HCN detection in the C/2026 A1 (MAPS) Kreutz sungrazing comet shortly before disruption

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Image processing: Melina Thévenot
Image credit: NASA/ESA/CSA JWST MIRI; Qicheng Zhang et al. 2026

- *How the **chemistry** affects the **formation** of **astrophysical objects?***
- *How the **chemistry** is **inherited** from previous stages?*

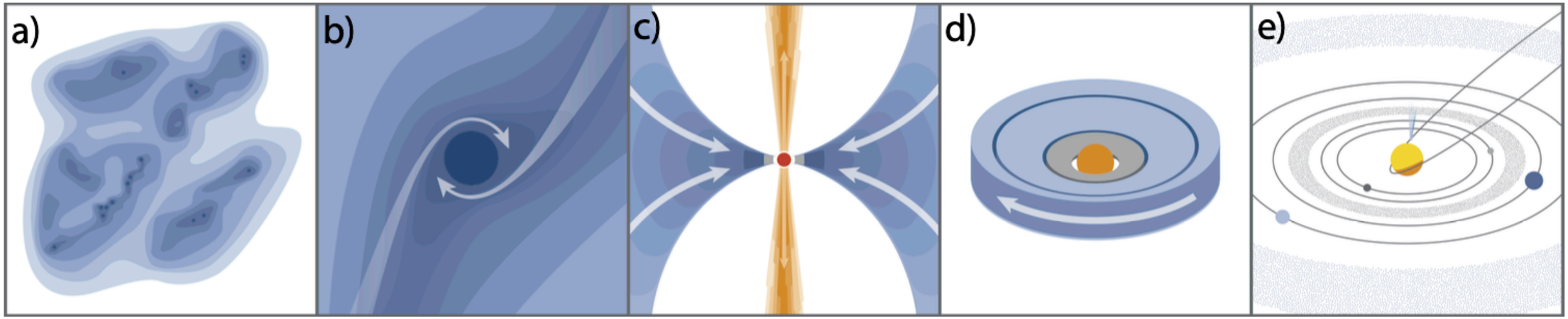

Figure 1: Different stages characterising low-mass (Solar-like) star and planet formation.[1]

[1]Öberg, K. I. & Bergin, E. A., Physics Reports 893 (2021), pp. 1–48

Formation of comets:

Age: ~4.2 billion years

- **Leftovers** of **planet** formation
- Ejected from **Early Solar System**

→ Probe of **Early Solar System chemistry**

Figure 2: Lovejoy comet. Credits: Fabrice Noel

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Conditions:

- Temperature T **~ 10-150 K**
- Density n_{gas} **~ 10-10^{12} cm^{-3}**
- Main Constituents: **H_2O, CO, CO_2**
  ~ 50 molecules detected

Figure 2: Lovejoy comet. Credits: Fabrice Noel

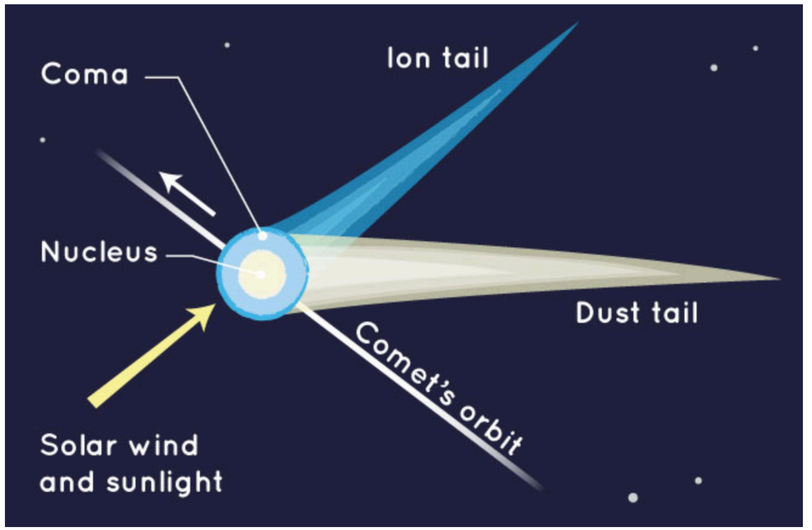

Figure 3: Structure of a comet. Credits: NASA/JPL - Caltech

Kreutz sungrazing comet

- Perihelion distance r_h **< 0.01 au**
- **Fragment** of a parent comet
  - From **thermal stress** at small rh[1]
  - From **collisions** with meteoric stream[2]

[1]Zhang et al., Research Notes of the AAS, 10, 57
[2]Jones et al. Space Sci Rev 214, 20 (2018)

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Credits: G. Rhemann, M. Jäger

C/2026 A1 (MAPS) Kreutz sungrazing comet

- Discovered in **January, 13th 2026** at r_h = 2.1 au[3]
- Observed with **JWST** on **February 6-7th 2026** at r_h = 1.6 au[4]
  - Nucleus size [400 ; 600] m
- Observed **IRAM-30m** on **April 1st-3rd 2026** r_h = 0.2 - 0.1 au[5]
  (DDT E03-25, PI: Godard Palluet)

[1]Zhang et al., Research Notes of the AAS, 10, 57
[2]Jones et al. Space Sci Rev 214, 20 (2018)
[3]Maury, A. 2026, CBET 5658
[4]Zhang et al., Research Notes of the AAS, 10, 57
[5]Godard Palluet et al. (in prep)

HCN detection

- April 1st

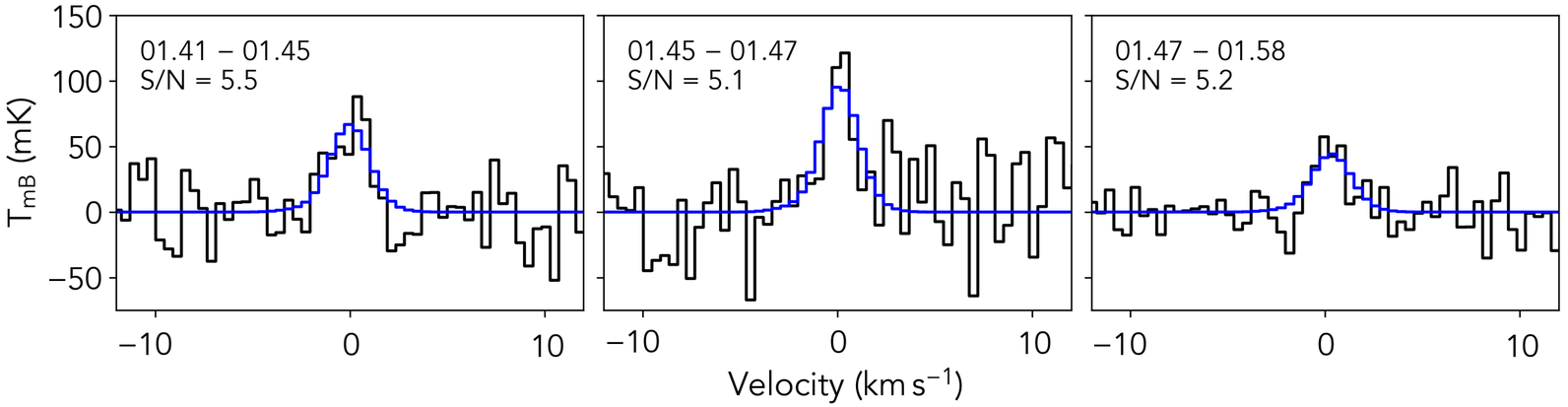
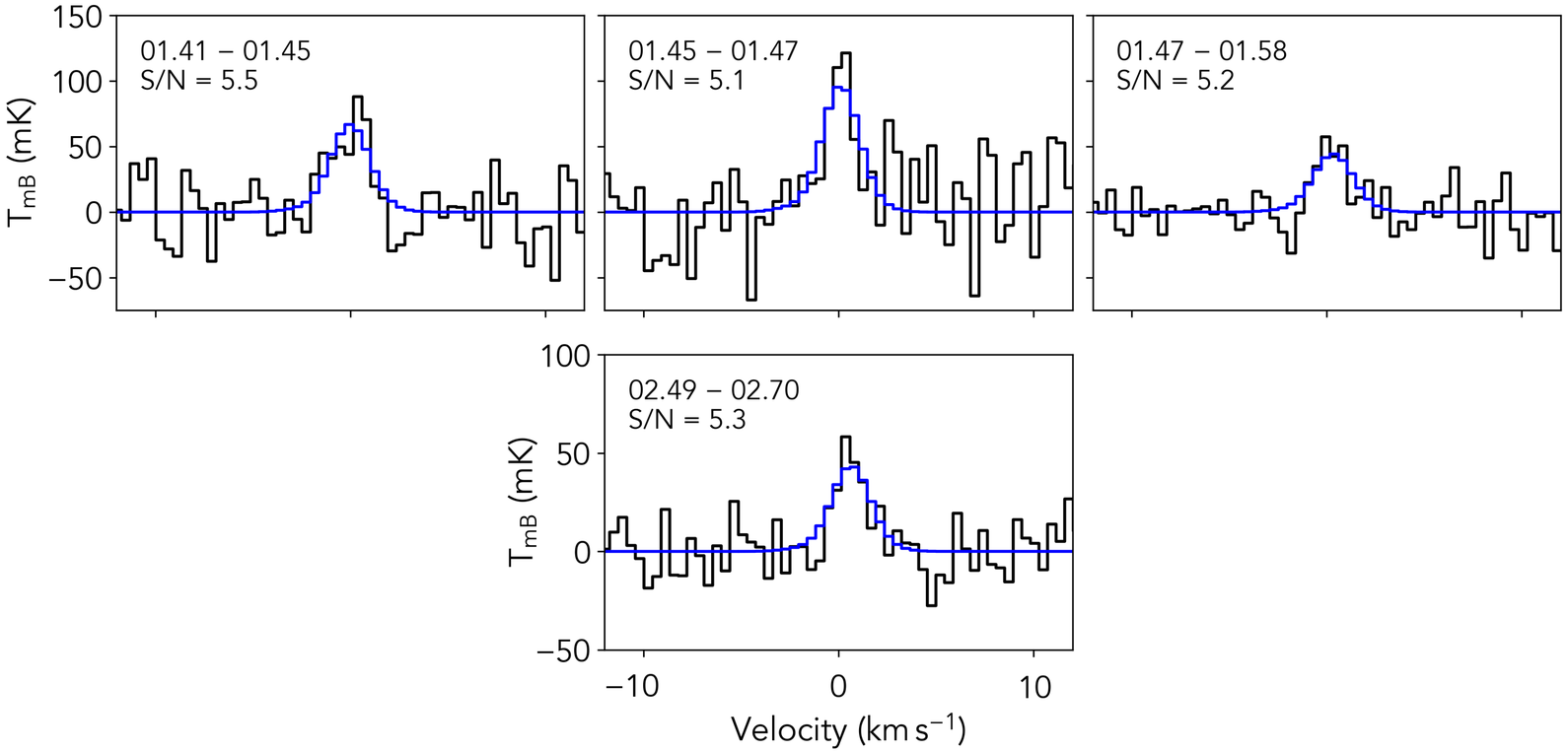


Figure 4: Variability of the HCN production rates as a function of heliocentric distance.

HCN detection

- April 1st
- April 2nd



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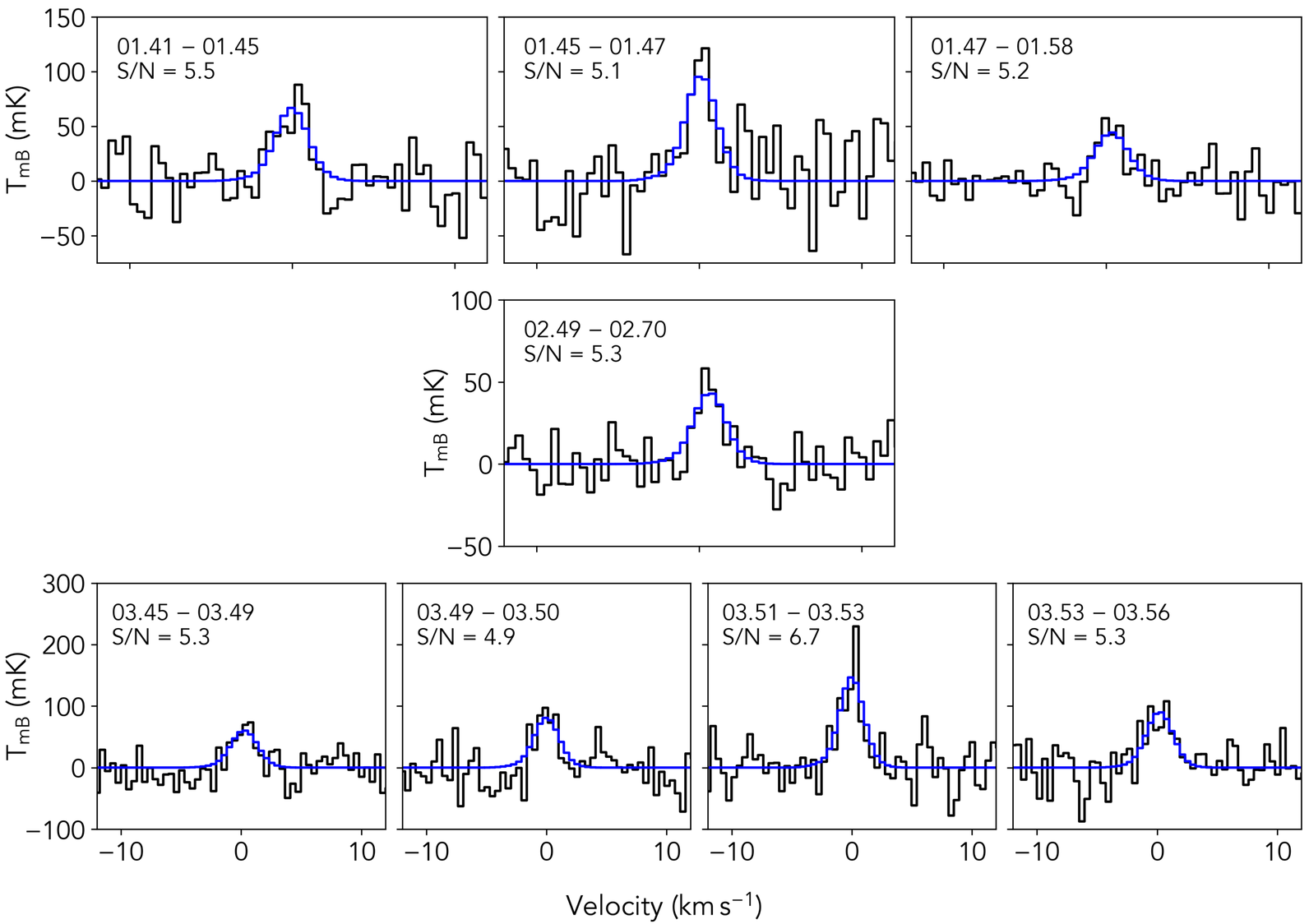
HCN detection

- April 1st
- April 2nd
- April 3rd



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Variability of the HCN production rates

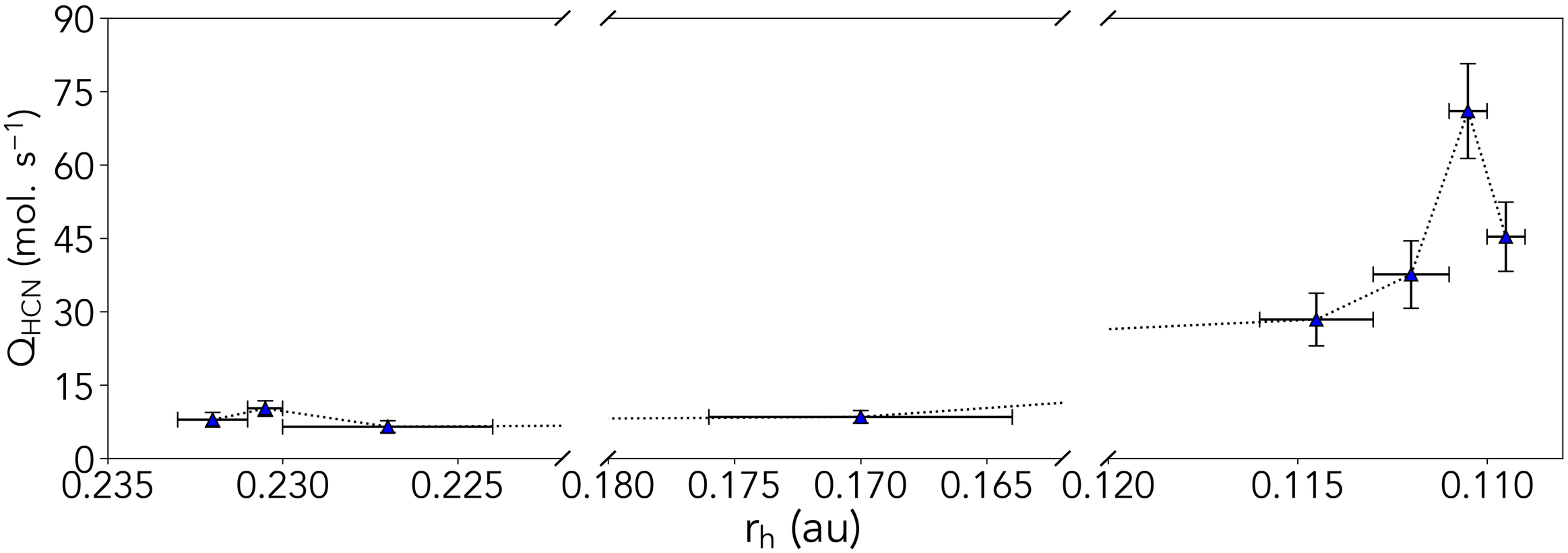

Figure 5: Variability of the HCN production rates as a function of heliocentric distance.

HNC tentative detection and other species

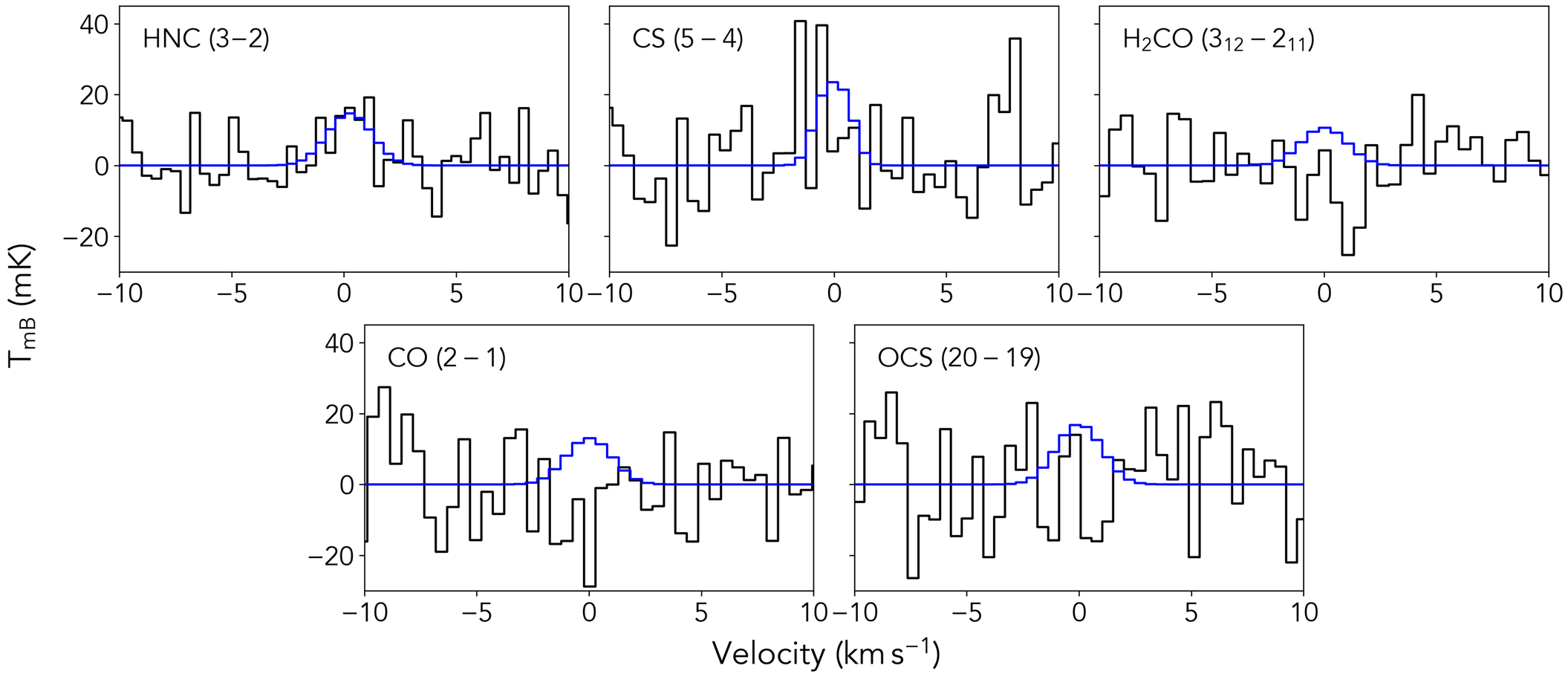

Figure 5: Tentative detection of HNC and non-detection of CS, H_2CO, CO and OCS.

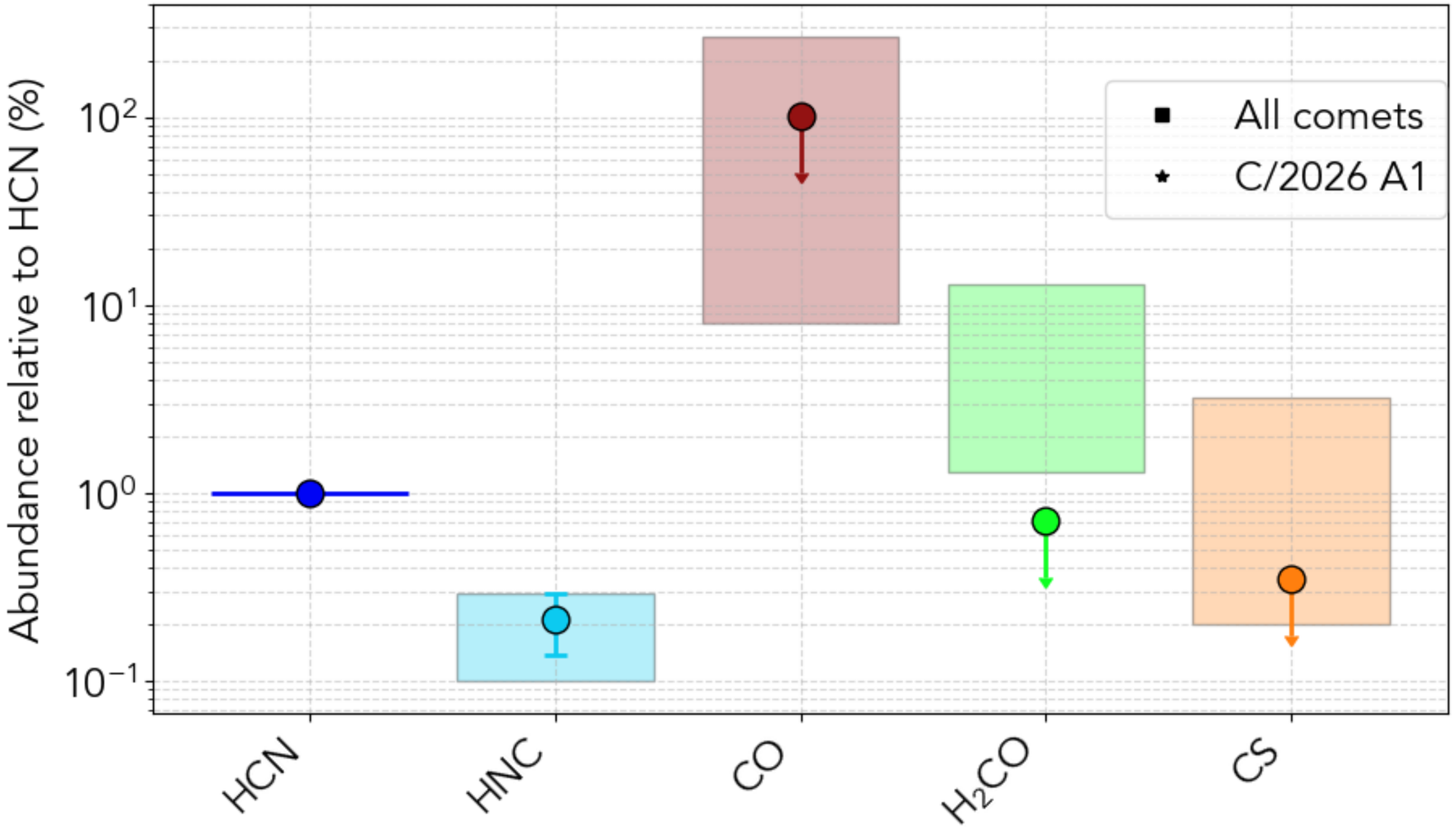

Figure 6: Abundance relative to HCN in C/2026 A1.[1]

[1]Adapted from Biver at al., A&A 708, L16 (2026)

C/2026 A1 (MAPS) - (Preliminary) Results

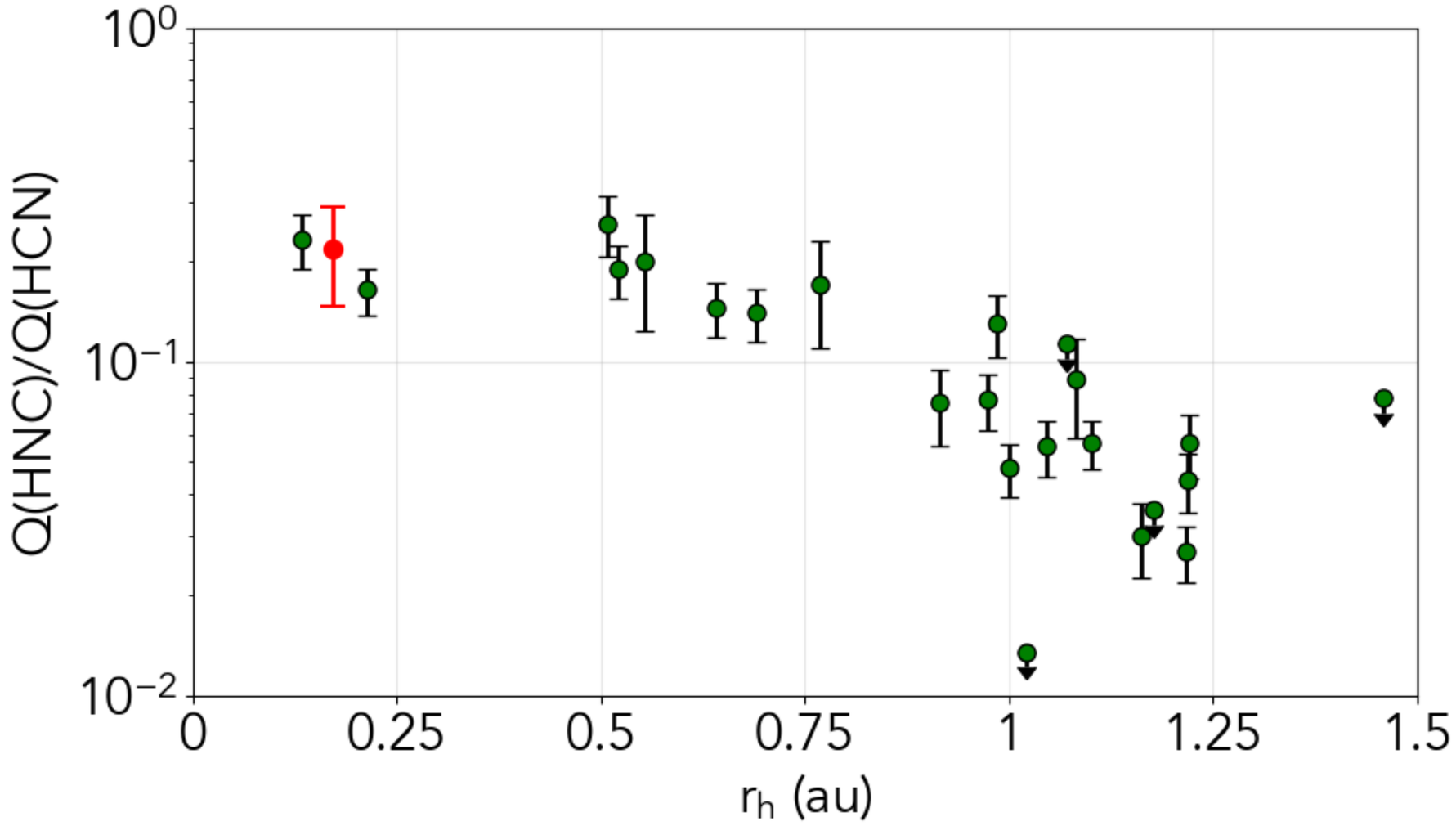

Figure 7: Ratio of HNC and HCN production rates.[1]

[1]Adapted from Lis et al., ApJ 675, 931 (2008)

Conclusions

- **IRAM-30m** observations of **C/2026 A1 (MAPS)**
- Detection of **HCN** and tentative detection of **HNC**
- **High variability** of the **HCN emission**
- Shorty before **full disintegration** of the comet …


Credits: G. Rhemann, M. Jäger

Perspectives

- Check sensitivity to **assumed physical conditions**
  - Temperature **T**
  - Water production rates **Q(H_2O)**
- Finish analysis of **chemical composition**

CAB team:

Víctor Rivilla (co-PI), Izaskun Jiménez-Serra (co-PI), Carmen Blanco, Darío Cobo Gómez, Laura Colzi, David Haasler-García, Gabriel Jaimes-Illanes, Álvaro López-Gallifa, Rosell Martín, Antonio Martínez-Henares, Andres Megías, Lara Moral, Alberto Pérez, Pilar Renodo, Marta Rey-Montejo, David San Andrés, Miguel Sanz-Novo

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Thank you for your attention

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Brisa Manciallas, Gloria Liñán Rodríguez