On the Generation and Detectability of Organic Chemistry in Hypervelocity Impact Ice Spectra

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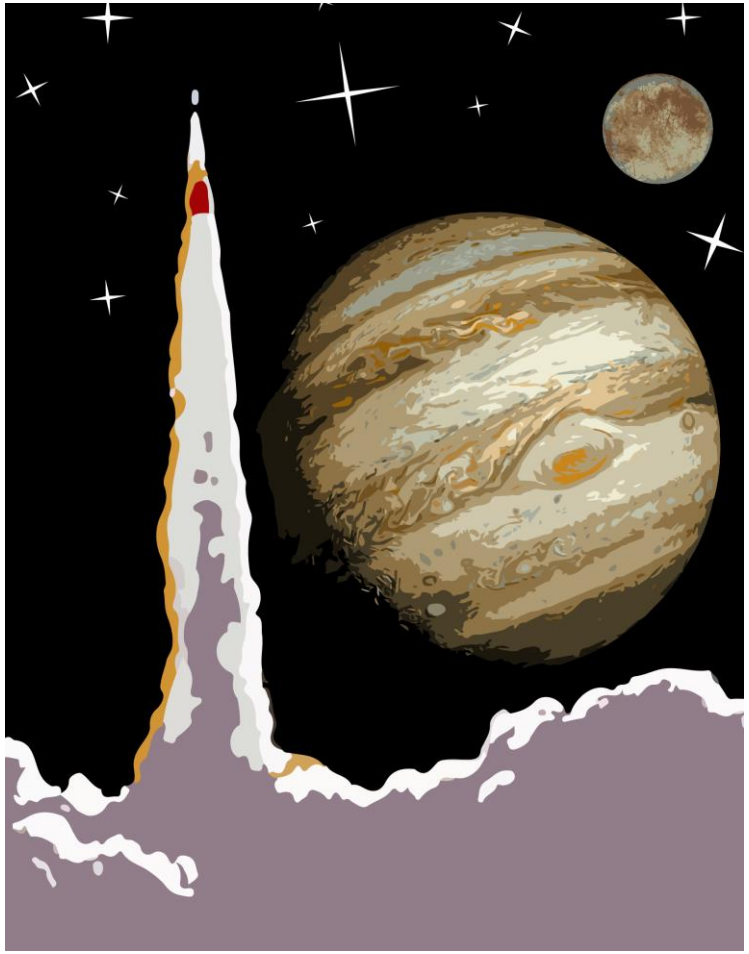
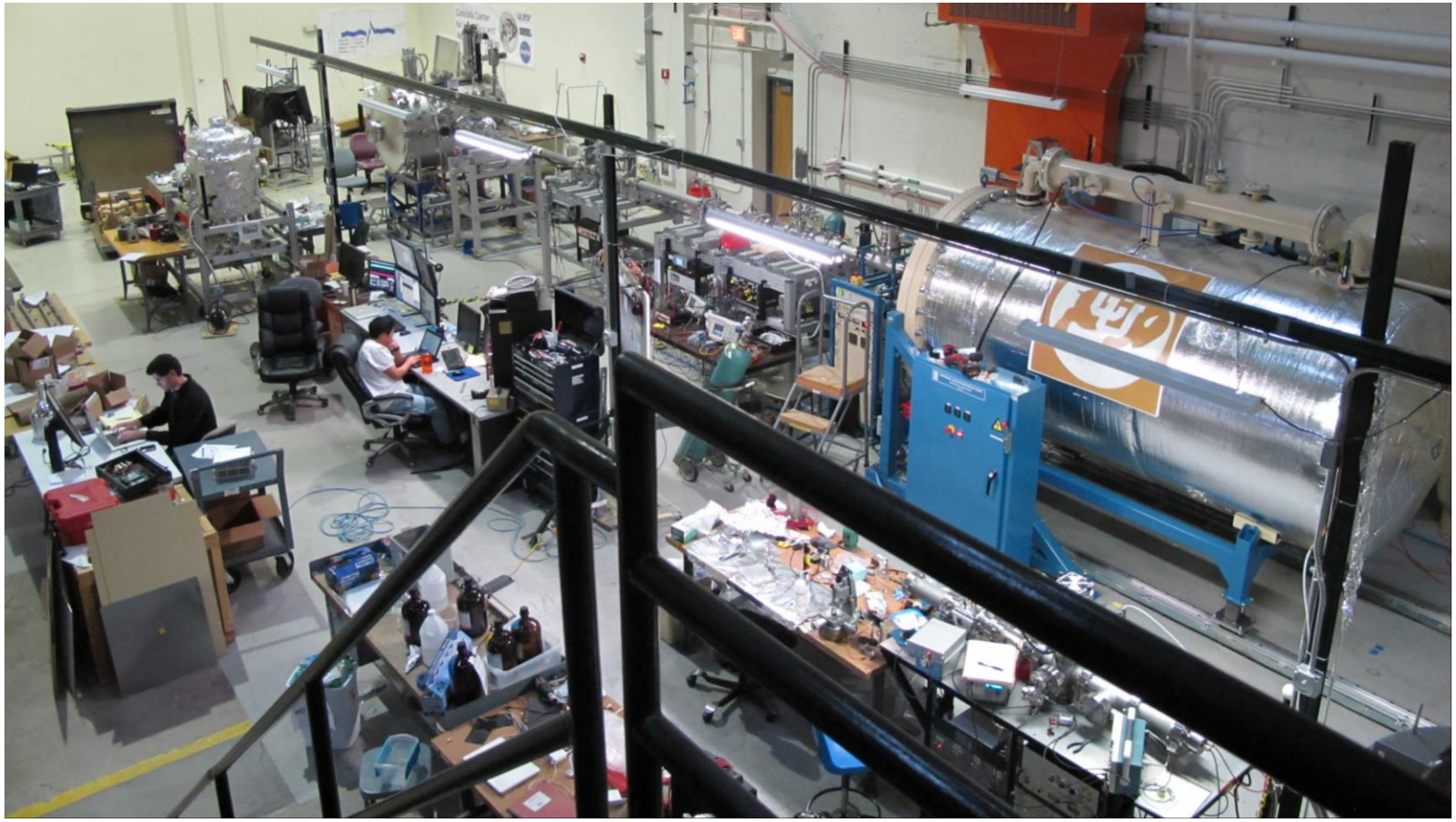
ICE AND DUST

- Ice and dust are prevalent in the solar system
- Impact ionization time of flight instruments on fly-by spacecraft need laboratory support
- Dust impacts into ice may be an overlooked production mechanism for organic chemistry

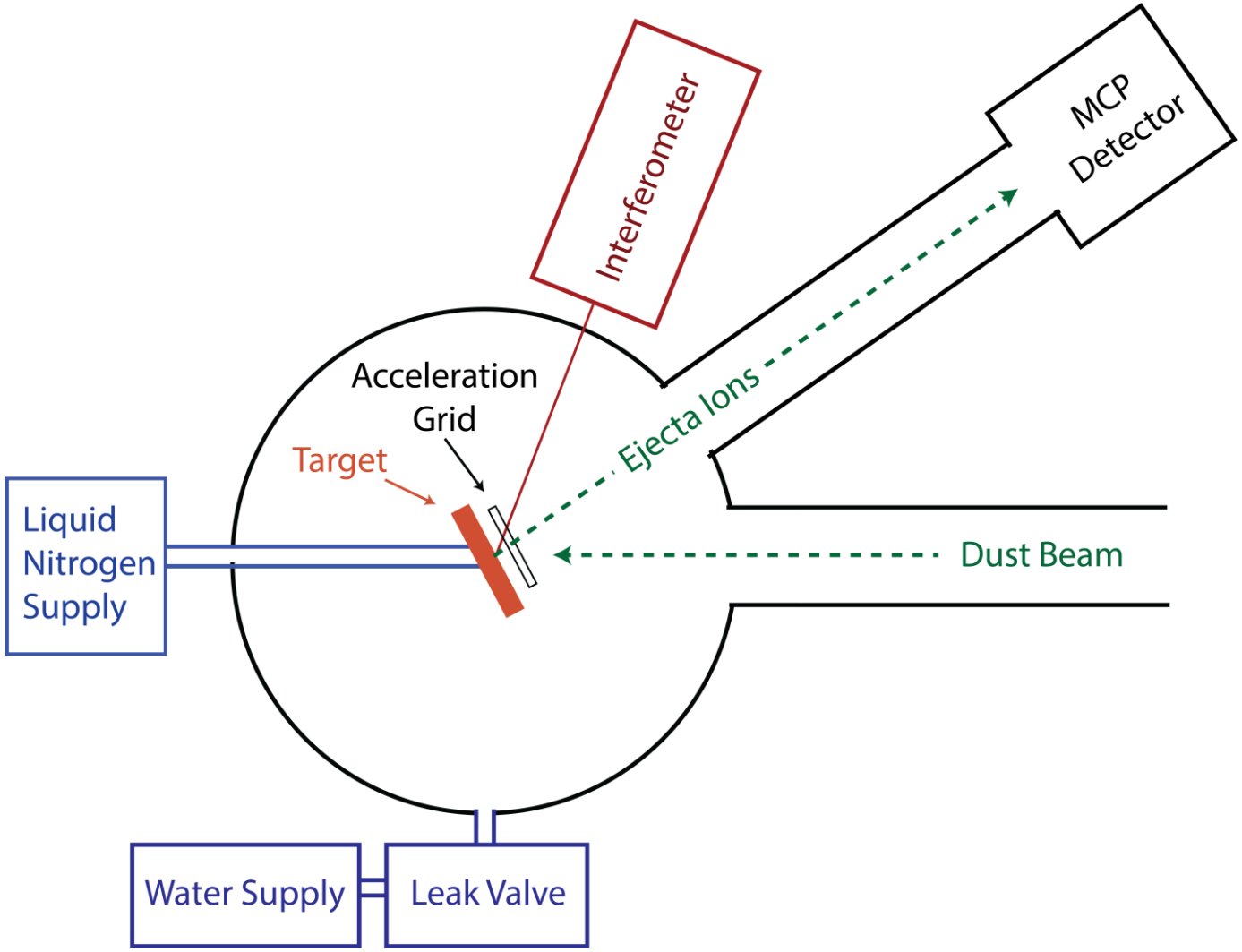


THE COLORADO DUST ACCELERATOR

Dust Parameters	
Size	~ 0.1-1 μm
Velocity	~ 1-100 km/s
Composition	Iron, Aluminum, Graphite, Olivine, Latex, etc.



THE CRYOGENIC ICE TARGET



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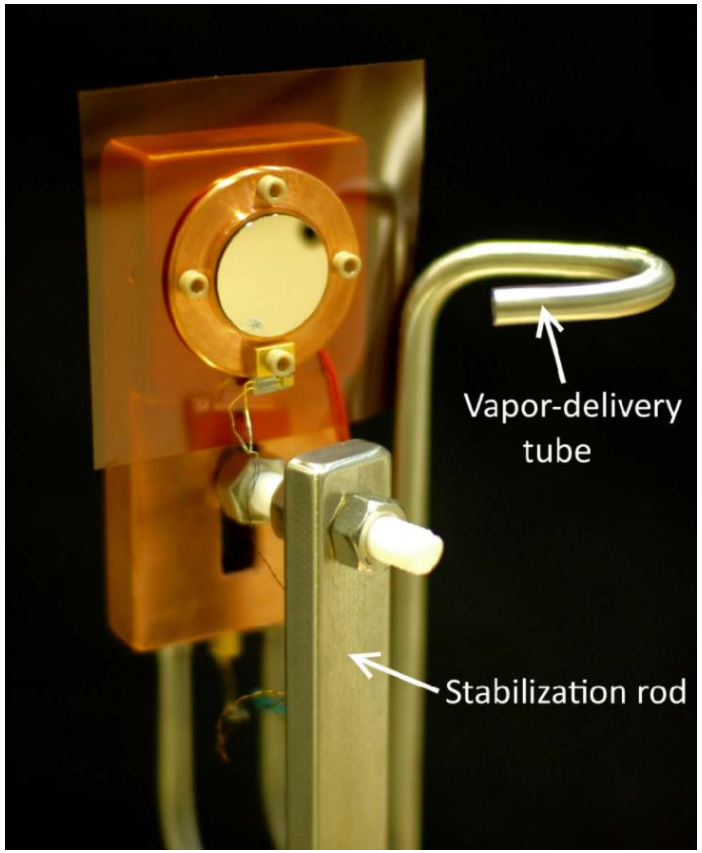

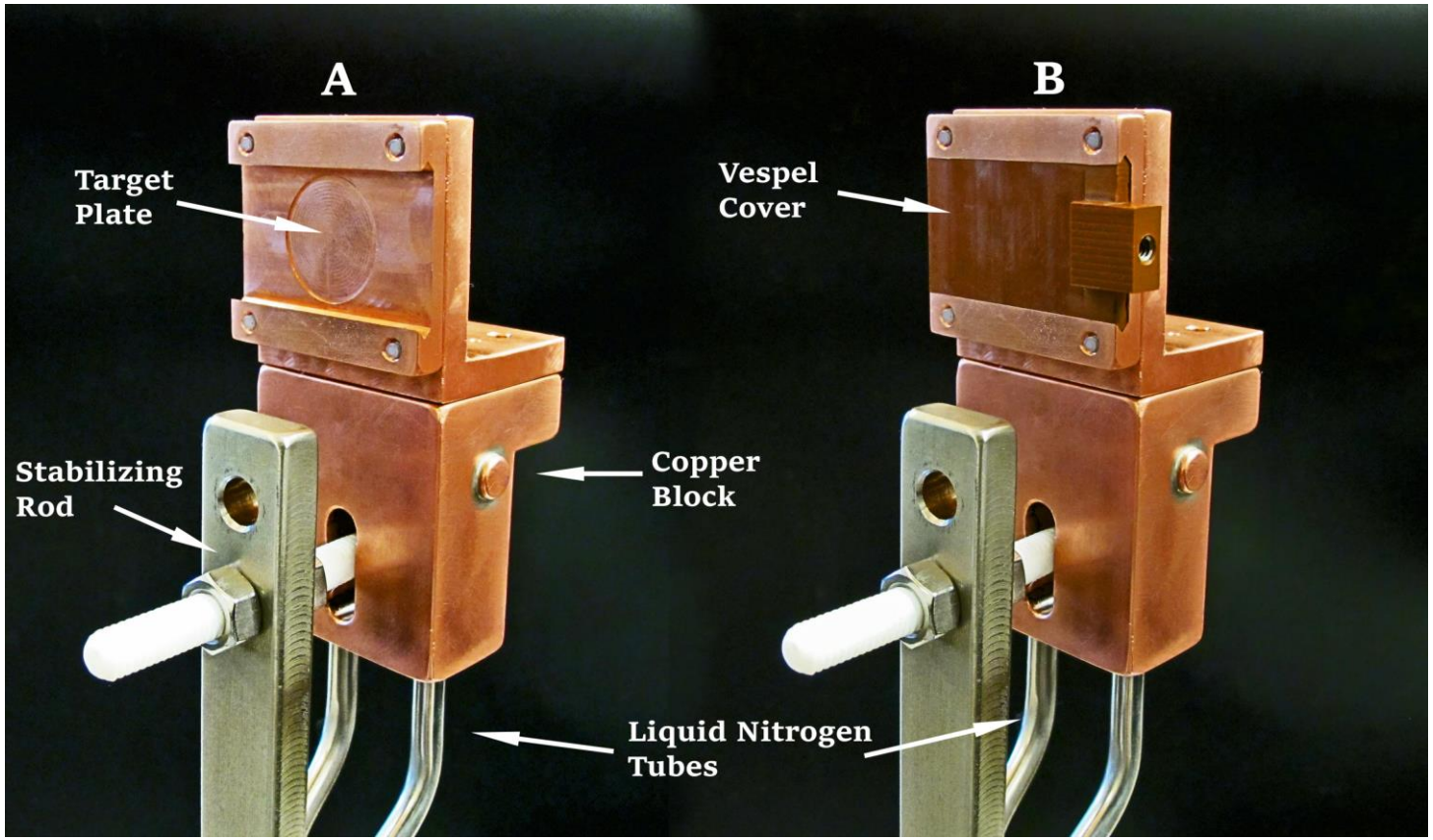

Time of flight instrument on fly-by spacecraft seek to measure organic chemistry in icy dust.

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Amino acid *molecules* shot at solid targets fragment at typical fly-by speeds (~5km/s).

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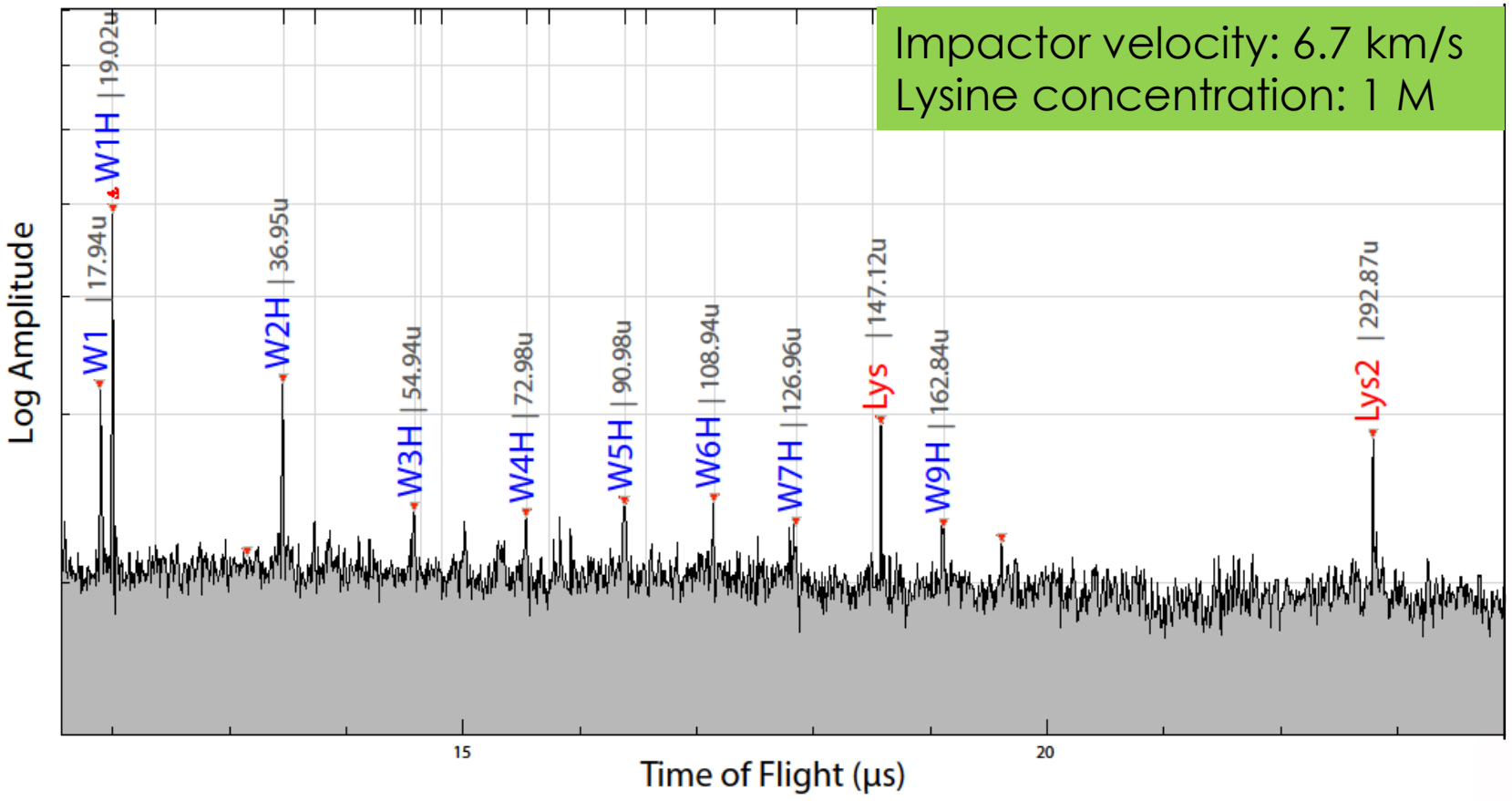
Complex organic molecules in ice may be shielded from impact stress by the ice matrix.

SCIENCE QUESTION

Does complex organic chemistry in ice survive impact at typical fly-by instrument velocities?

(spoiler: yes)

LYSINE RESULTS



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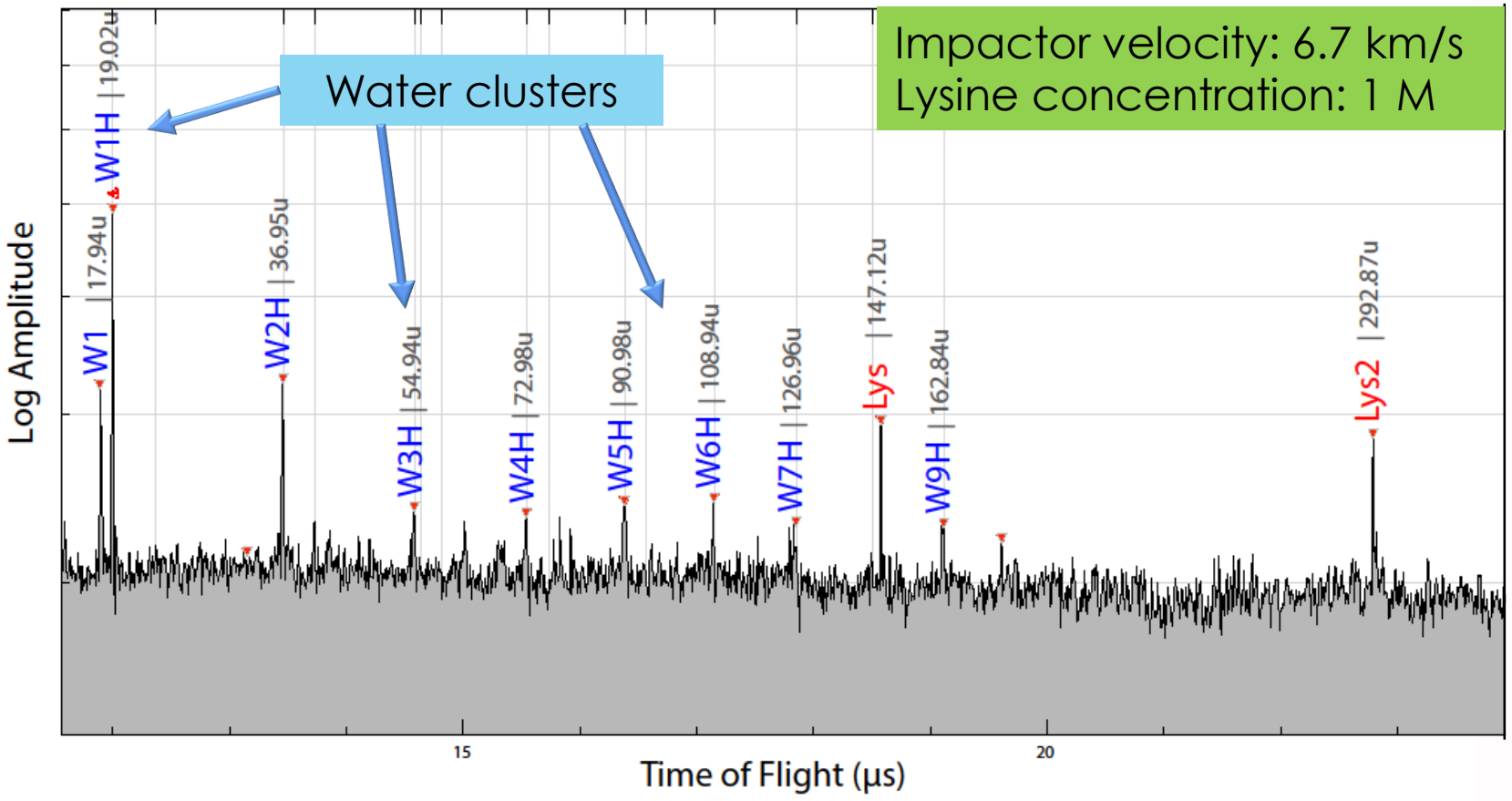

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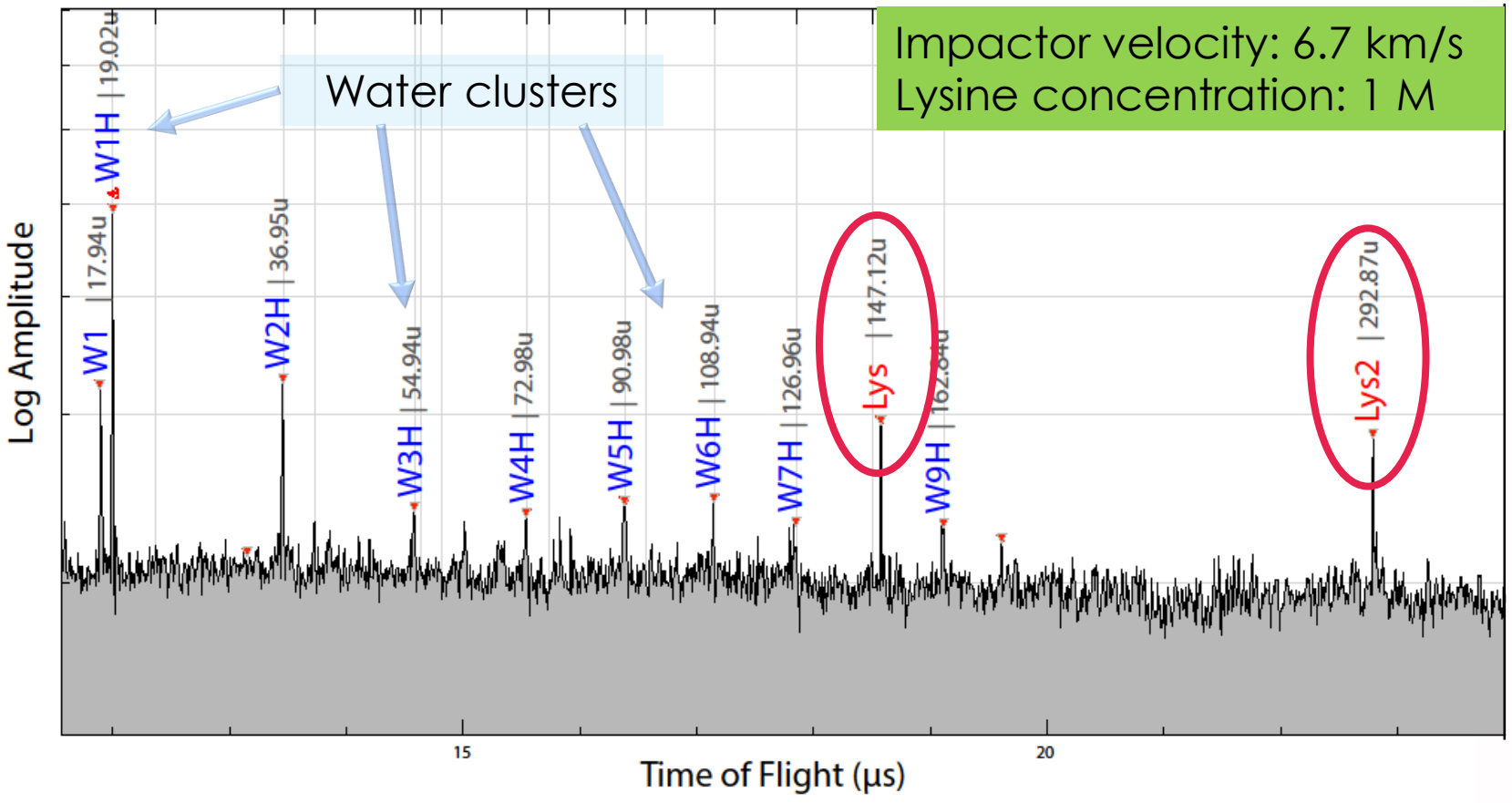
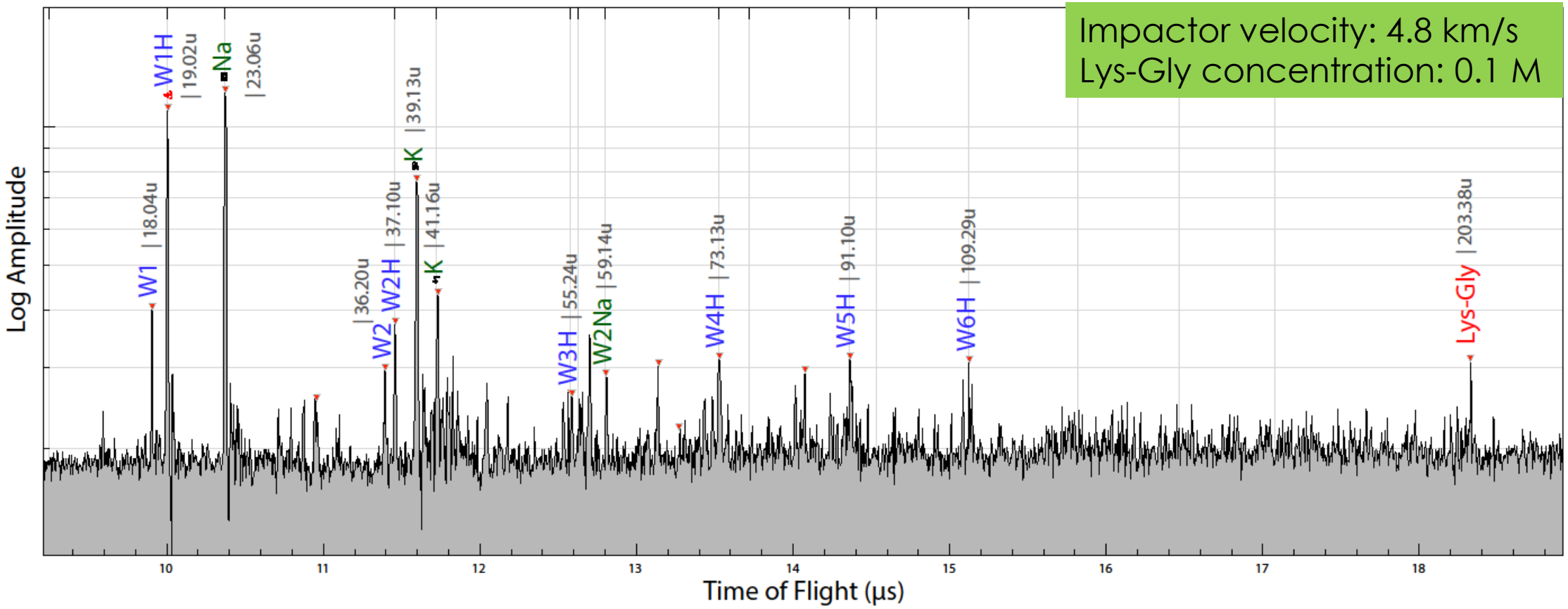


LYS-GLY RESULTS



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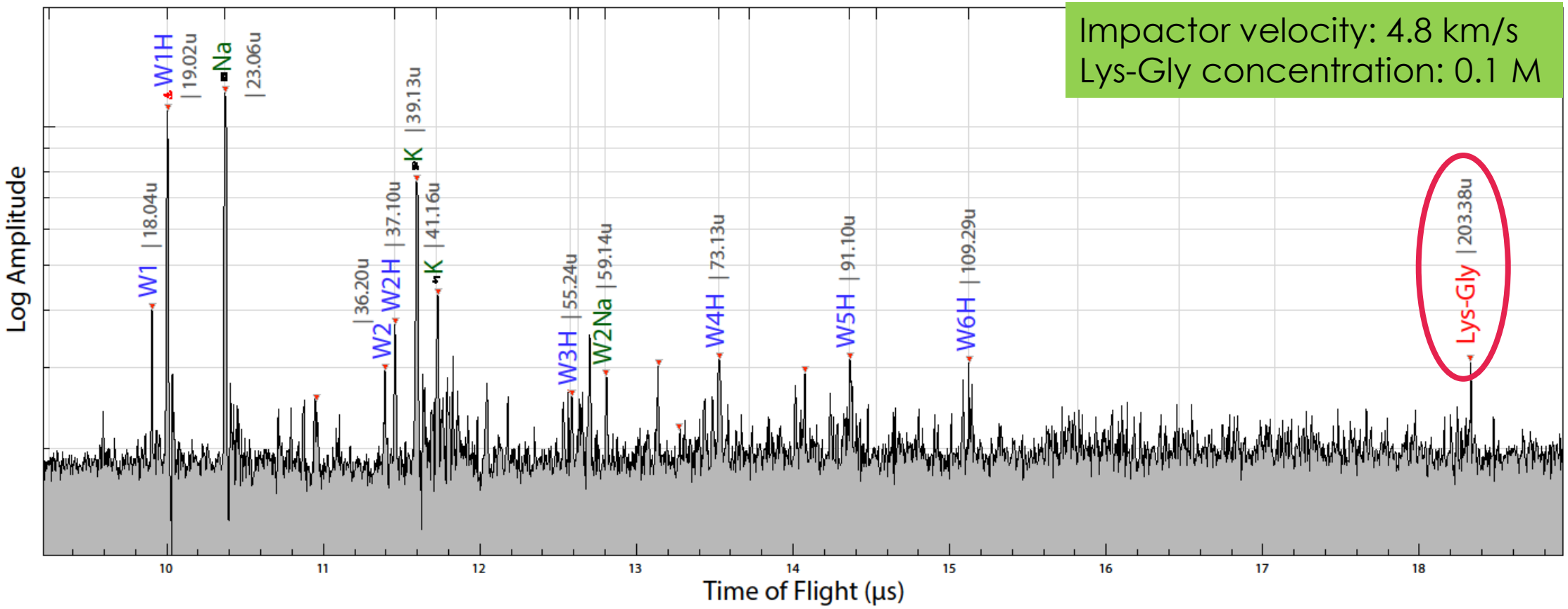
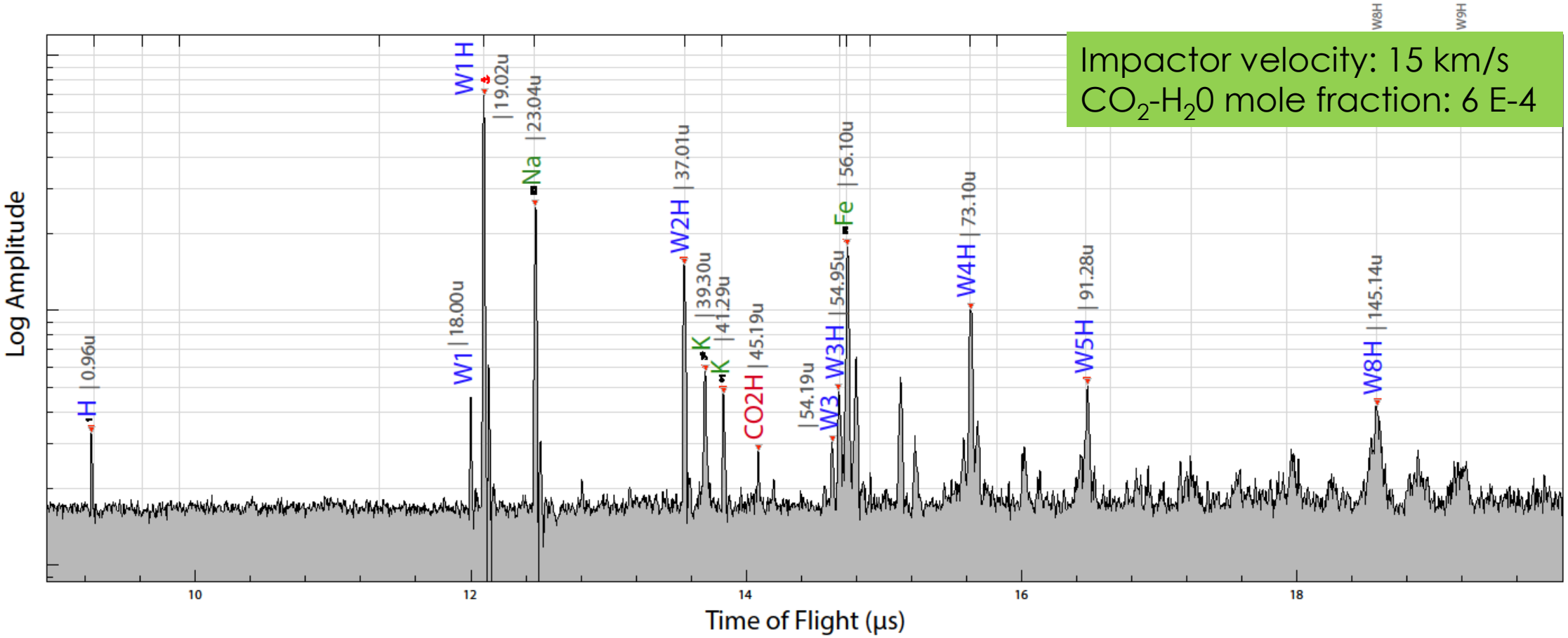


SCIENCE QUESTION

Carbon dust impacts in H_2O may produce CO_2, but can trace CO_2 be detected by our instrument?

(spoiler: yes)

BUBBLED CO_2 RESULTS



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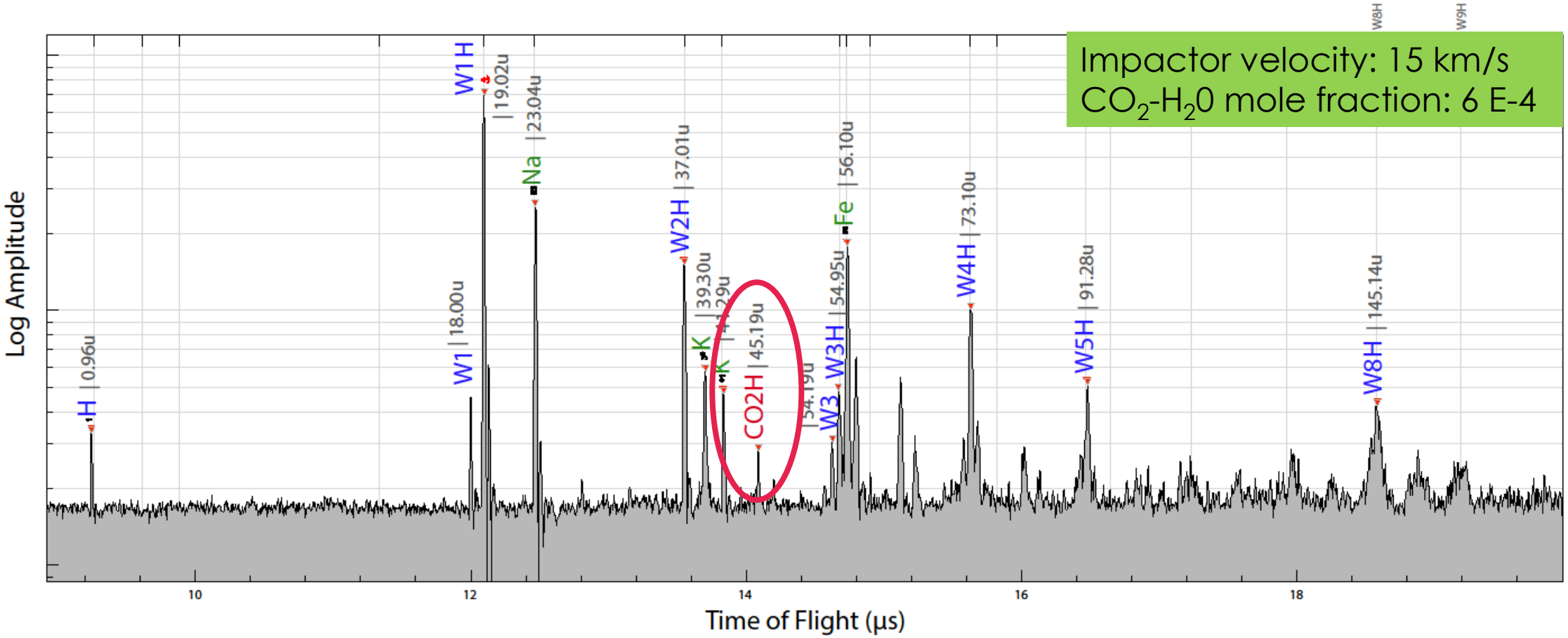
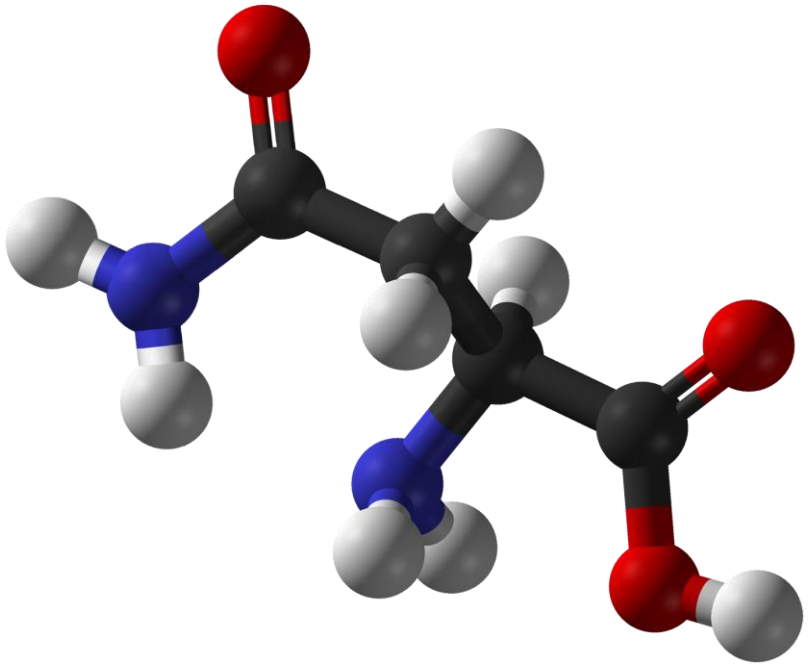


UPCOMING EXPERIMENTS: *GENERATION* OF ORGANIC CHEMISTRY

- Determine CO_2 detection limits
- Generation of CO_2 through dust impact
- Generation of complex organic chemistry
  - Stepped complexity



[2] Wikimedia Commons

UPCOMING EXPERIMENTS: *DETECTING* ORGANIC CHEMISTRY

- Introduction of salt compounds
- Known linear combinations of amino acids
- Fatty acids in pure H_20

[1] NASA JPL

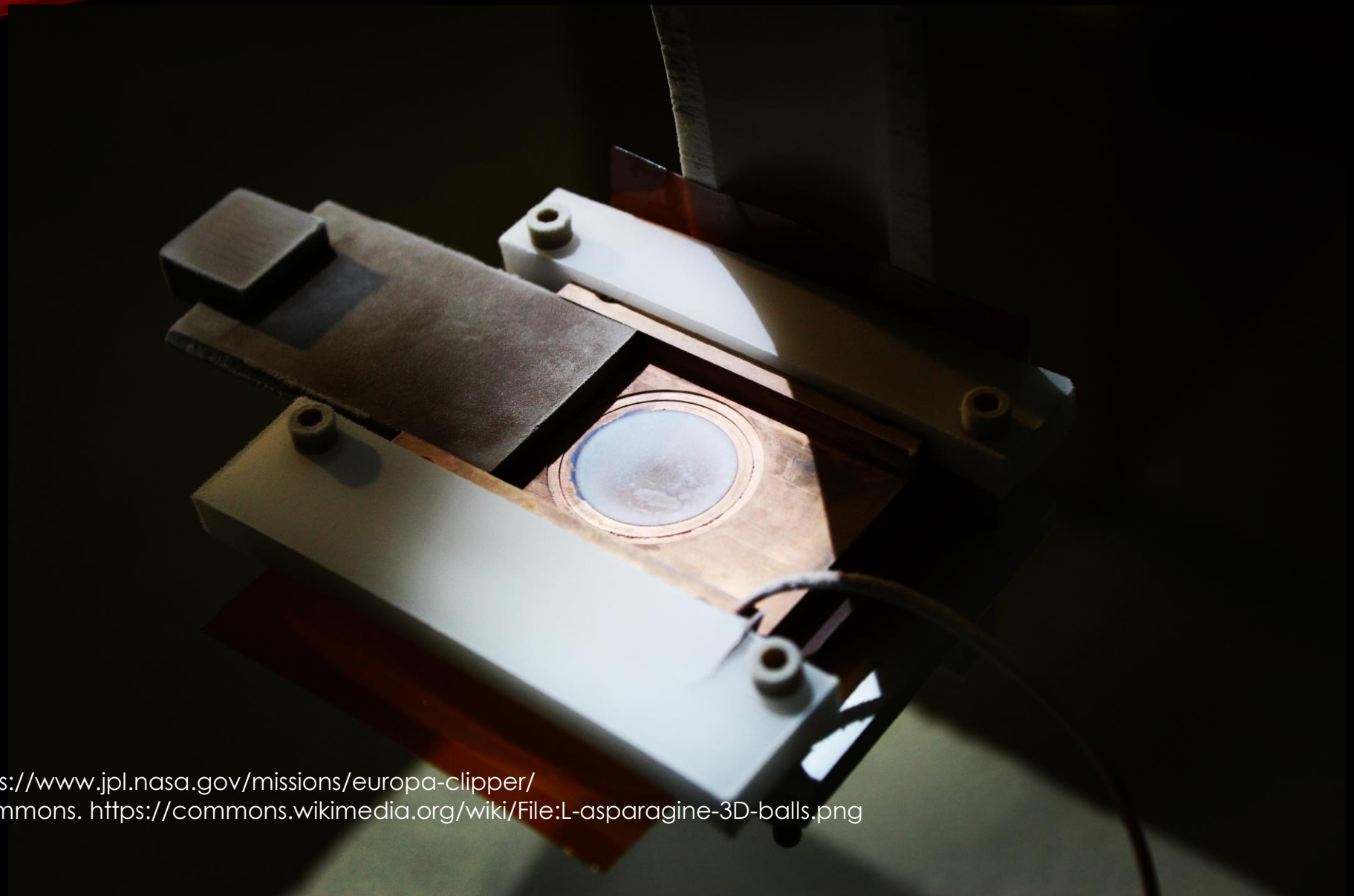


Image citations:
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