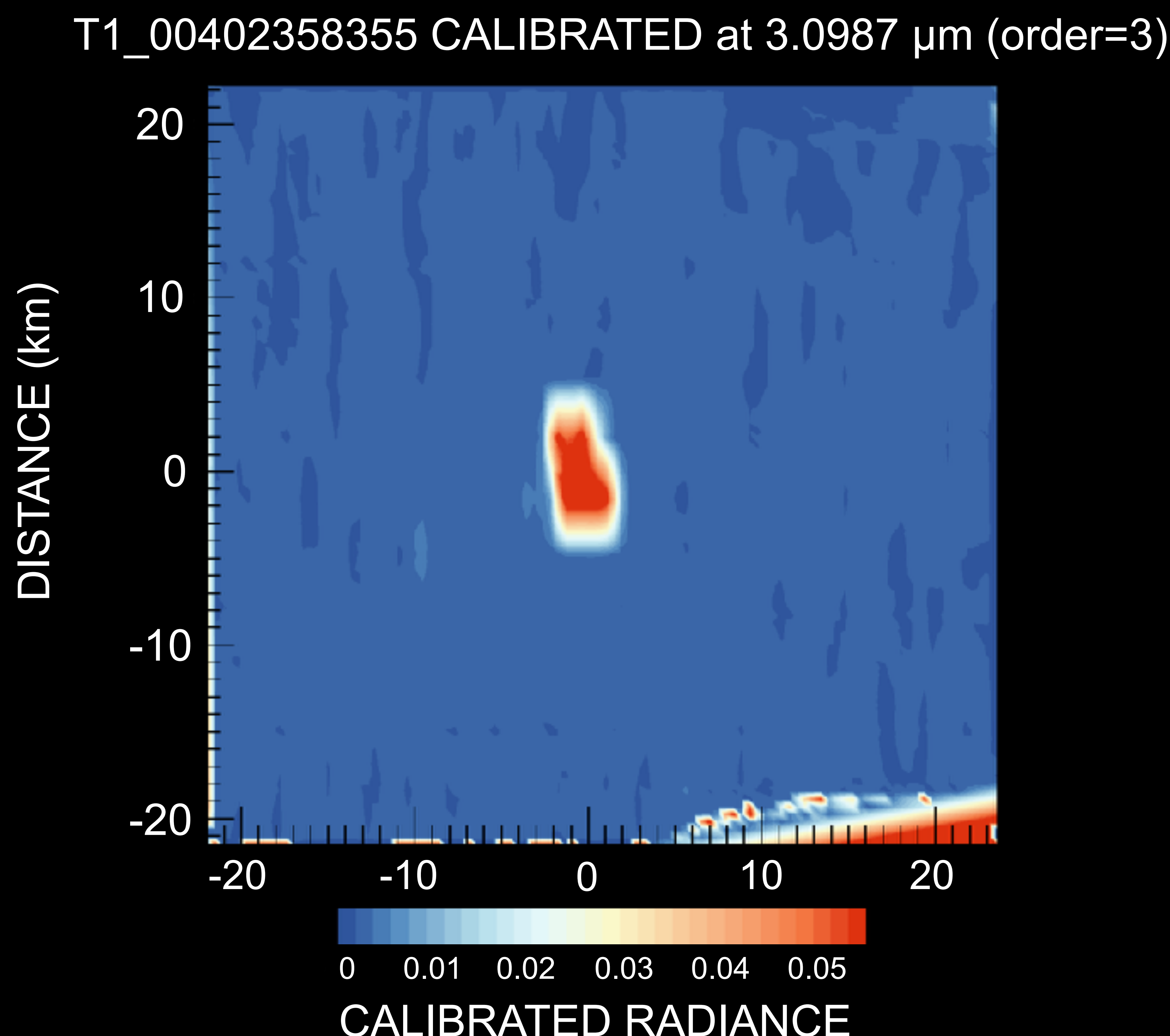


Stray light: geometrical variations



CALIBRATED RADIANCE

Stray light: geometrical variations



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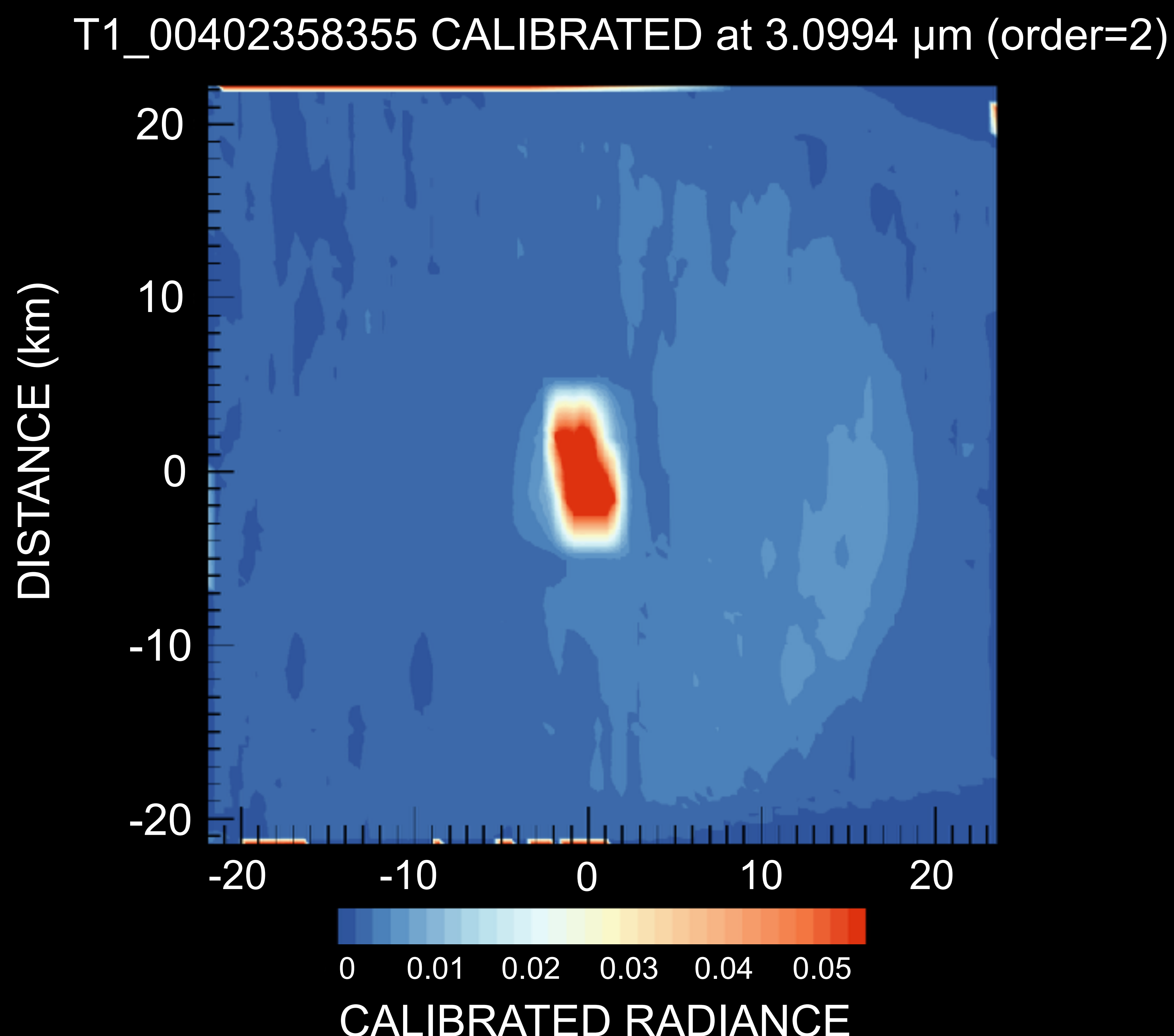

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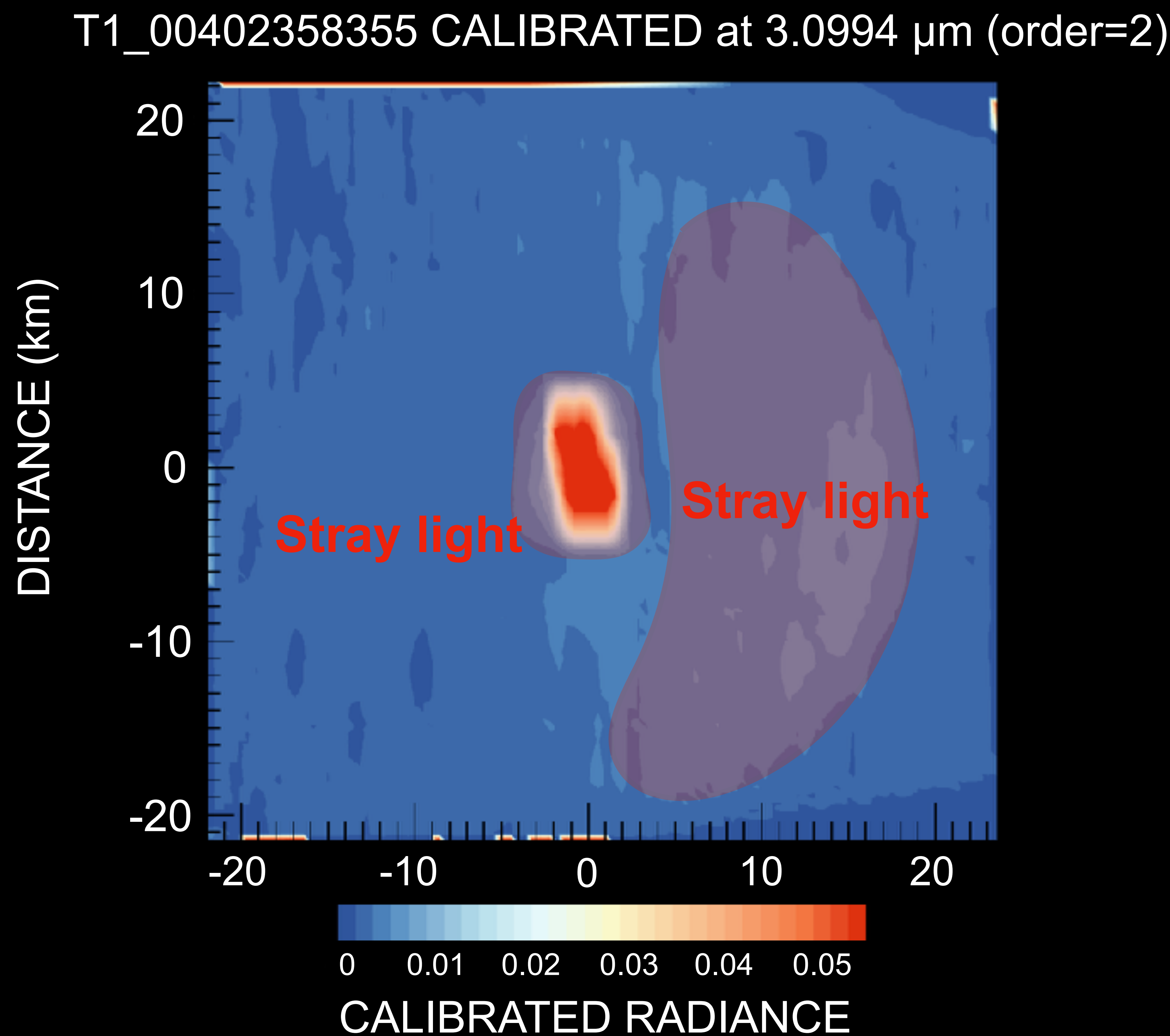
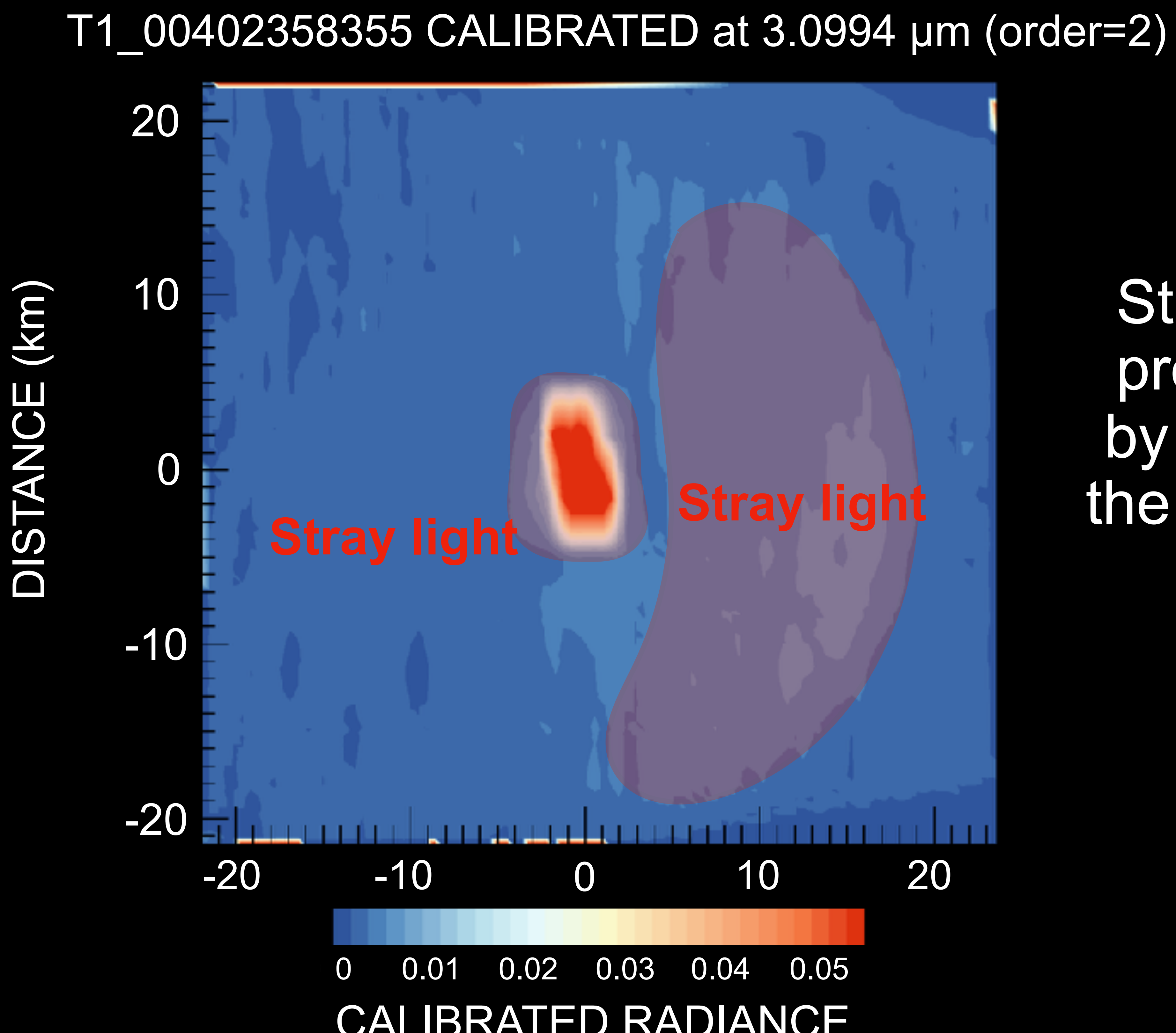
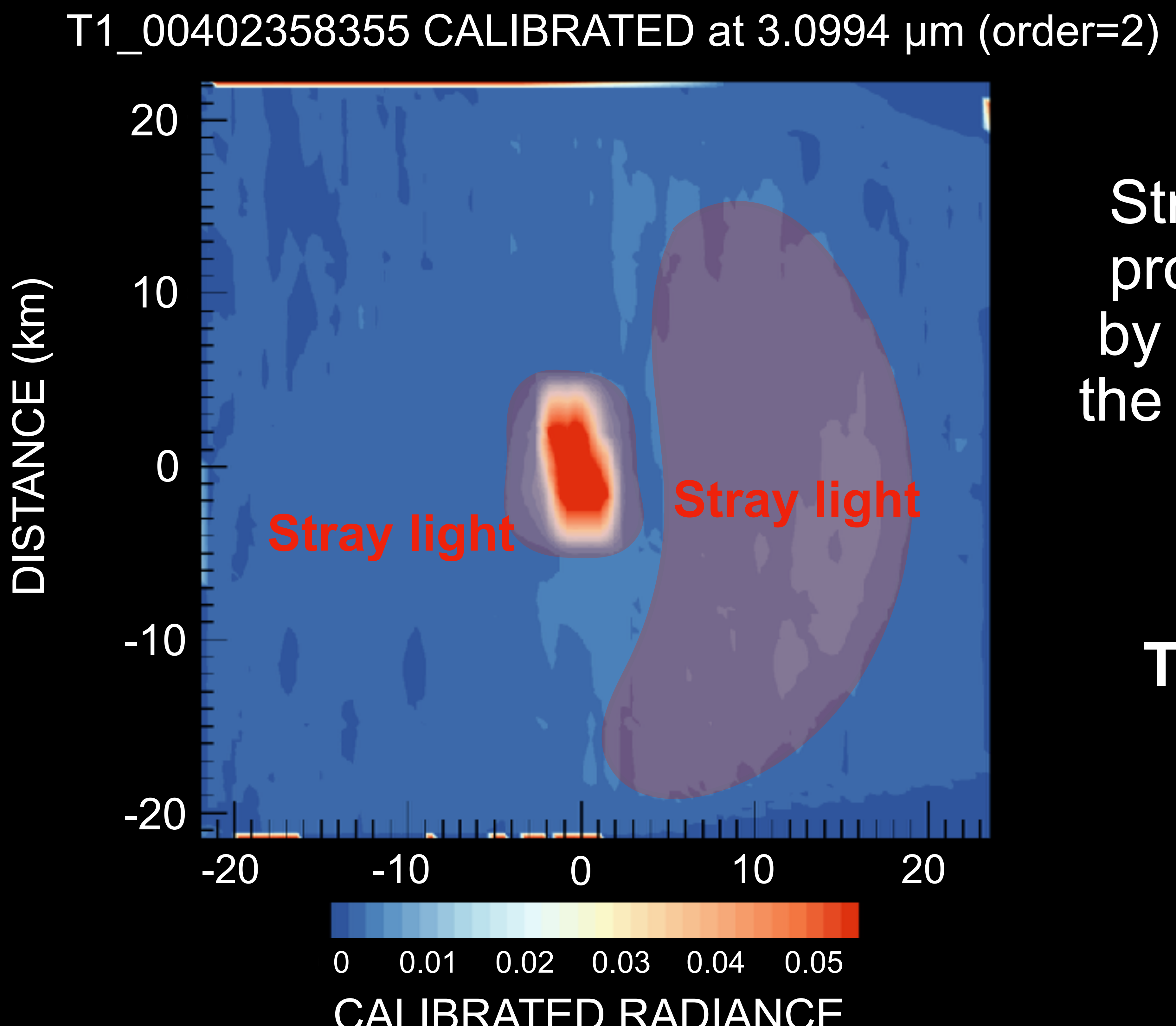


Stray light: geometrical variations



Strayligth is most probably caused by a **reflexion** on the slit in particular conditions

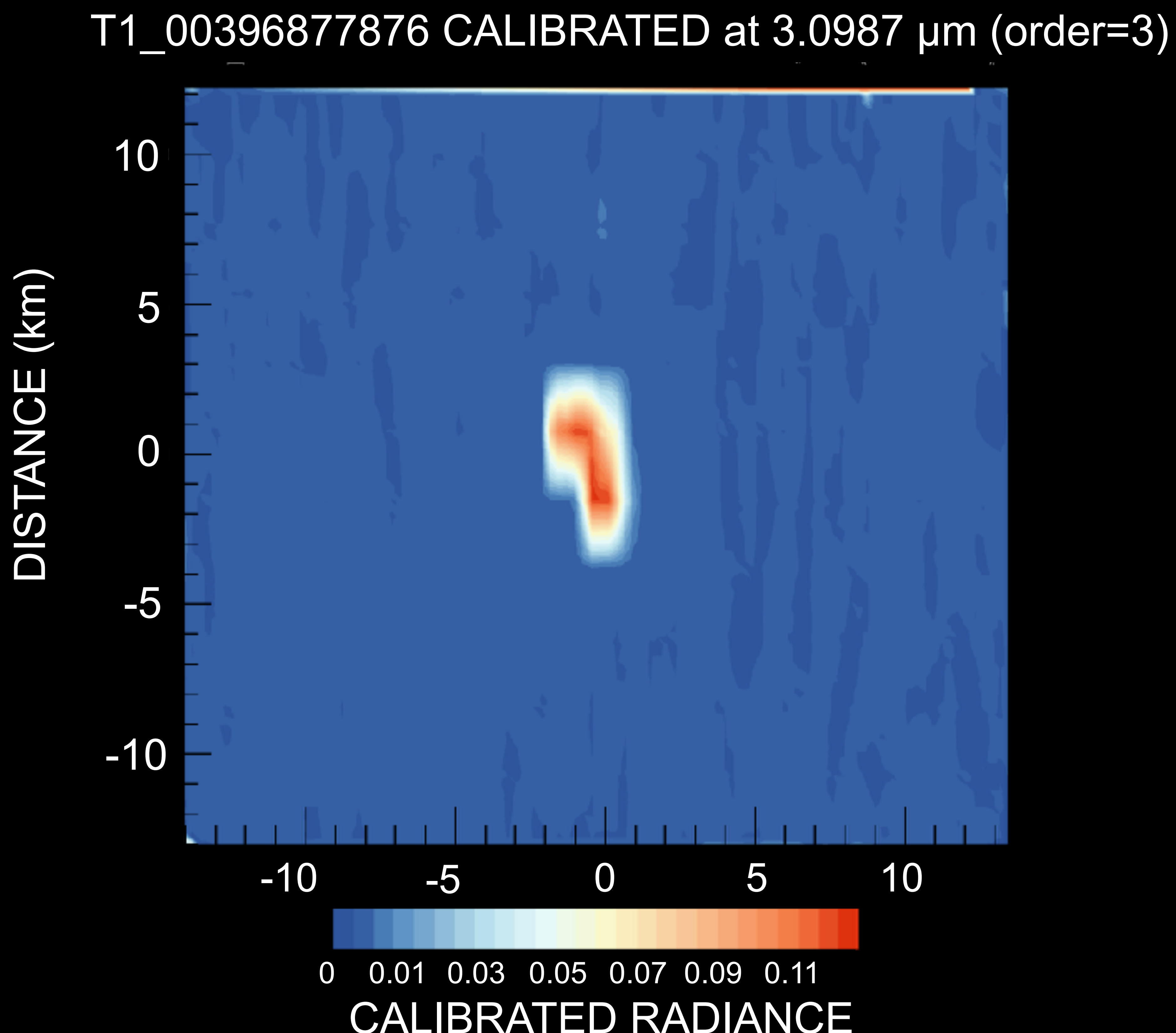
Stray light: geometrical variations



Straylígth is most probably caused by a **reflexion** on the slit in particular conditions

But wait,
There's more

Stray light: darks contamination?



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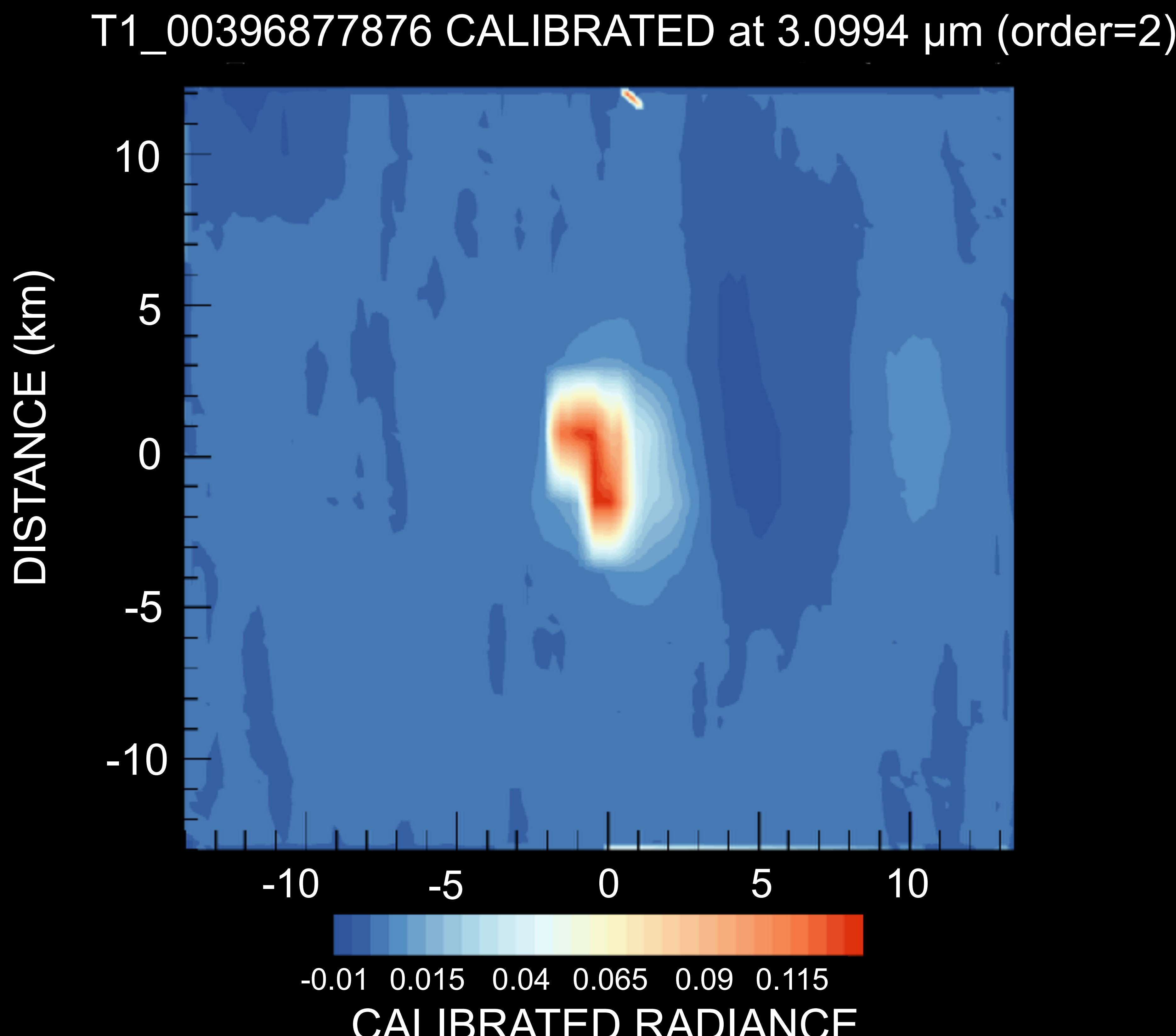

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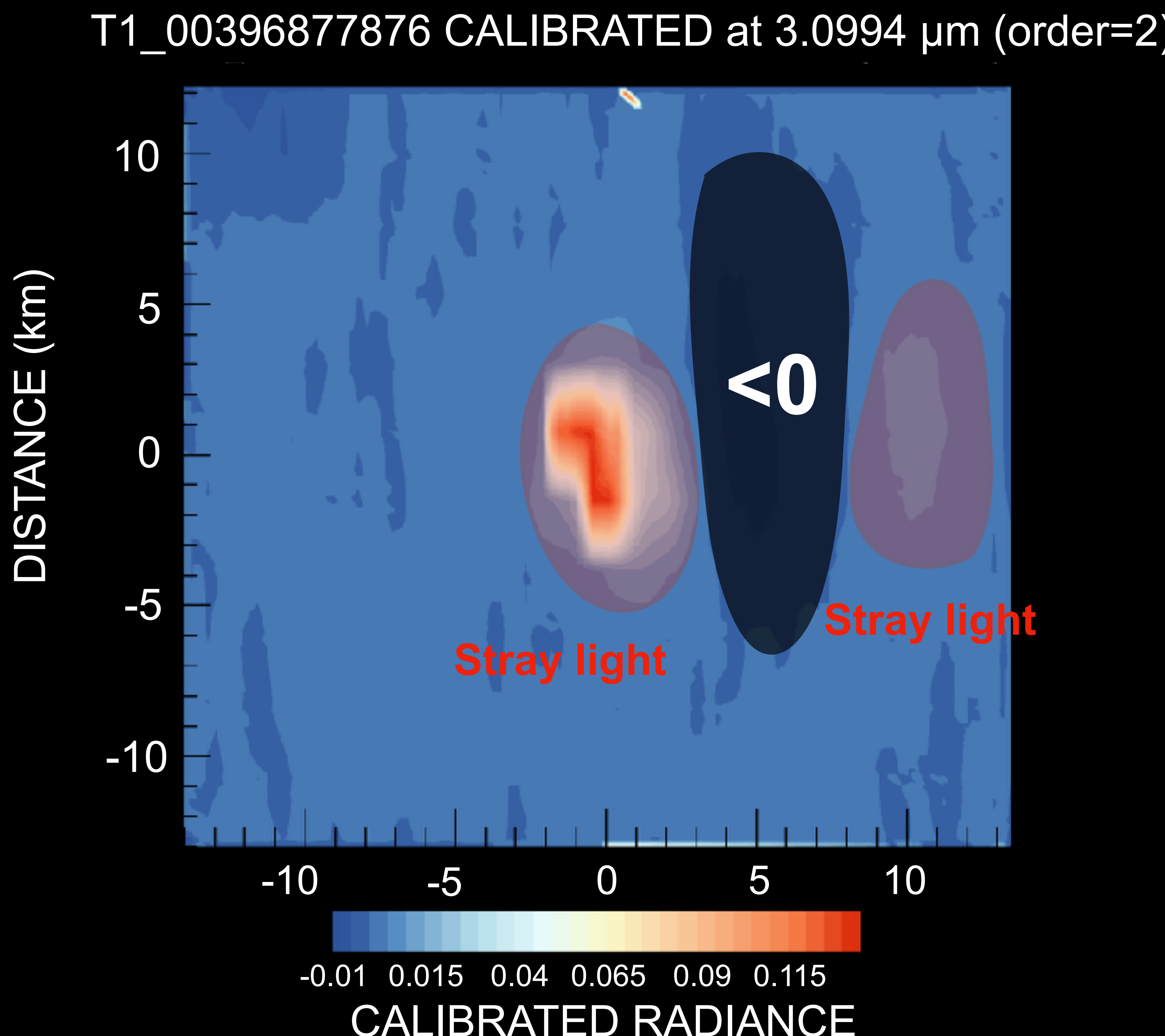
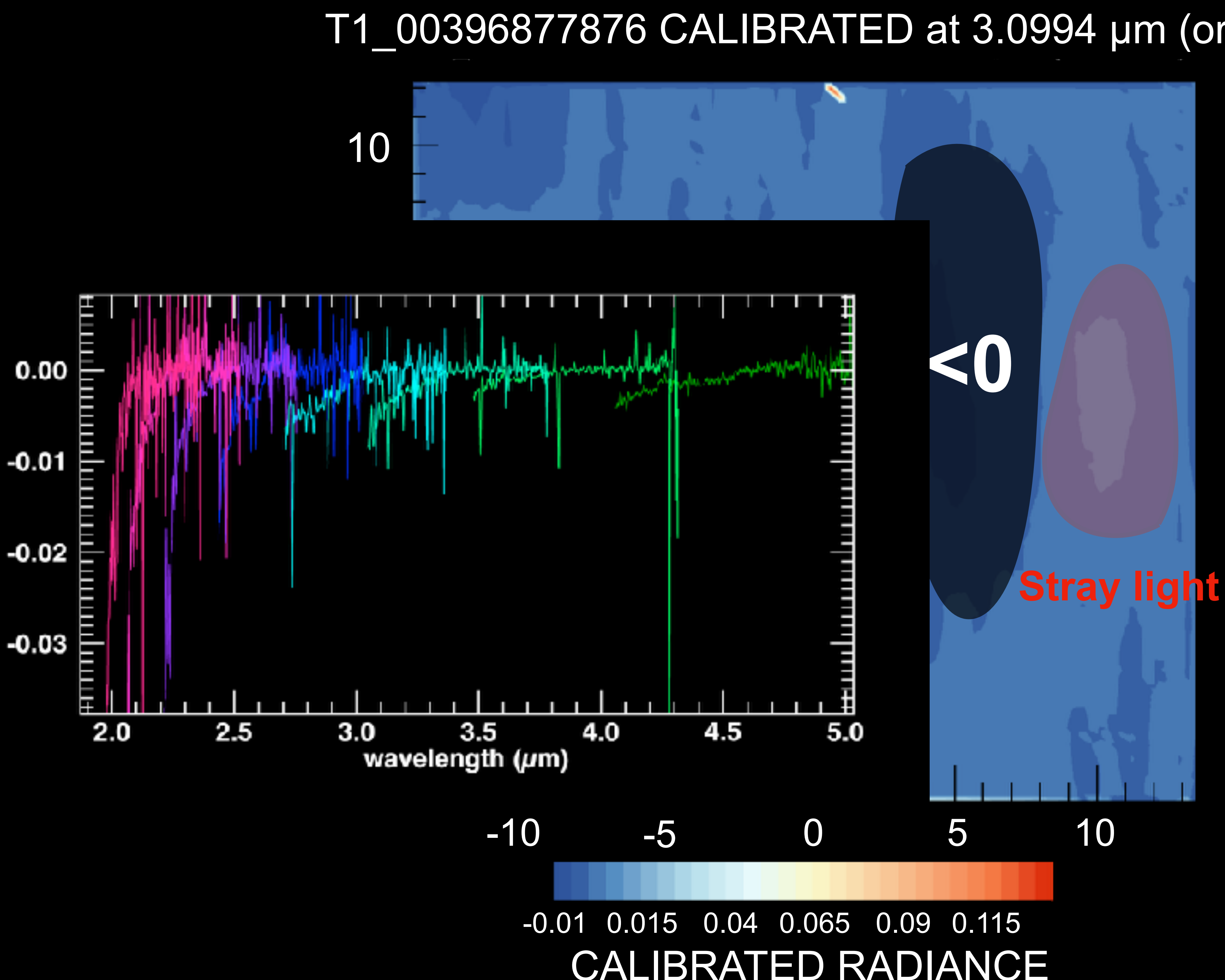


Stray light: darks contamination?



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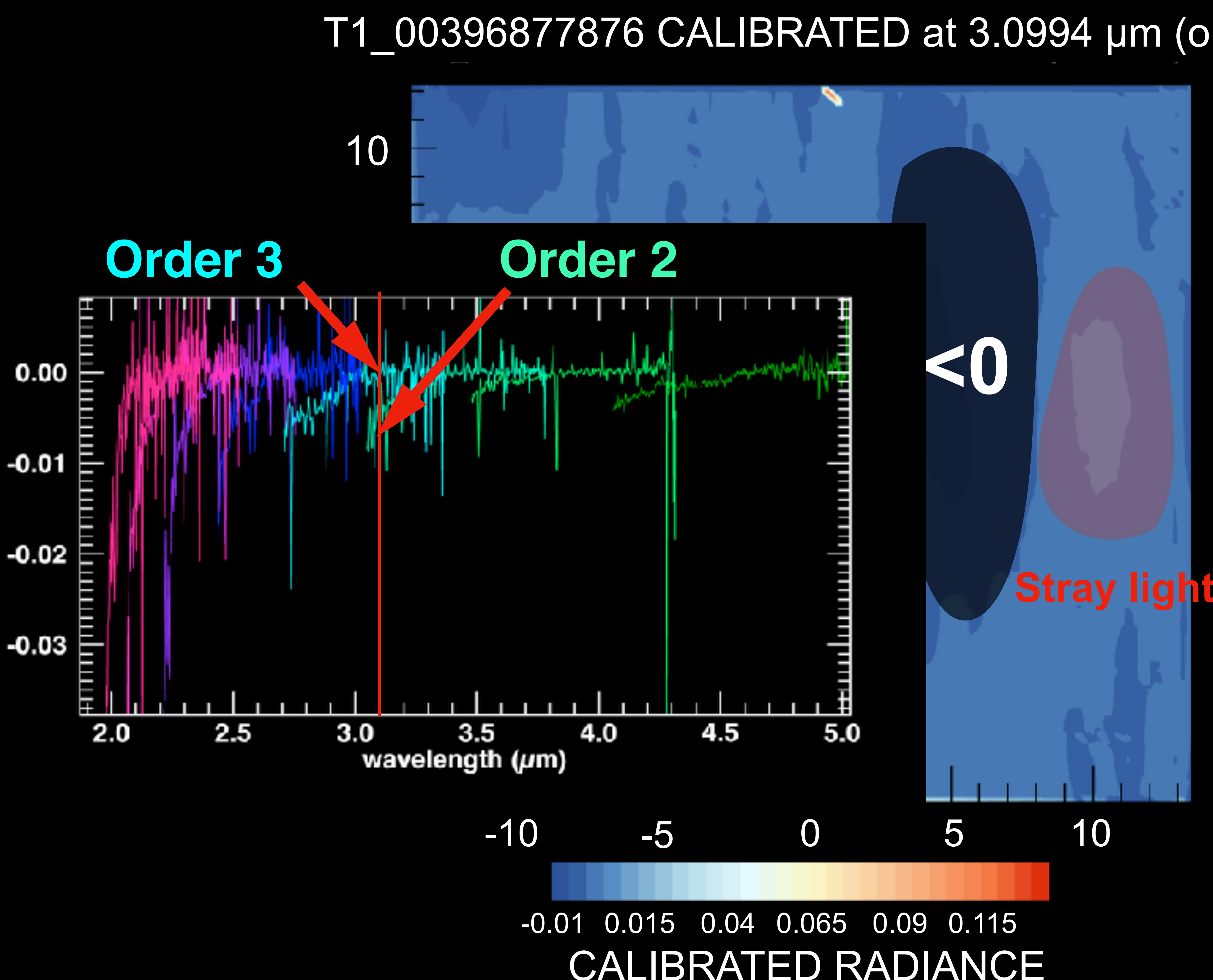

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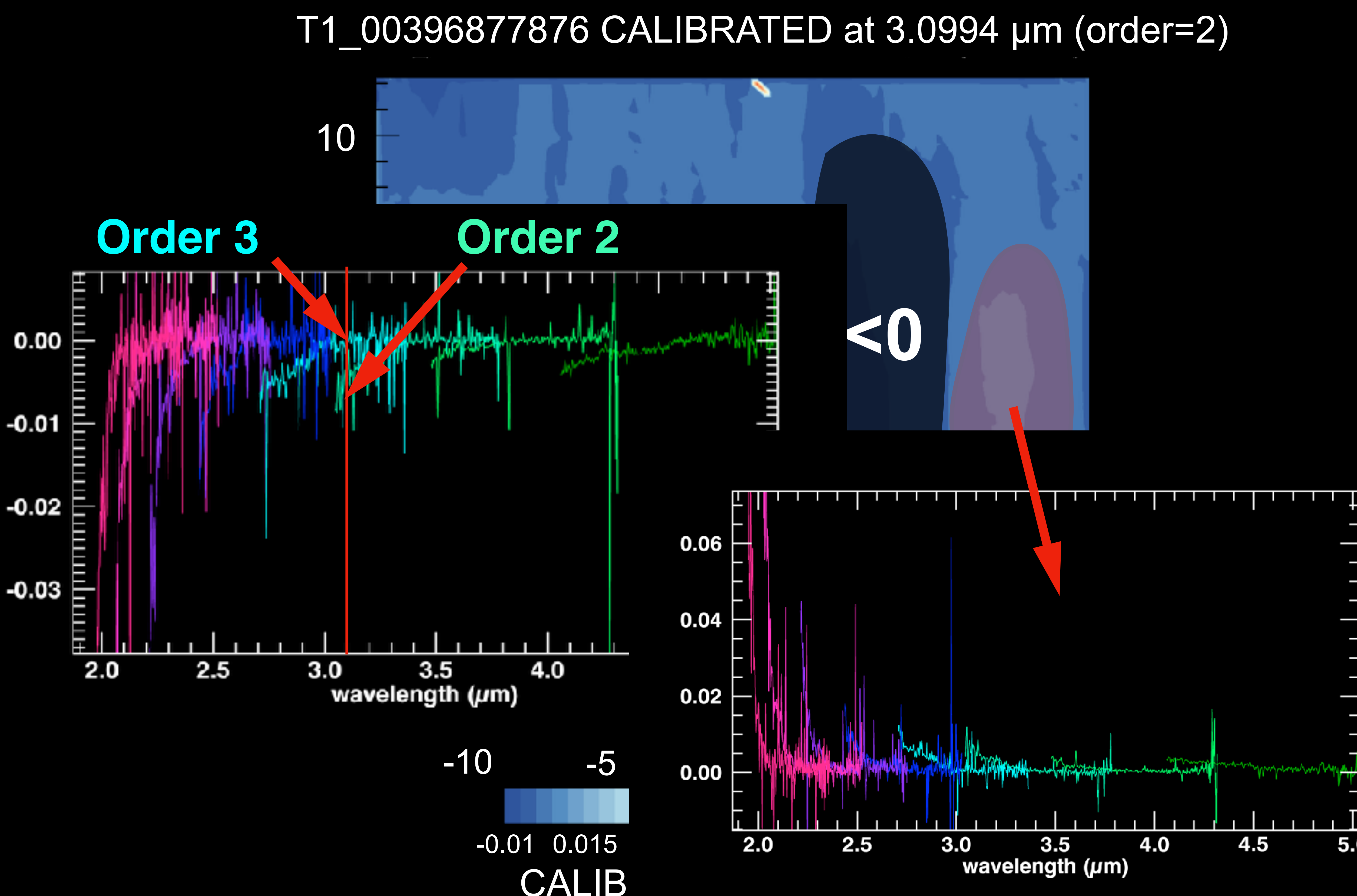

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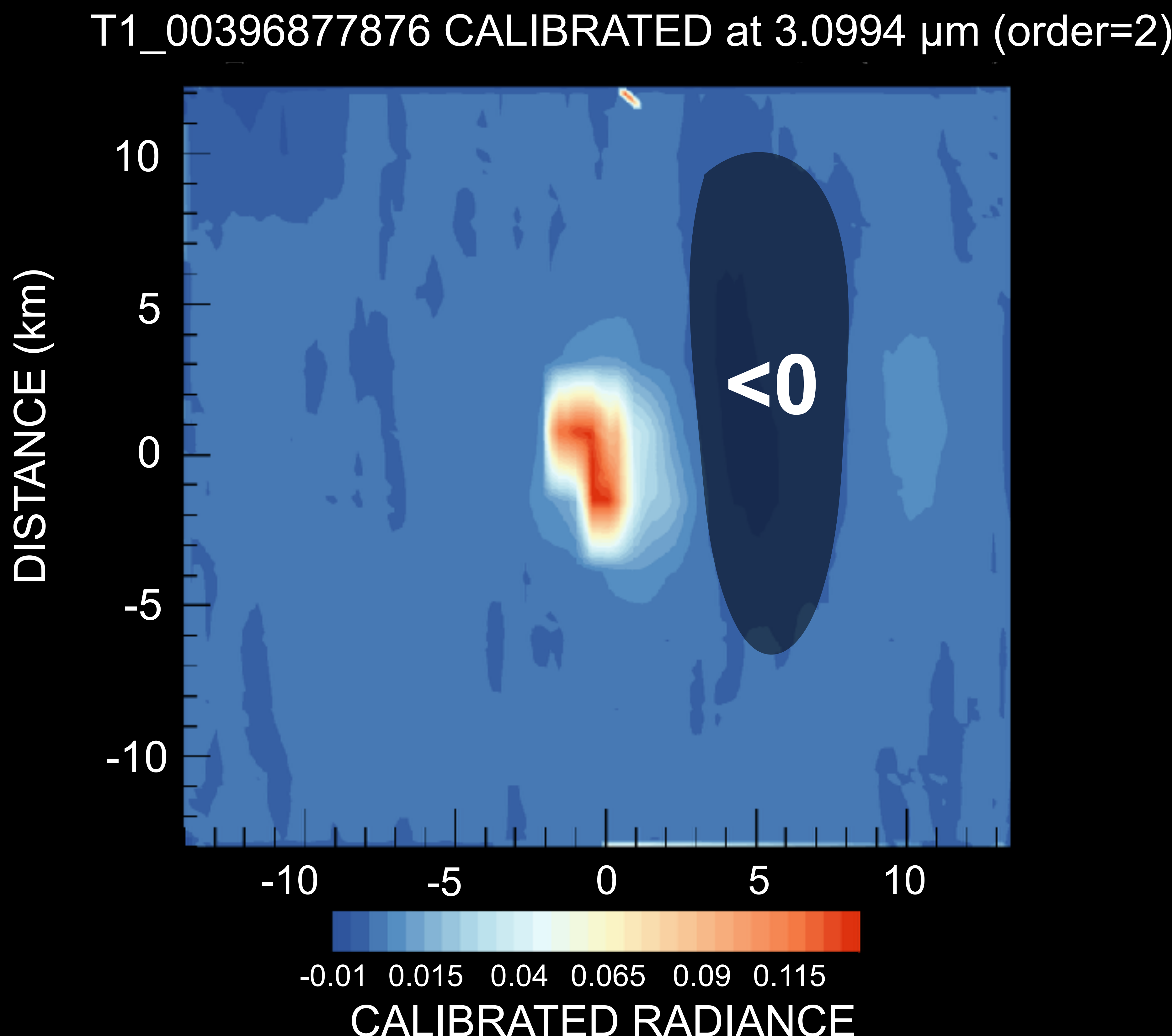

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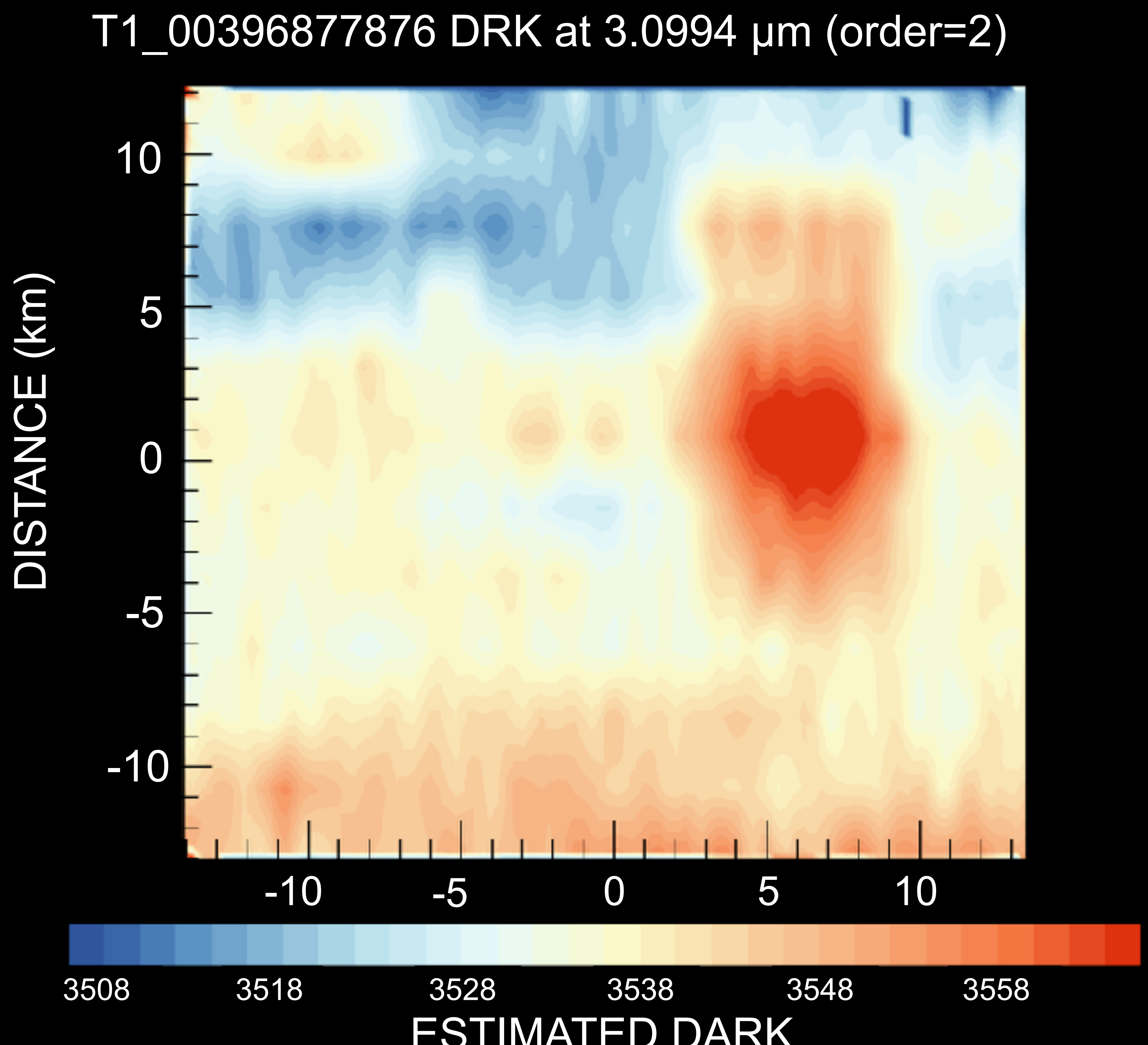

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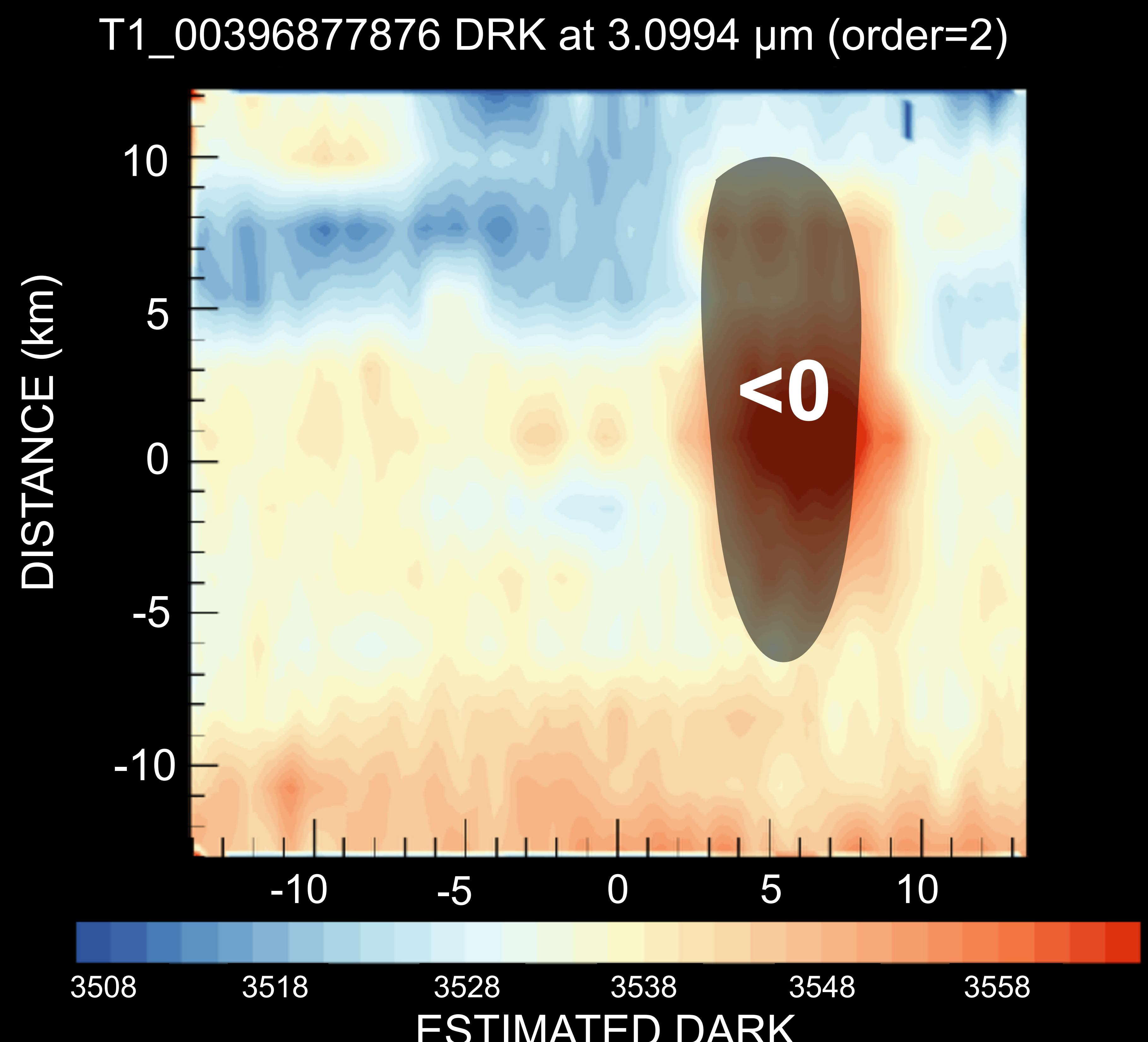

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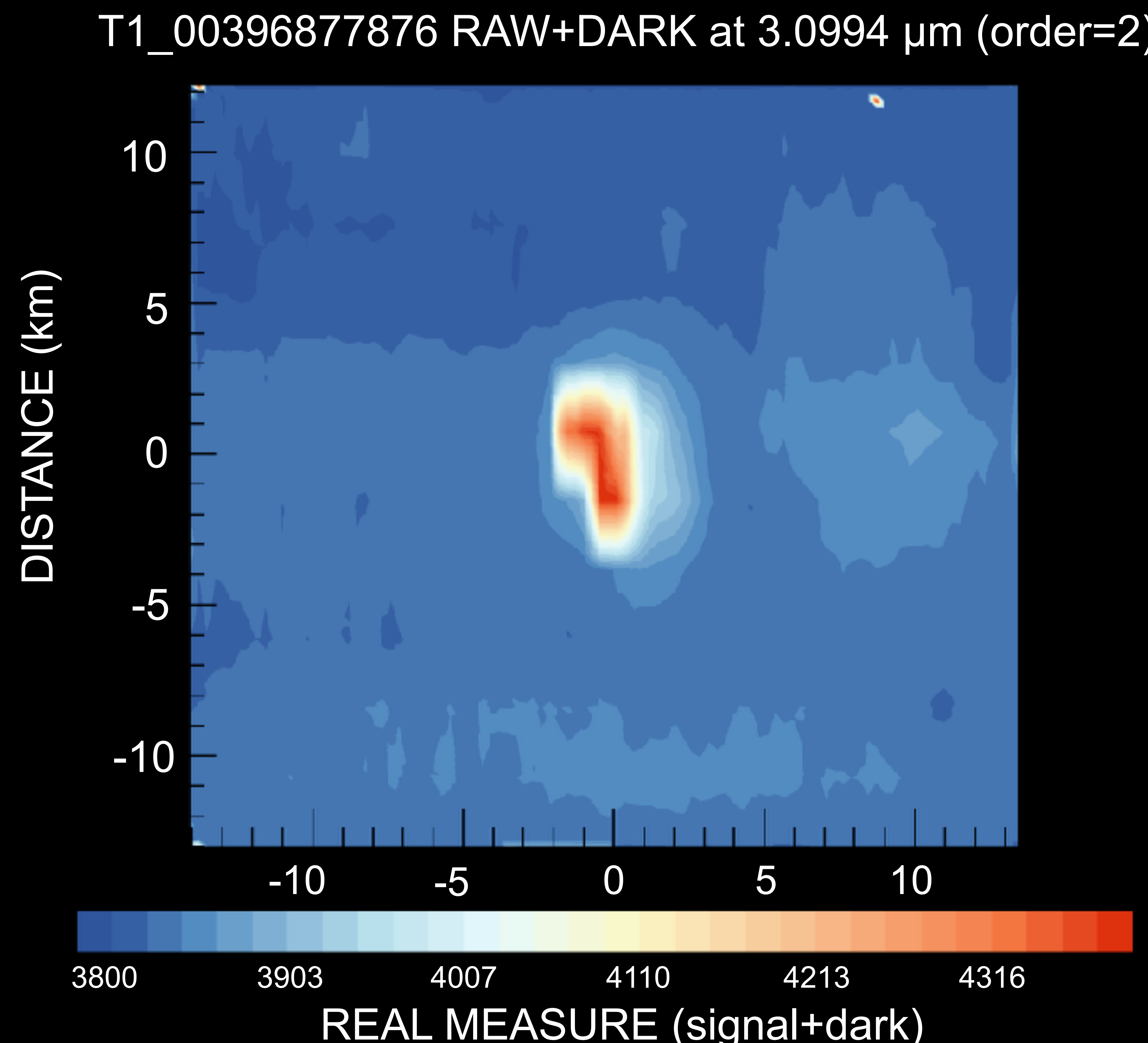
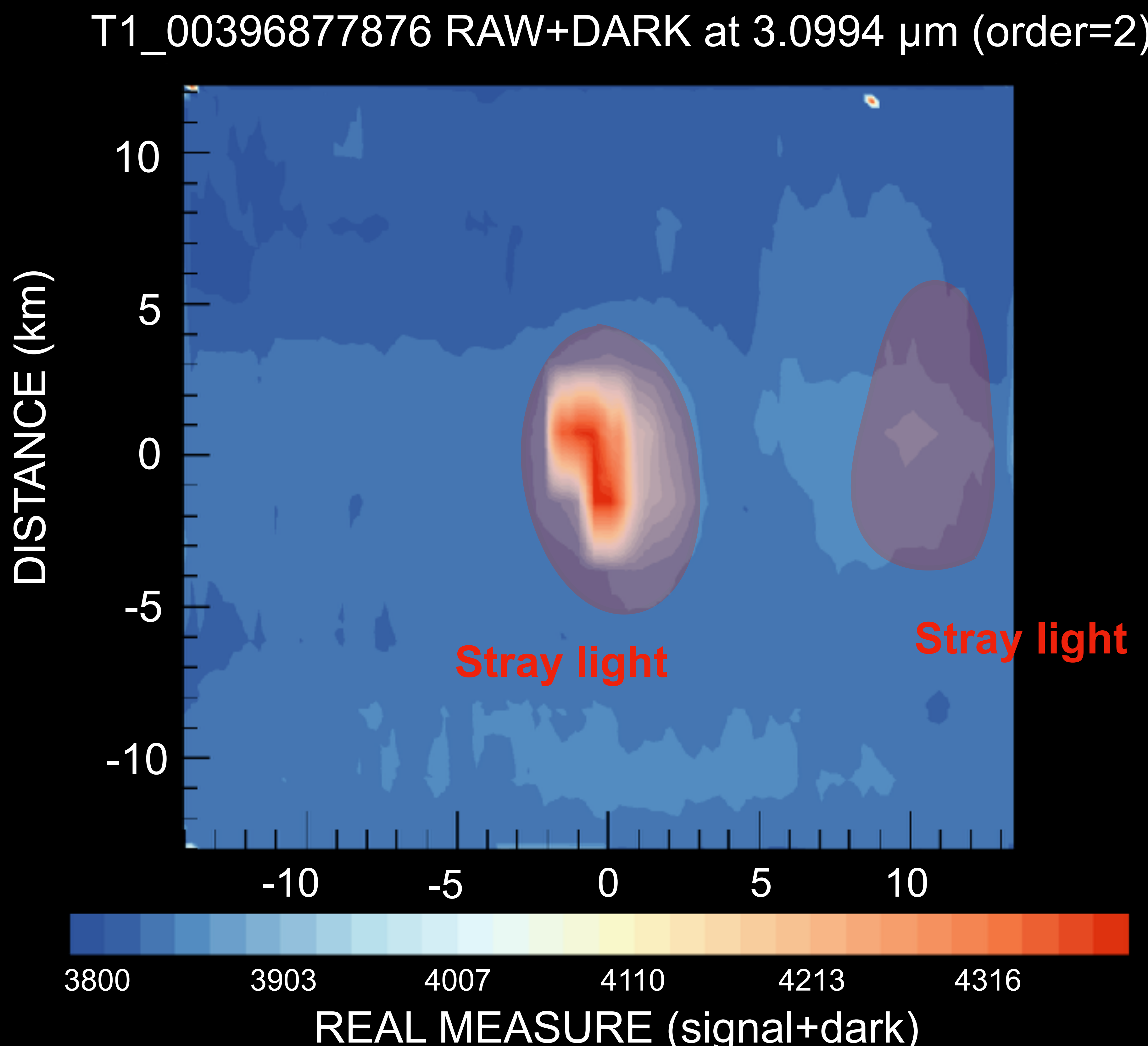


Stray light: darks contamination?



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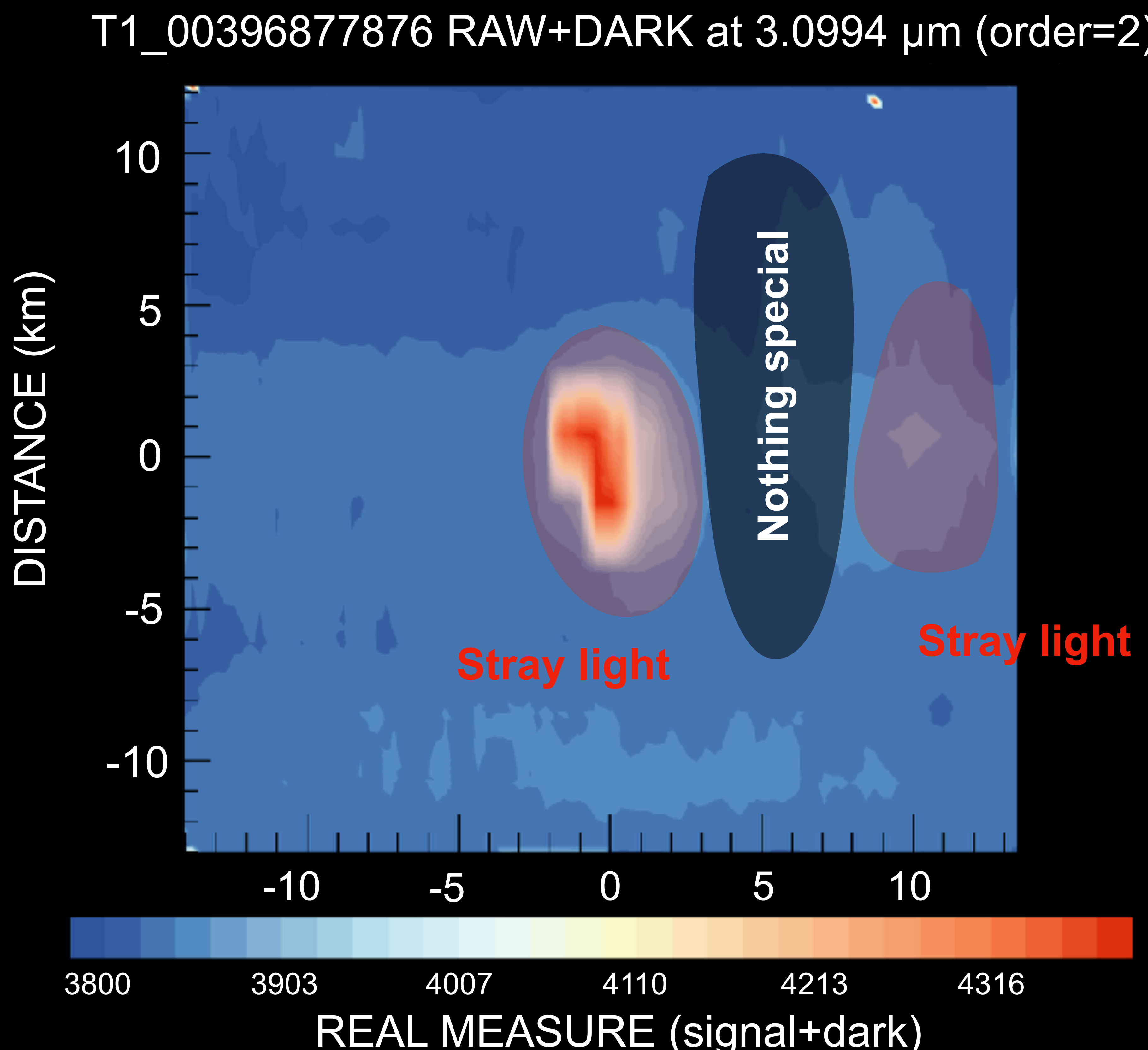


Stray light in the darks

- Detected in (some) dark measurements and visible in both interpolated and original darks
- …but not in sky measurement at the same location

Interpretation:

Stray light in general related to a reflexion in the vicinity of the slit

Input direction depends on shutter status (stray light in dark happen in different conditions)

We should be able to correct it the same way as regular stray light

General method for removing stray light :

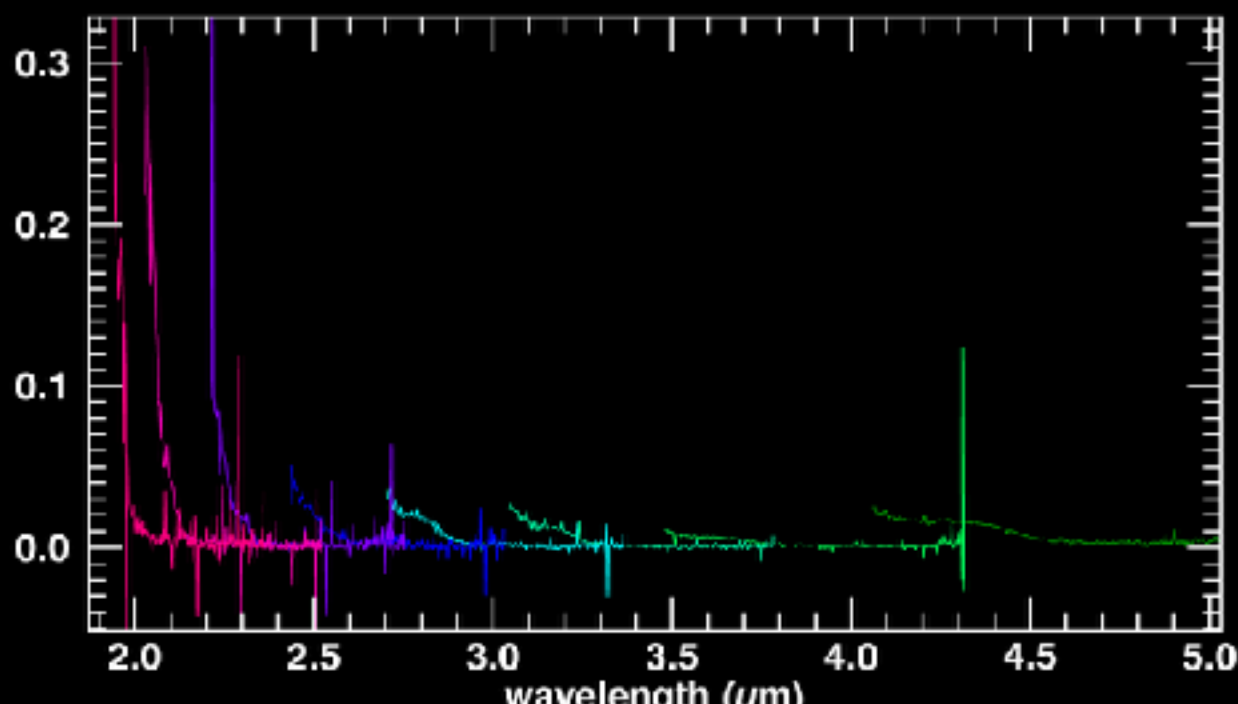
1) Find the closest (in time) model of stray light

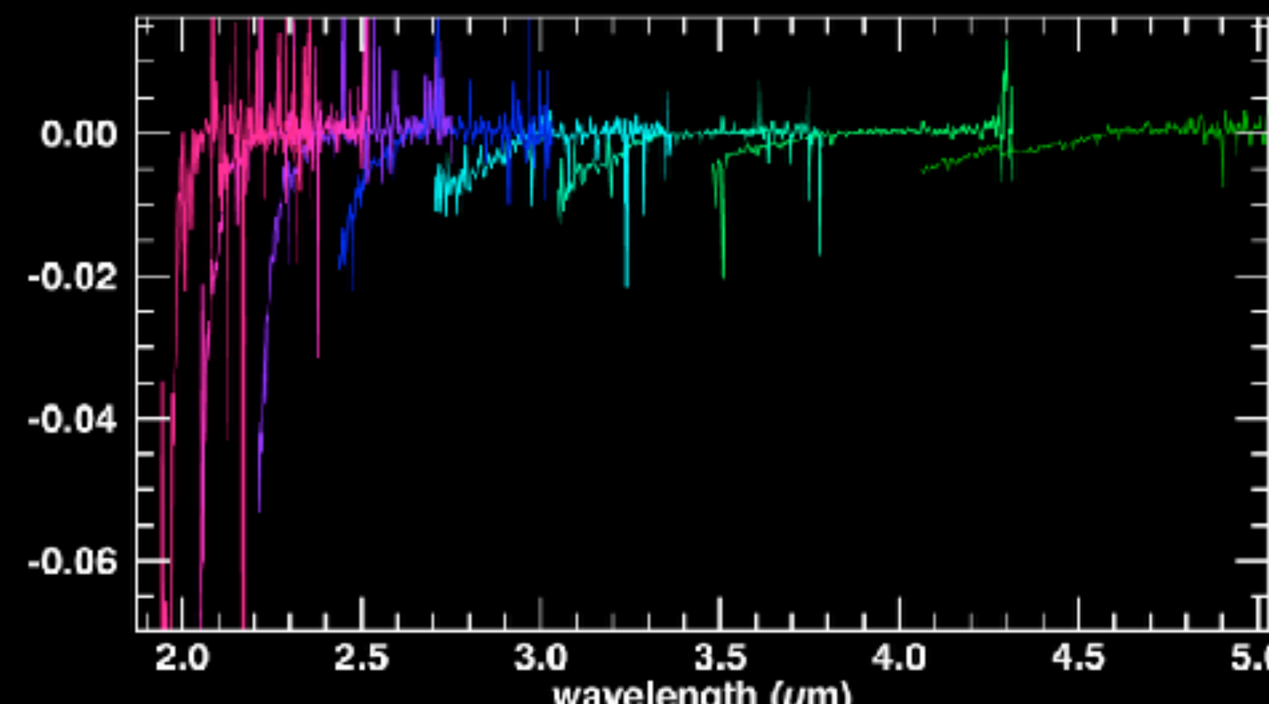
 23 models for regular

 4 models for stray light affecting the darks (harder to detect, noisier

2) Scale it order by order

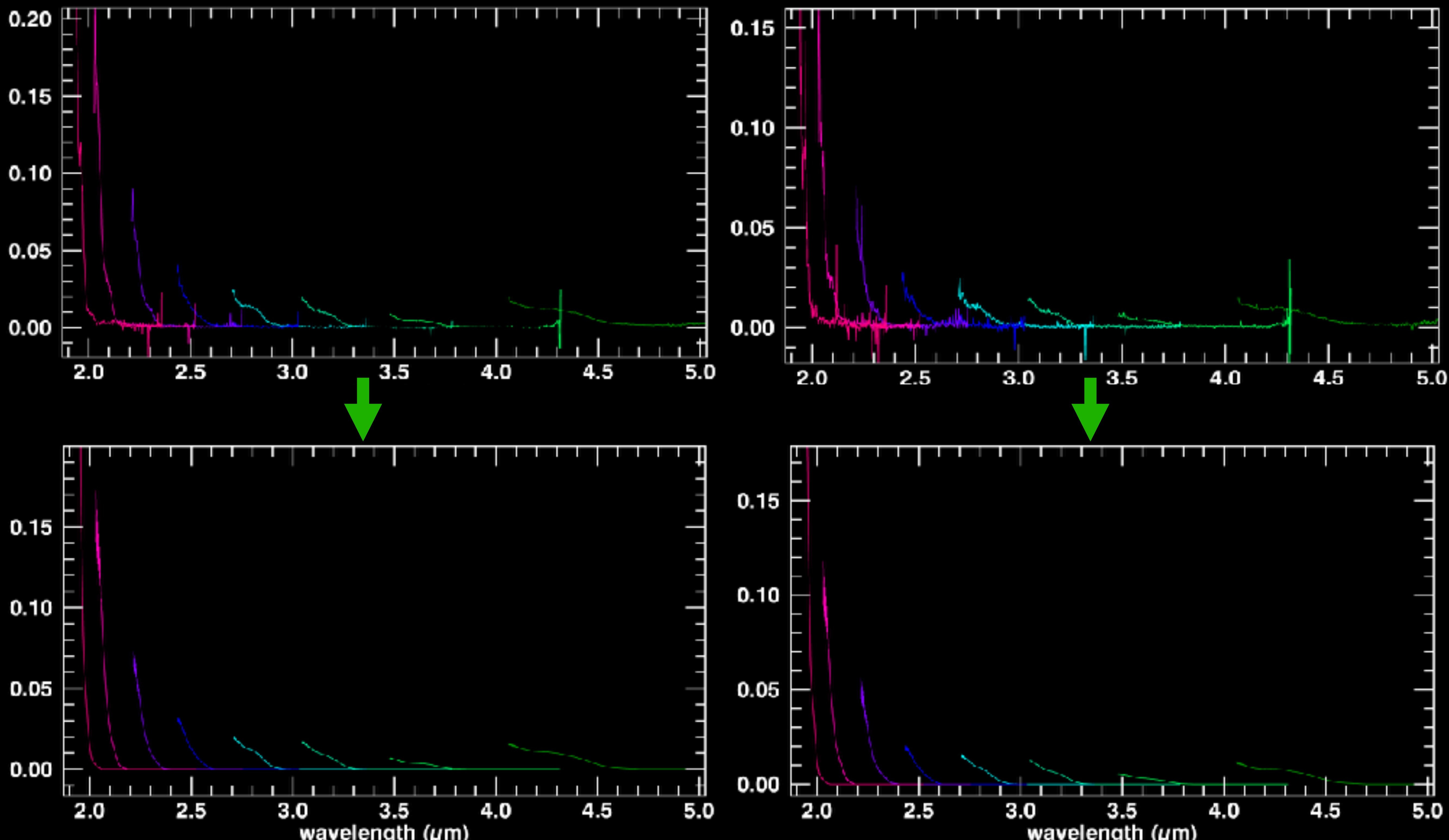
3) Remove the scaled model to the observation





T1_00396877876 (1760) CALIBRATED

Examples of stray light measurements and models



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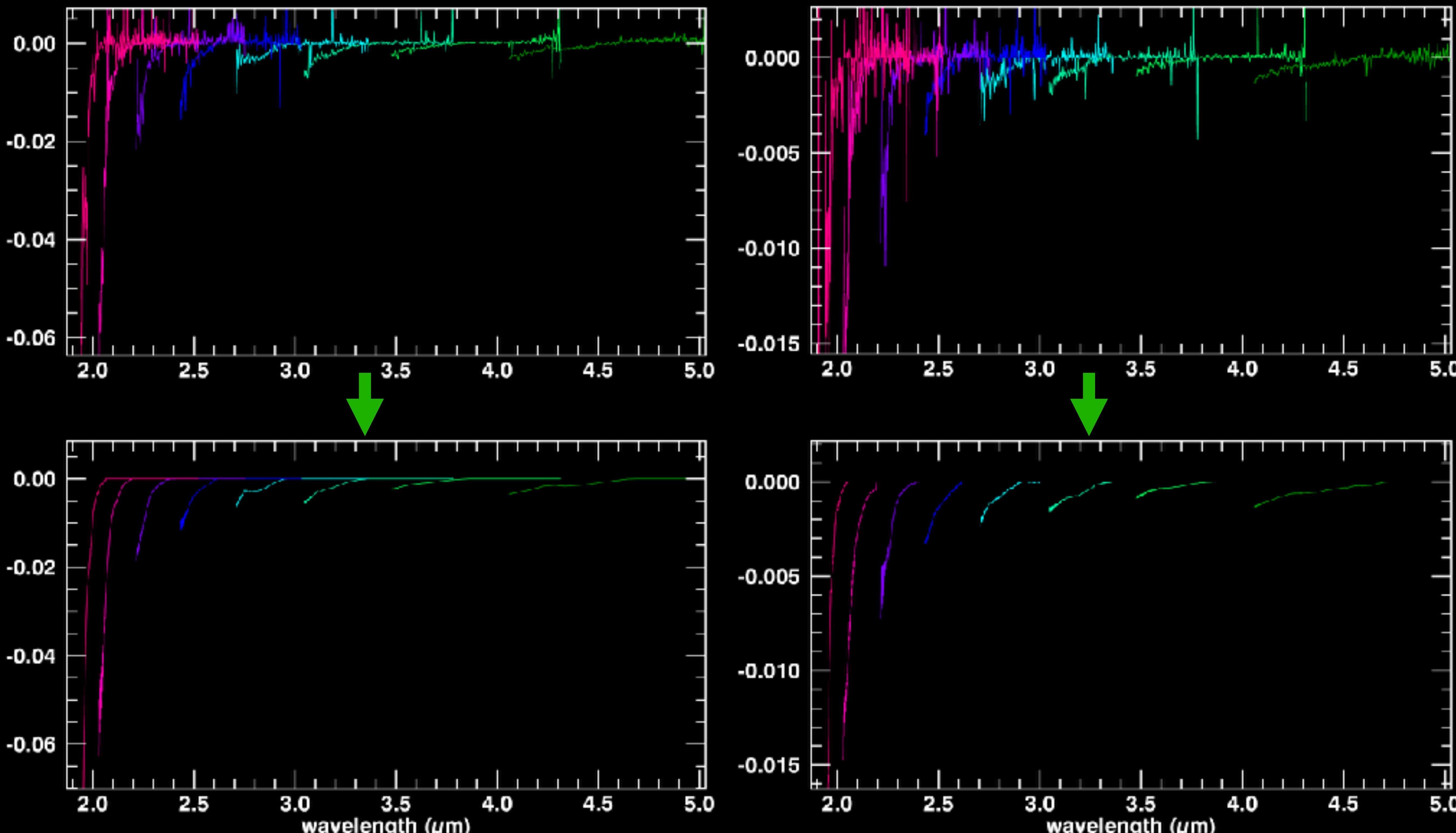
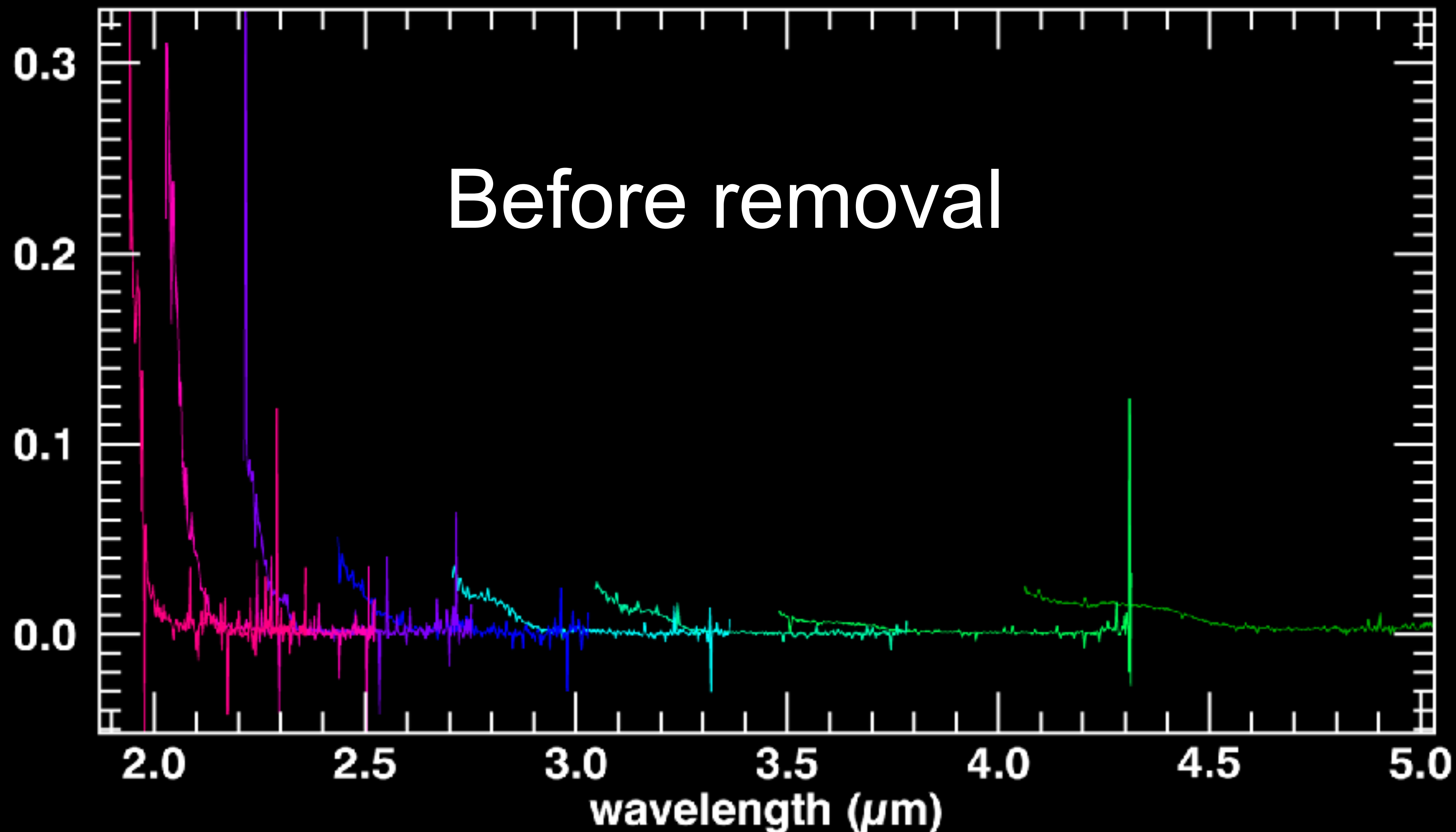
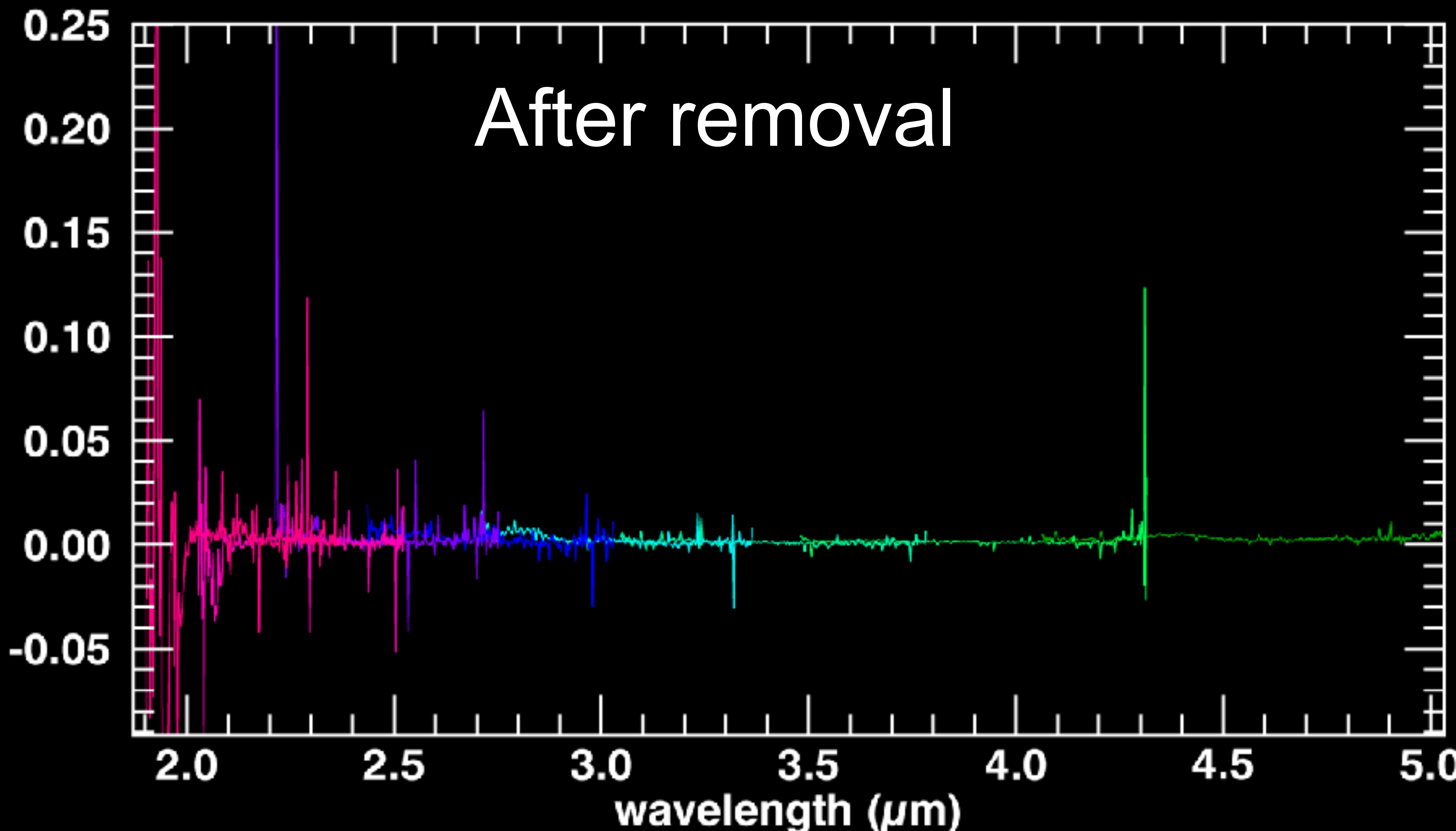


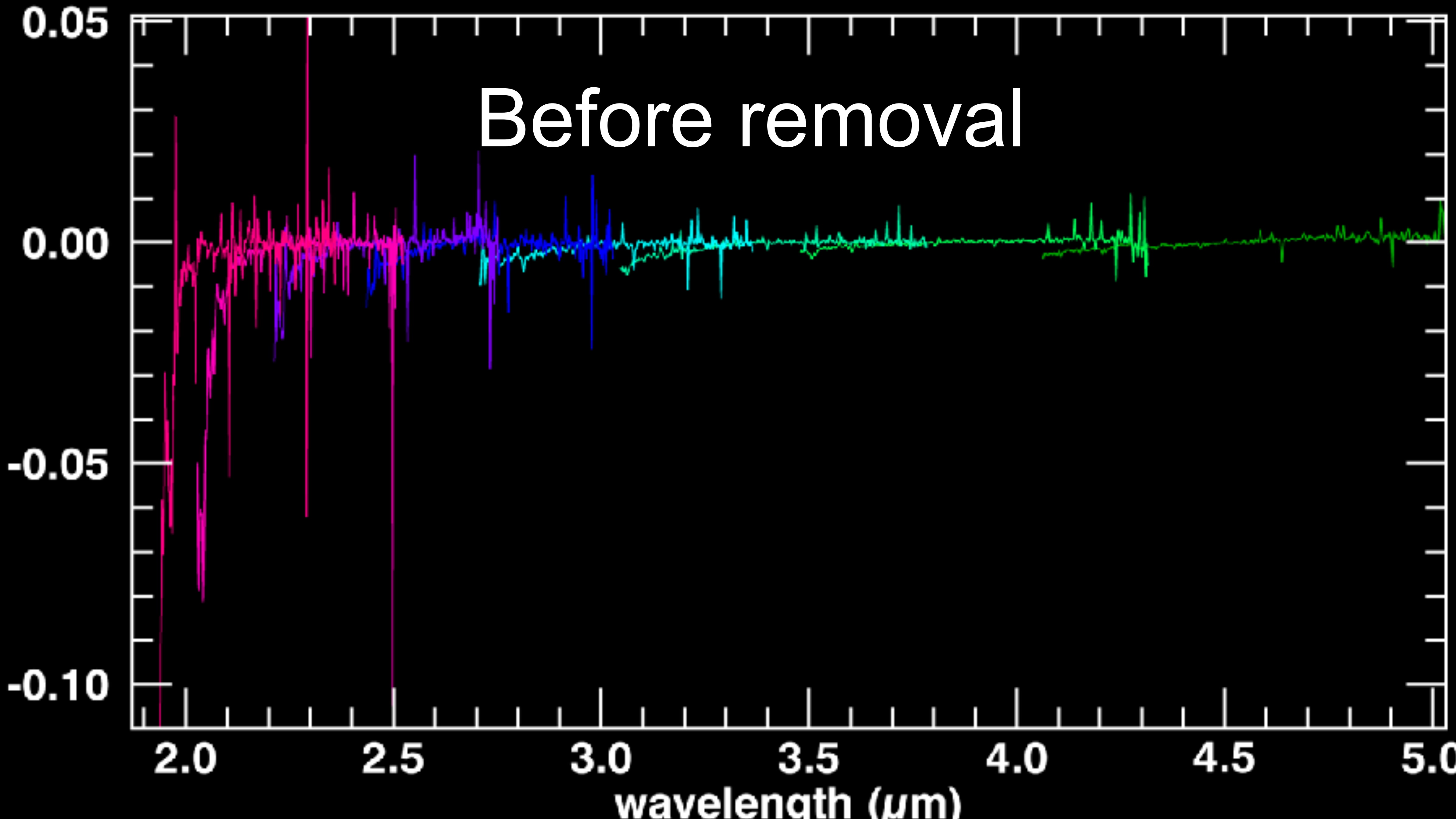
Stray light removal



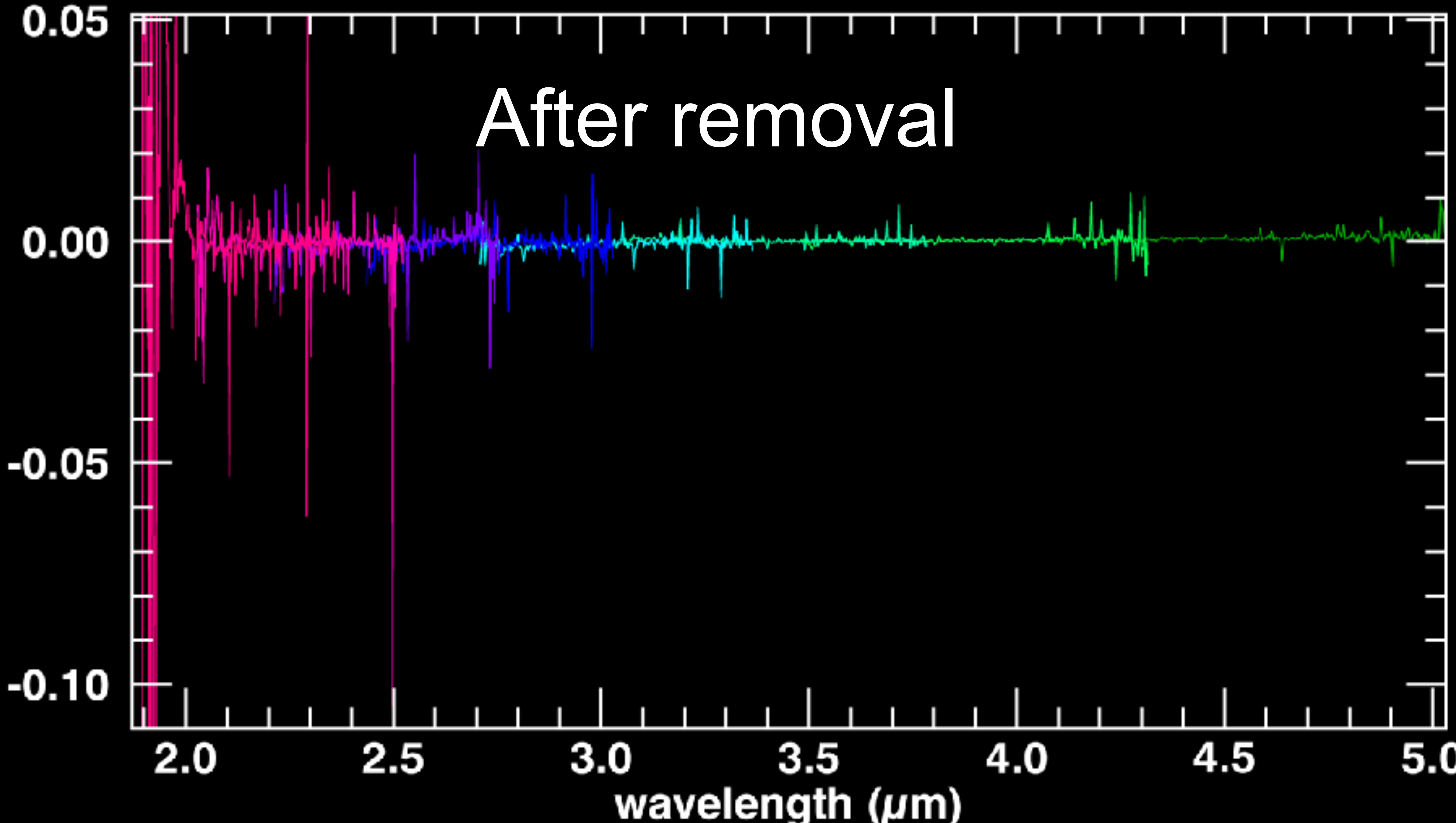
Stray light removal



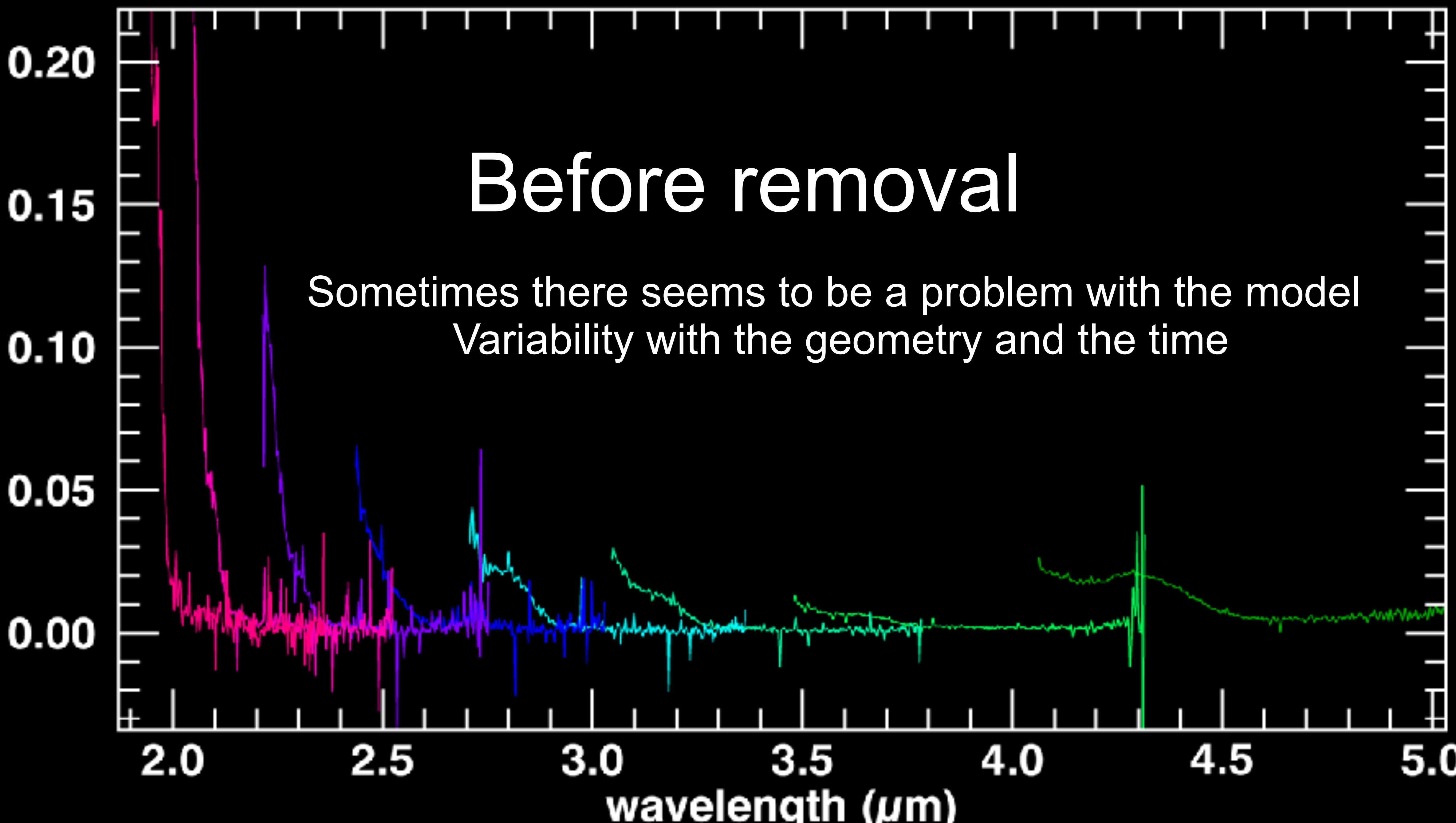
Stray light removal



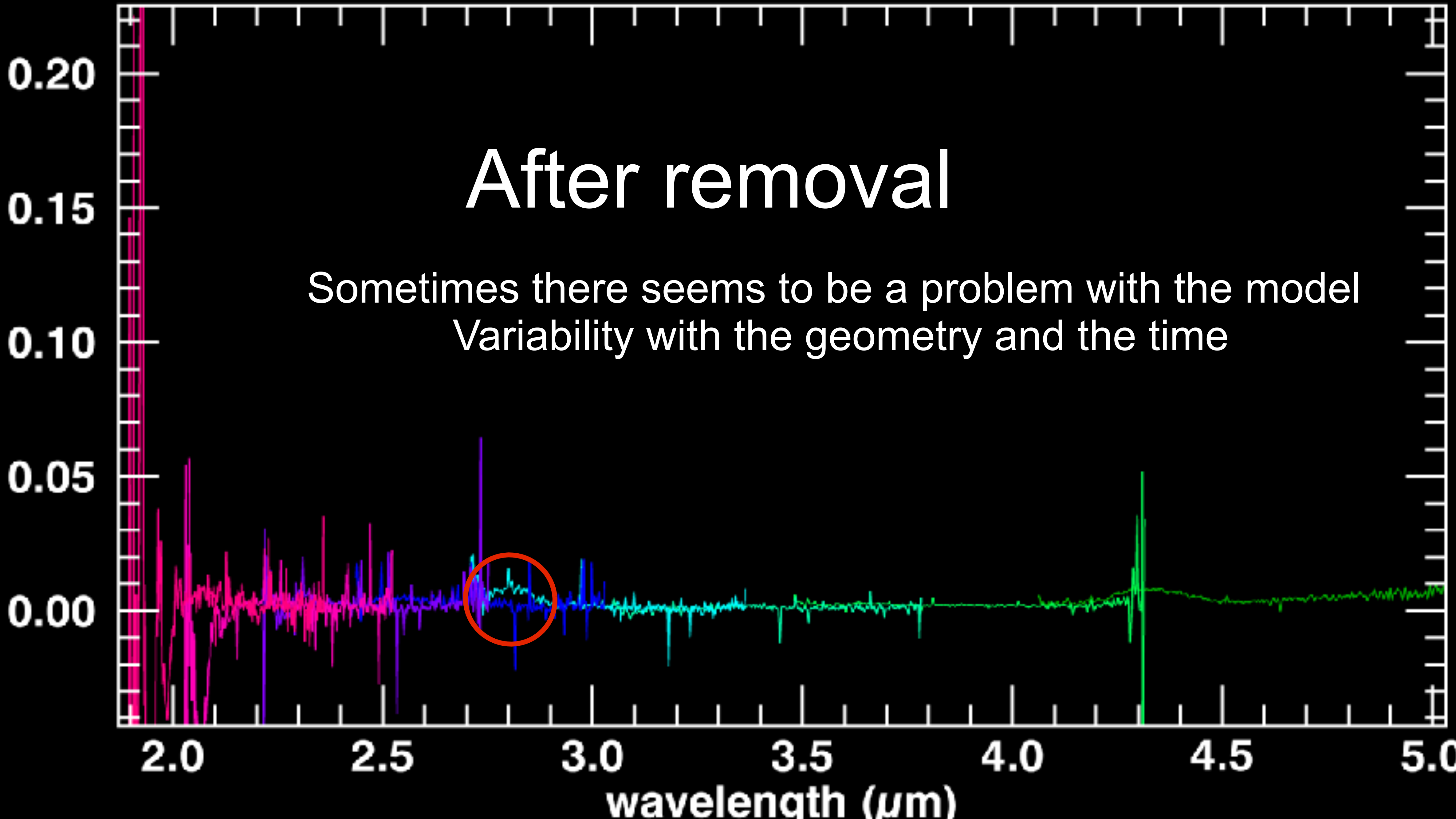
Stray light removal



Stray light removal



Stray light removal



Conclusions:

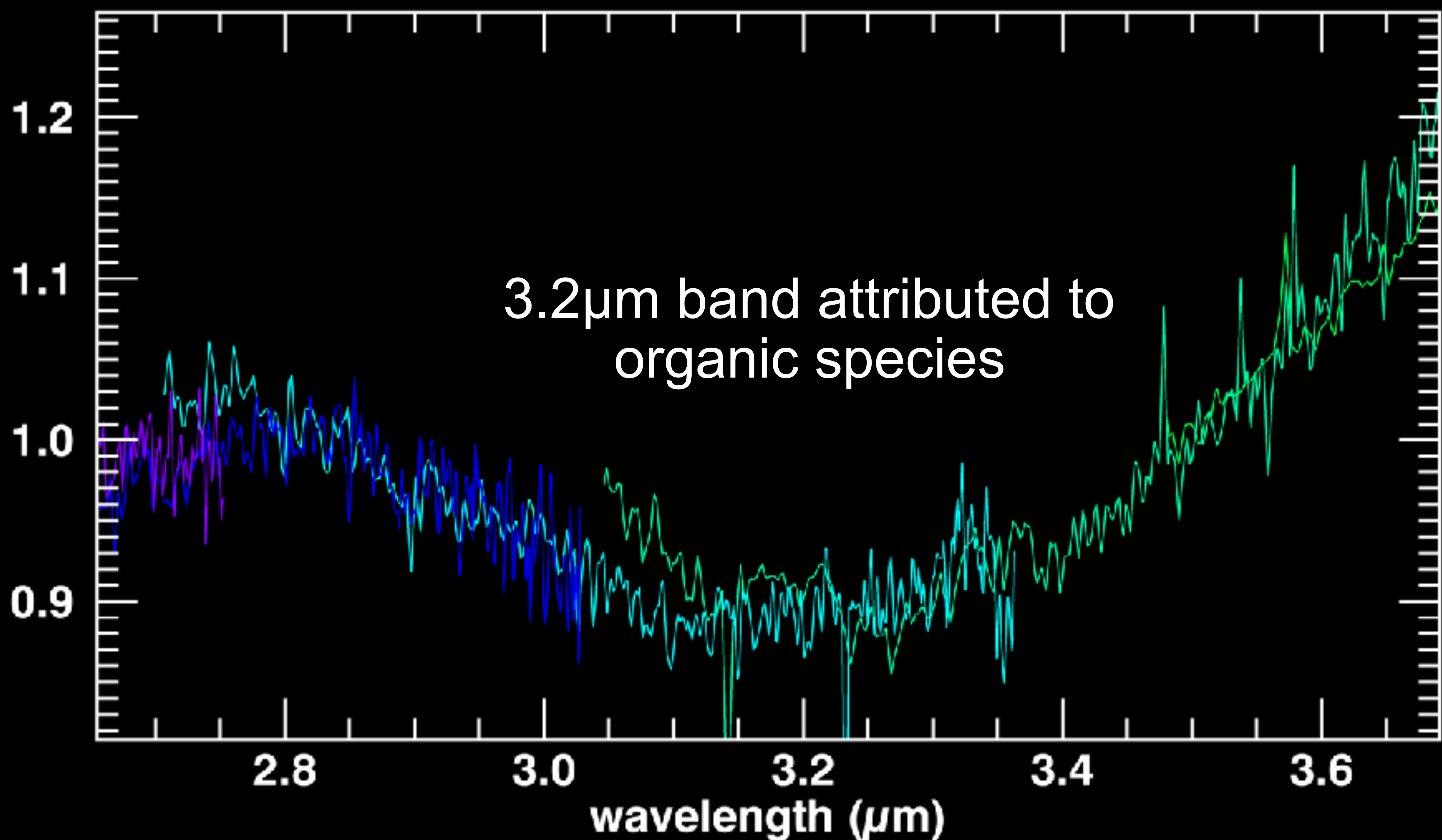
- Stray light can be corrected (first order) in every observation

- 3 codes for correcting stray light are available
    - 1 for a quick correction of a complete VH cube
    - 1 for a best possible correction (tries every stray light model, almost finished)
    - 1 for single spectra correction

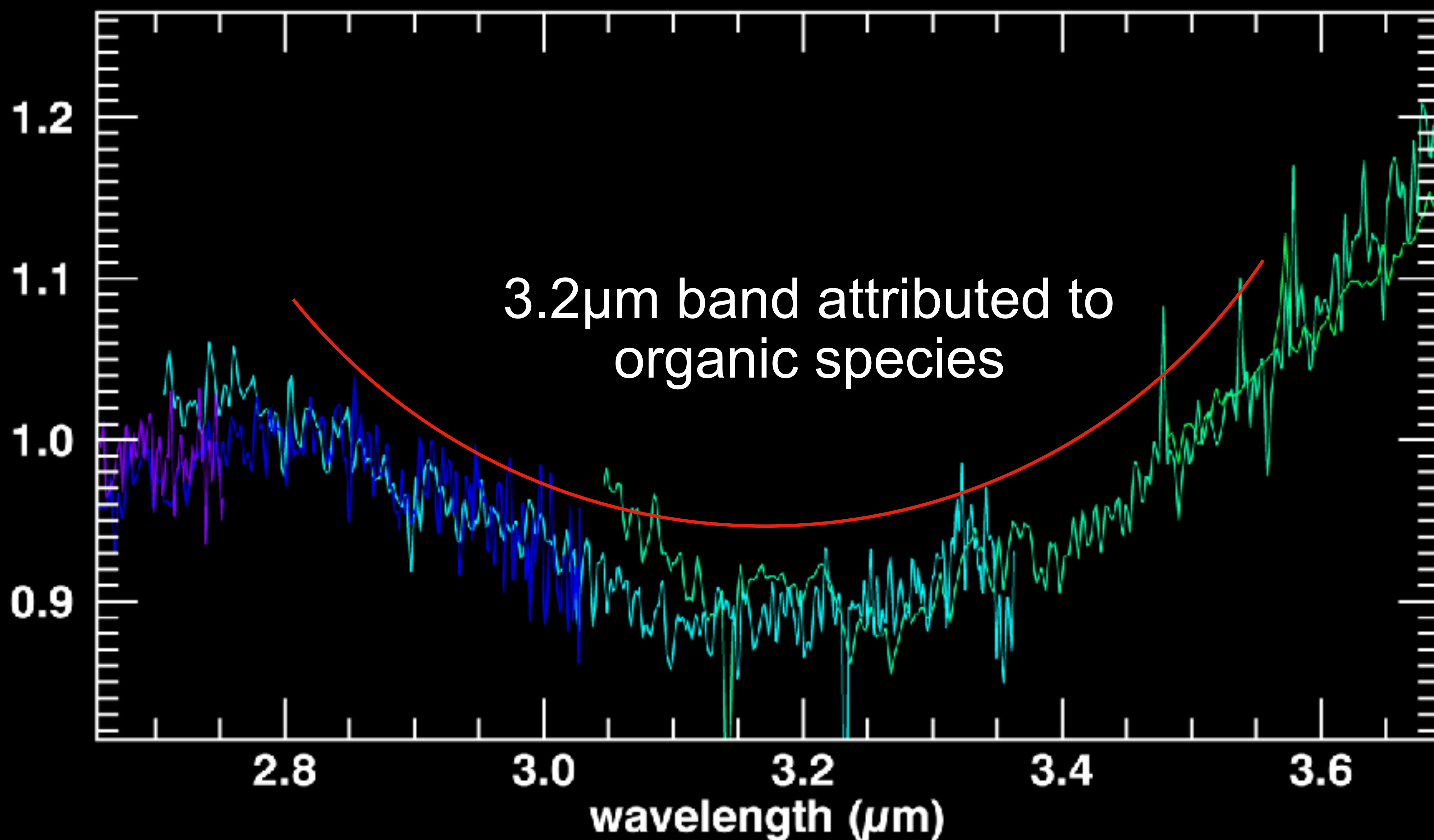
Perspectives:

We can now compare VH and VM on the 3.2μm band

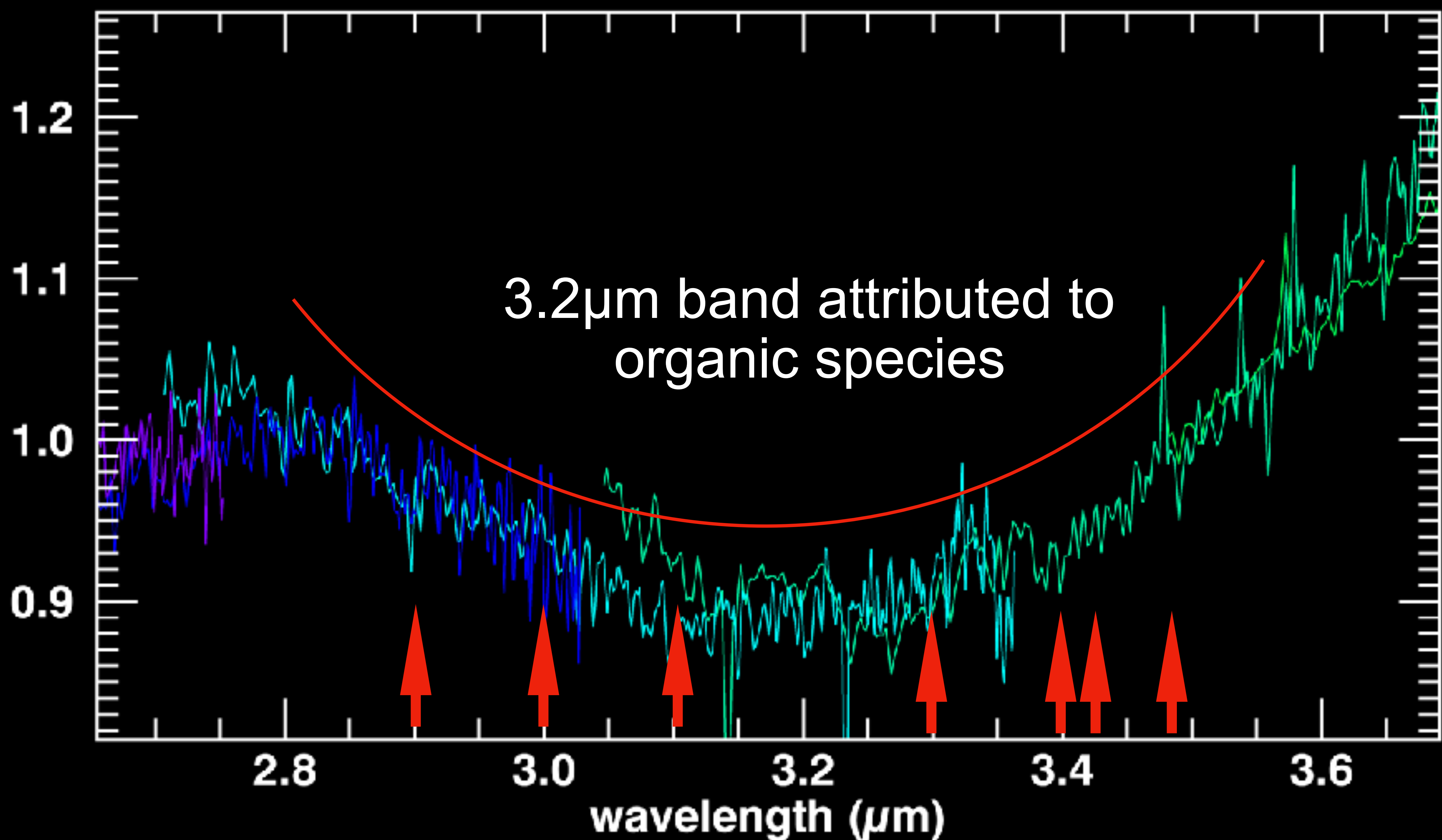
Conclusions:



Conclusions:



Conclusions:



Conclusions: