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# TRAME

TRACING THE ACCRETION-METALLICITY RELATIONSHIP

(WITH NIRSpec@JWST)

Summary and Aims. JWST is going to revolutionize our understanding of star formation processes, especially in distant star forming regions (SFRs). I am involved in the NIRSpec (+NIRCam/MIRI) GTO group (PI: De Marchi, Meixner) focused on observations of three massive starburst clusters located in the outer Galaxy (NGC3603), Large Magellanic Cloud (30 Doradus), and Small Magellanic Cloud (NGC346). Within the TRAME project, final aims are twofold: 1) the study of the nature of the star formation process in distant clusters and how it may differ from nearby regions; 2) the comprehension on how disk evolution and mass accretion phenomena depend on parental environment, such as metallicity, density, and stellar population. This study is unique since existing spectroscopy of Pre-Main Sequence (PMS) stars is mainly limited to the solar vicinity.

Project financed for 20 k€ and within the context of “Schede” JEDI and SF-JWST@INAF

The figure shows the first impressive results we obtained with JWST in July 2022 for NGC346. Thanks to the wonderful capabilities of JWST, it is possible to see the presence of many more building blocks than previously expected in the form of clouds packed with dust and hydrogen. The plumes and arcs of gas contain energized H and dense molecular H.

Image science credits: NASA, ESA, CSA, Jones, De Marchi, Meixner

Image processing credits: Pagan, Habel, Lenkic, Chu

F200W F277W F335M F444W filters



# Tasks and Deliverables

## *I year:*

**Task-1)** Preparatory work for the first observations with NIRSpec (+NIRCam/MIRI) of NGC346 (Deliverable 1); Co-responsibility to select targets identified in the first visit to be observed during second epoch with NIRSpec (Deliverable 2);

**Task-2)** Help for the characterization of the targets observed during the first visit in NGC346 (Deliverable 3); Contribution for the papers on NIRCam detection of PMS stars in NGC 346 (Jones et al. 2023, Nature Astronomy) and the paper on NIRSpec observations of young Sun-like stars in the same very low metallicity cluster (De Marchi et al., Nature Astronomy, submitted); Help for defining the first epoch NIRSpec observations of NGC3603 and 30 Doradus (Deliverable 4)

## *II year (ongoing work):*

**Task-3)** Characterization of stellar and accretion properties of the targets in 30 Dor and NGC3603 (Deliverable 5); Selection of targets for the second NIRSpec visit of NGC346 (Deliverable 6)

**Task-4)** Major contribution for the papers on the accretion properties of 30 Doradus (De Marchi et al., in prep) and NGC3603 (Rogers et al., in prep)

## Budget Description

6.4 k€ (*I year*) used for

- ☆ 1-month visit at ESA/ESTEC
- ☆ 1-month visit at ESA/ESTEC (The Netherlands)
- ☆ Invited Talk at the TOE III Workshop in Porto

13.6 k€ (*II year*) will be used for

- ☆ one-month visit at ESA/ESTEC
- ☆ participation at the EAS@Padua
- ☆ submission of a paper (Biazzo et al., in prep) in ApJ
- ☆ hardware

## Other Related Activities

- MODS@LBT observations of a cluster of the outer Galaxy, useful as bridge between nearby and distant LMC/SMC regions (PI: Biazzo)
- Within the GTO with MOONS, for which I am involved as ST and co-I, some galactic distant embedded clusters will be observed
- Submitted as chair a Special Session on “Star formation in the condition of Cosmic Noon” for the EAS in Padua
- Guest Editor for the “Star and Planet Formation” Issue of the Universe Journal



# Milestones

1 year

nature astronomy

Article <https://doi.org/10.1038/s41550-023-01945-7>

## JWST/NIRCam detections of dusty subsolar-mass young stellar objects in the Small Magellanic Cloud

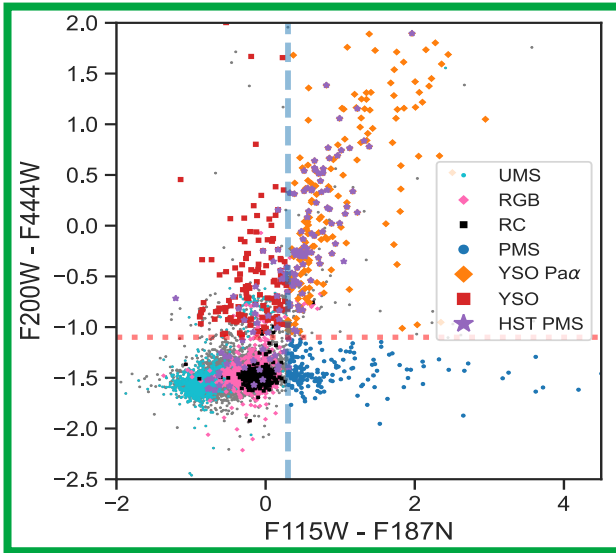
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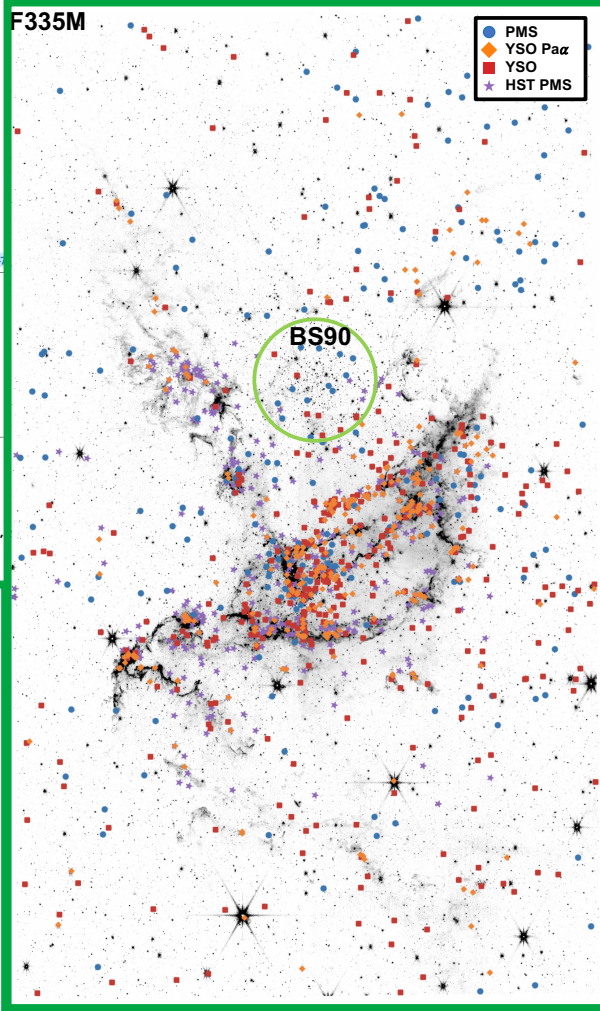
Check for updates

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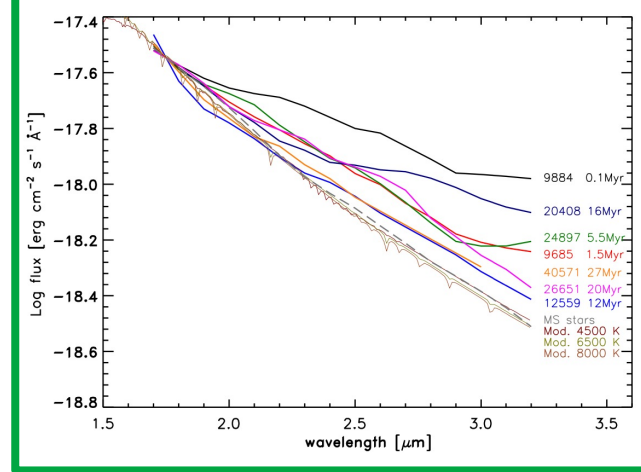
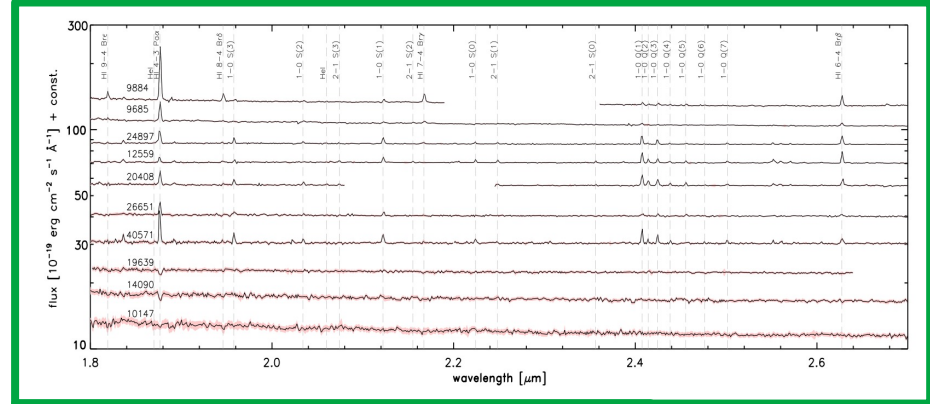


Main results:

- ☆ JWST ten magnitudes more sensitive than Spitzer for young embedded objects
- ☆ Dust is present even at  $Z$  as low as  $0.2Z_{\odot}$



G. De Marchi, G. Giardino, **K. Biazzo**, N. Panagia, E. Sabbi, et al., Nature Astronomy, submitted



Main results for this very low- $Z$  SFR:

- ☆ PMS stars can accrete at sustained rates for over 20 Myr
- ☆ Disks lifetime are longer than in nearby SFRs

## 11 year (ongoing papers)

- De Marchi et al., on NIRSPEC observations of PMS stars in a LMC cluster
- **Biazzo** et al., on LBT observations of PMS stars in a cluster of the outer Galaxy
- Habel et al., on NIRCam deep observations of PMS stars in a SMC cluster
- Rogers et al., on NIRSPEC observations of PMS stars in a LMC cluster

Since this is a long-term project involving large amount of data, more financial support is needed (mainly in terms of man power) in the near future