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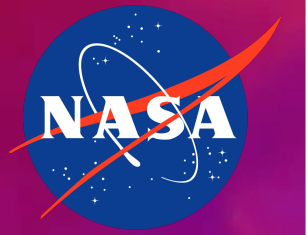

Protostellar Feedback in Massive Star-Forming Regions

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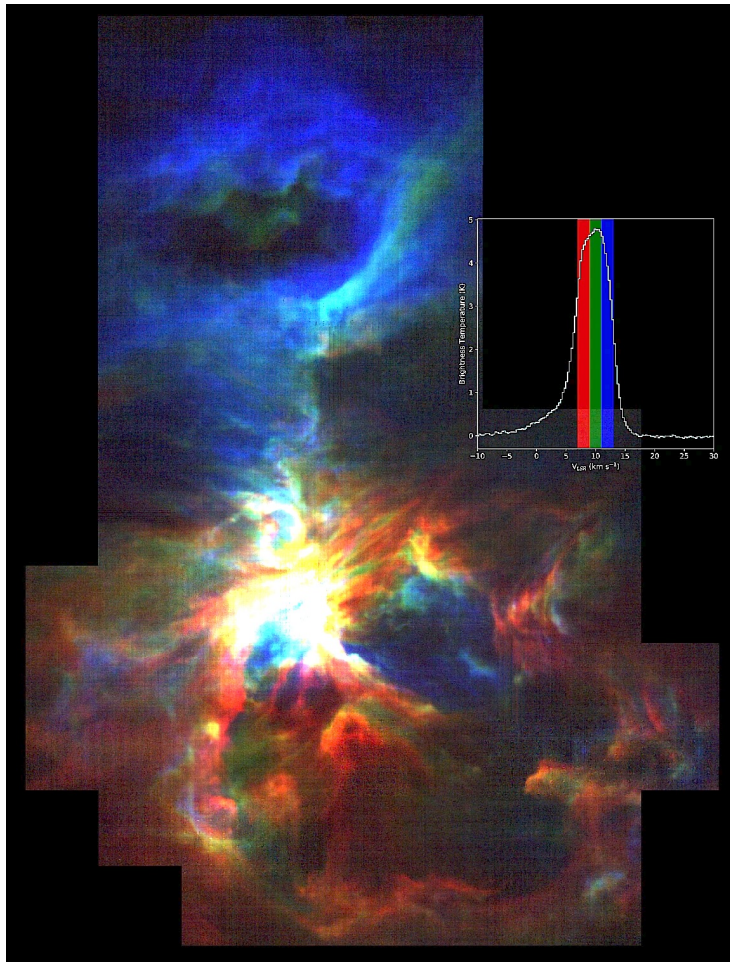
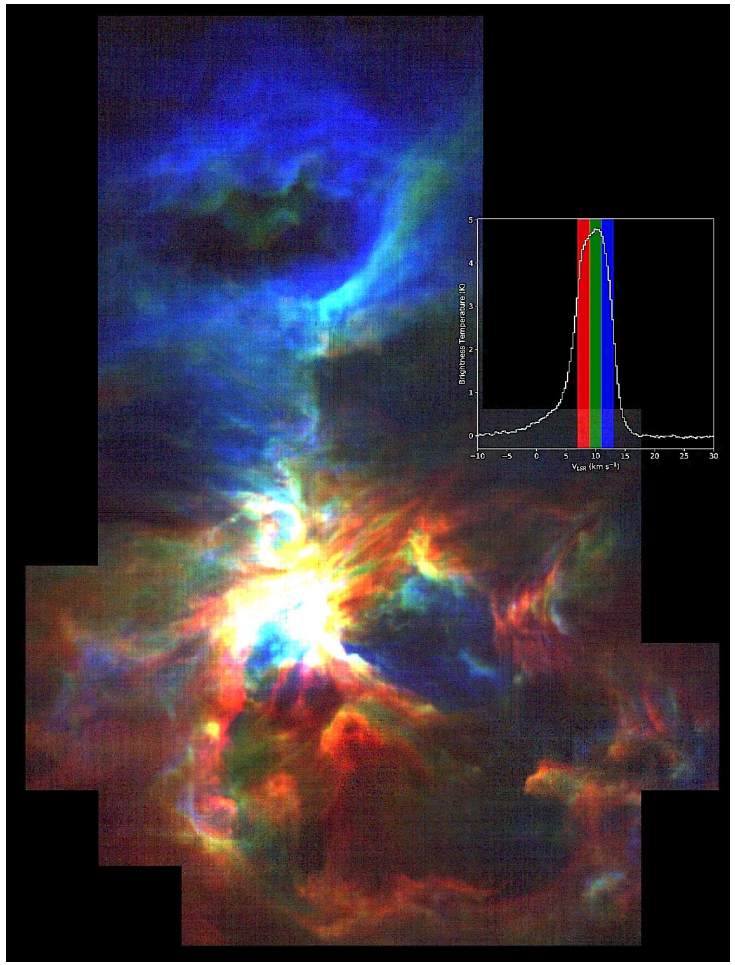
Highlights



Ionized carbon map of the Orion Nebula

- We discover that **fossil outflows** from massive stars **breaks** the bubble shell in the Orion Nebula using **SOFIA ionized carbon observations.** These types of activities **limit the future star formation.**
- The expanding bubble shell in the Orion Nebula were **broken** and **riddled by outflows.**
- Our findings give the **first direct evidence of outflow activity** in the Orion Nebula.

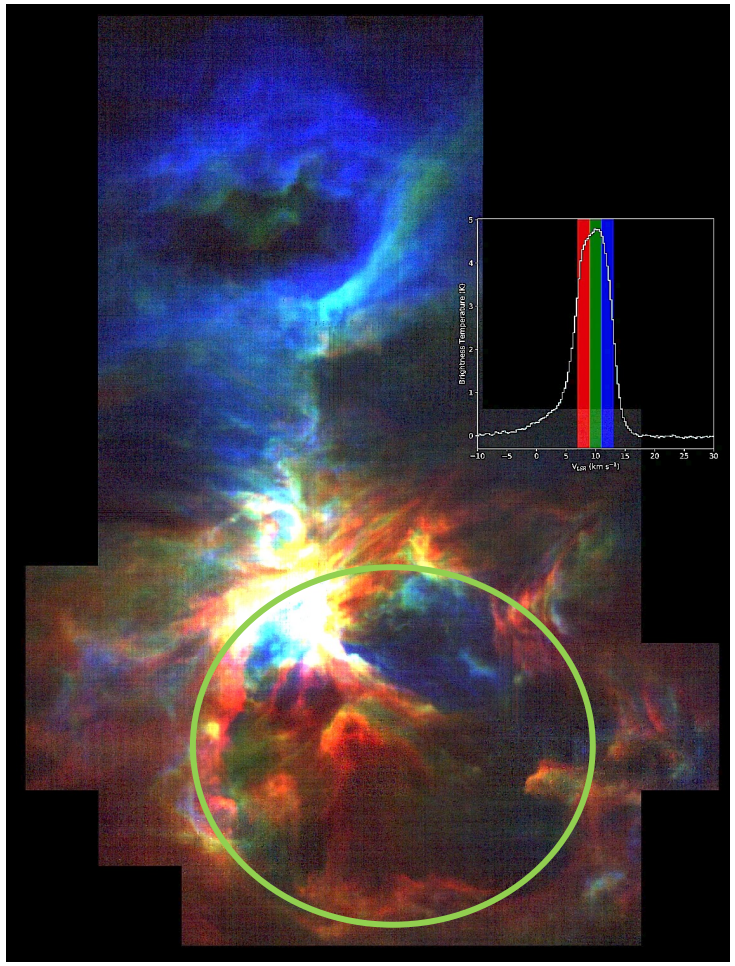
Why ionized carbon?



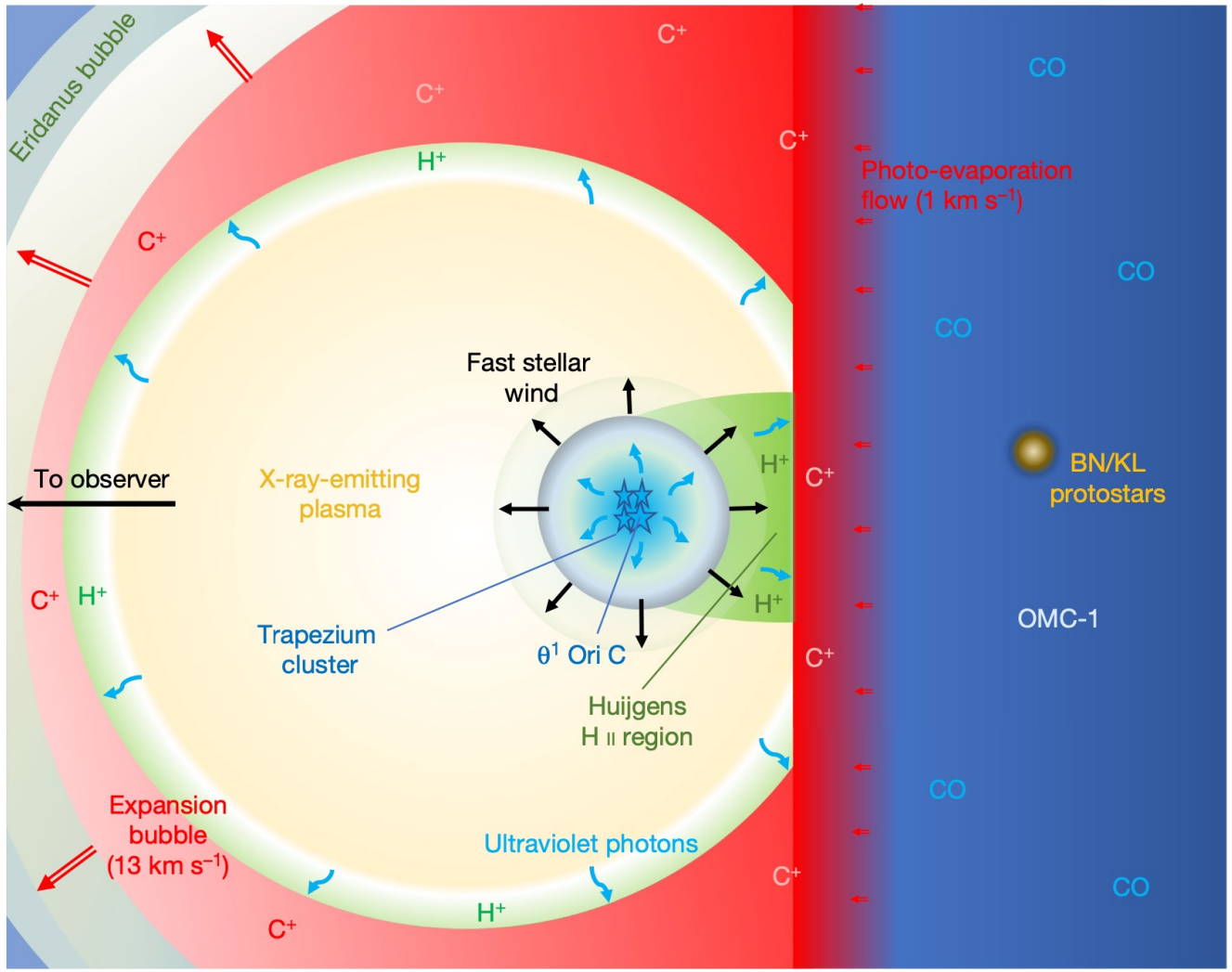
Pabst et al. 2019; Nature

- It is the most dominant cooling line (T~50–300 Kelvin (**-370 to +80 F**).
- We gathered **2 million ionized carbon's spectra** thanks to SOFIA Observatory.
- SOFIA ionized carbon observations provide information on kinematics, i.e., **how fast structures move and in which direction.**

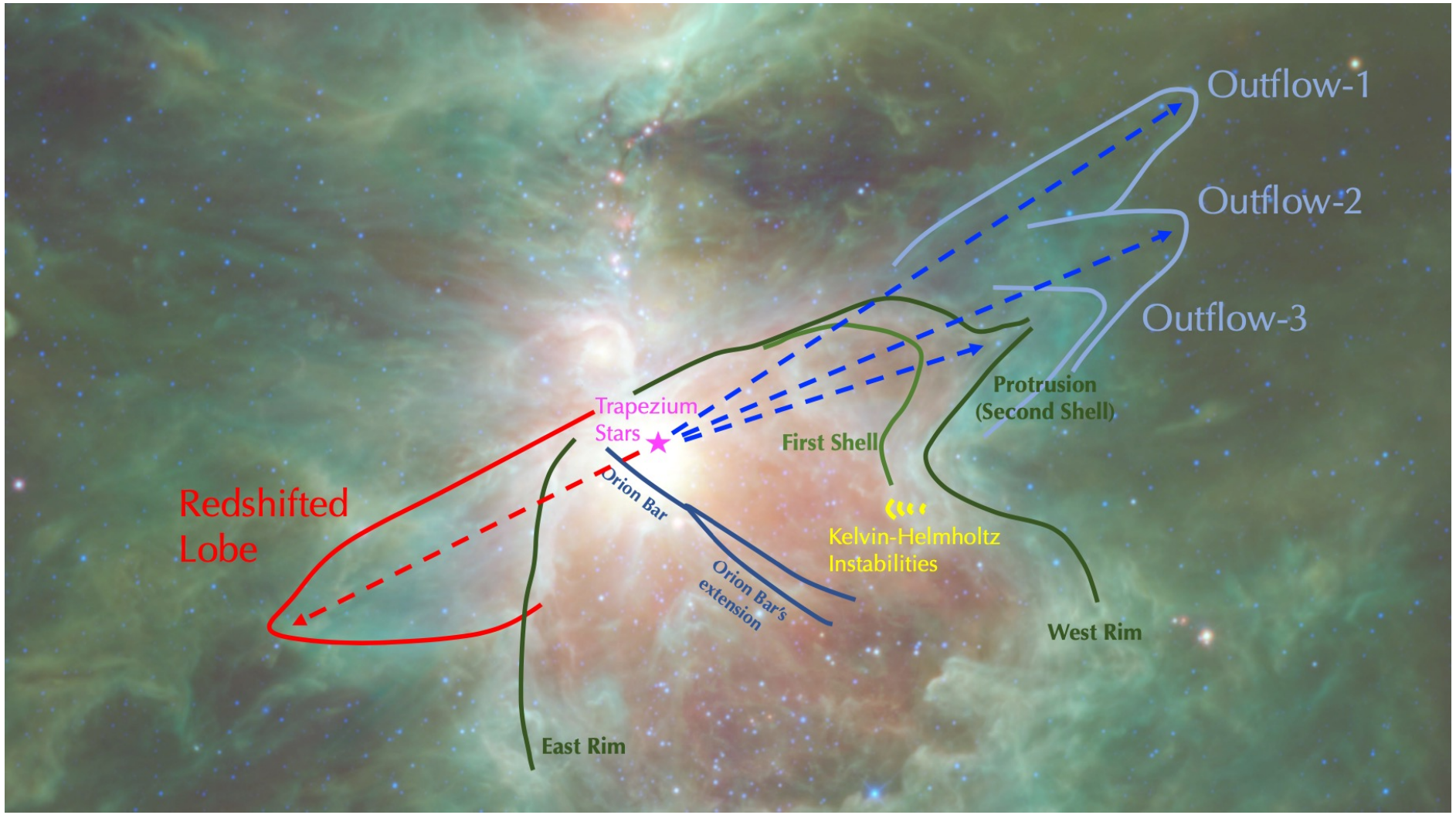
Major findings from SOFIA



Pabst et al. 2019; Nature

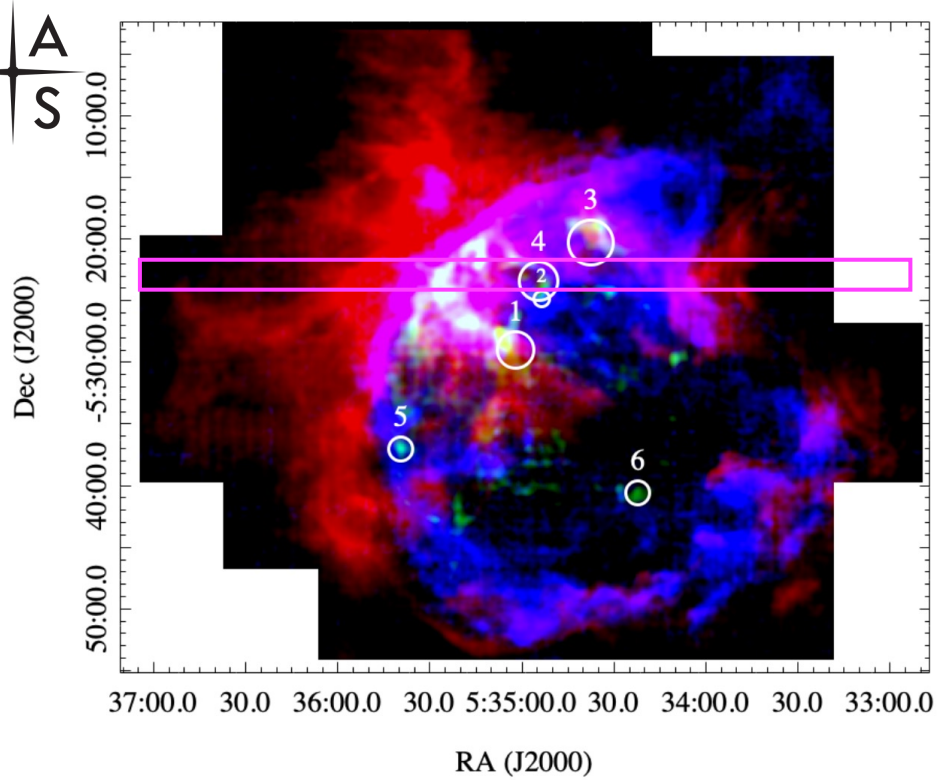


Major findings from SOFIA

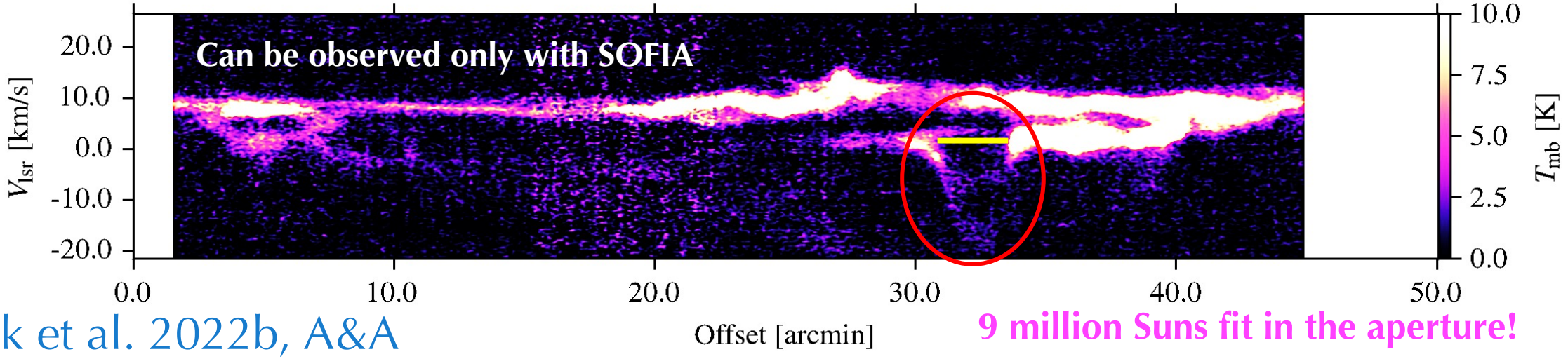


Kavak et al. 2022a, A&A

Very fast outflows in Orion



- Studied six outflows interacting the bubble shell in the Orion Nebula **for the first time.**
- These outflows are moving towards us at **~60,000 mph.**
- Outflows made the bubble shell something more like a sieve, with tens of **thousands of tiny holes** from which gas **(~17,000 F)** can escape.



Kavak et al. 2022b, A&A

9 million Suns fit in the aperture!

Summary

- Outflows brake the Orion Nebula and create punches.
- The first evidence of this in Orion is from SOFIA Observatory
- Protostellar feedback through outflows limits future star-formation and sets an important phase in the evolution of the Galactic interstellar medium.

Thank You, let's get in touch!

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