

How fast is too fast?

Detection of the Amino Acid Histidine and its Fragmentation Products in Hypervelocity Impact Ice Spectra: Implications for Flyby Mission Velocities

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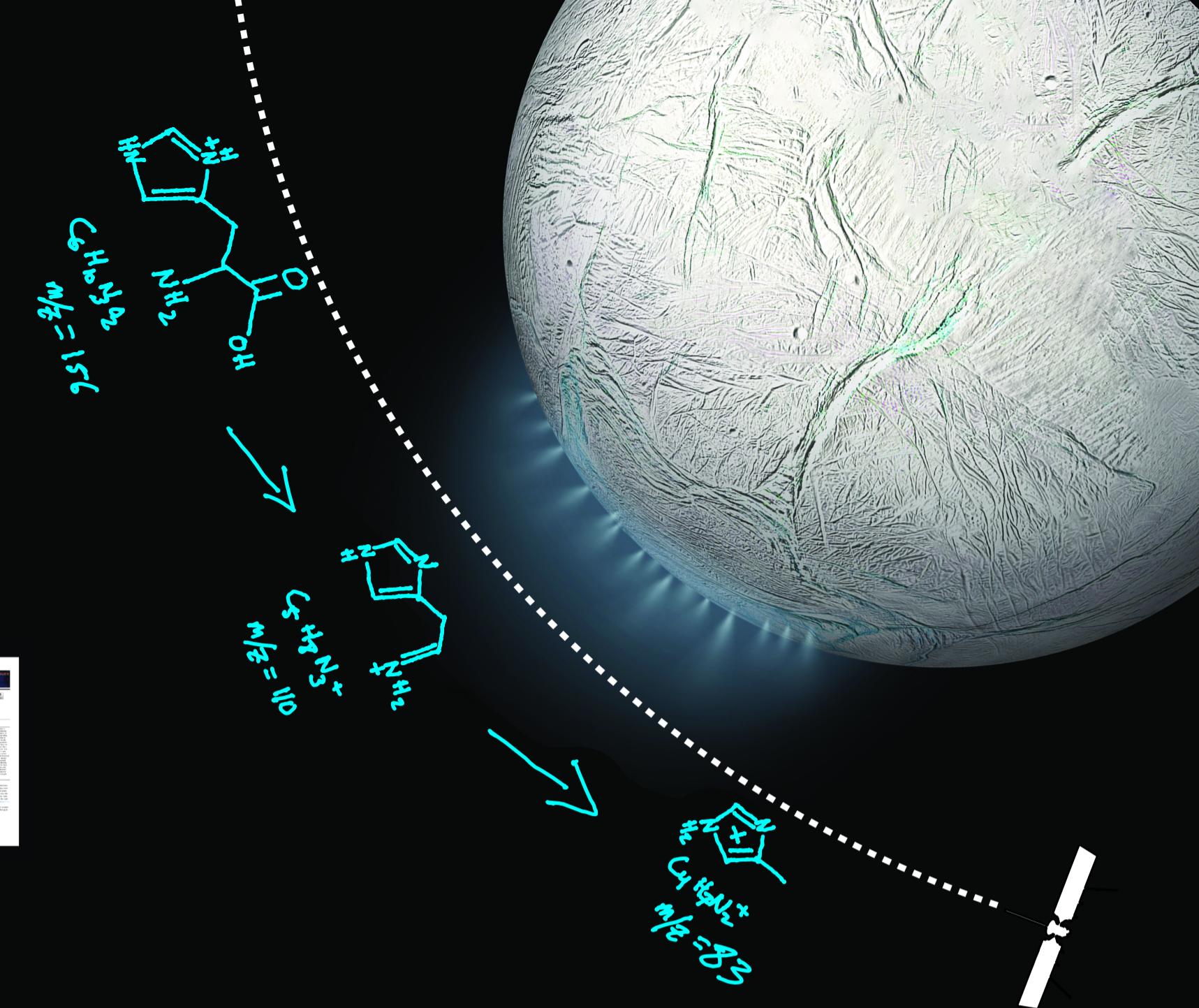
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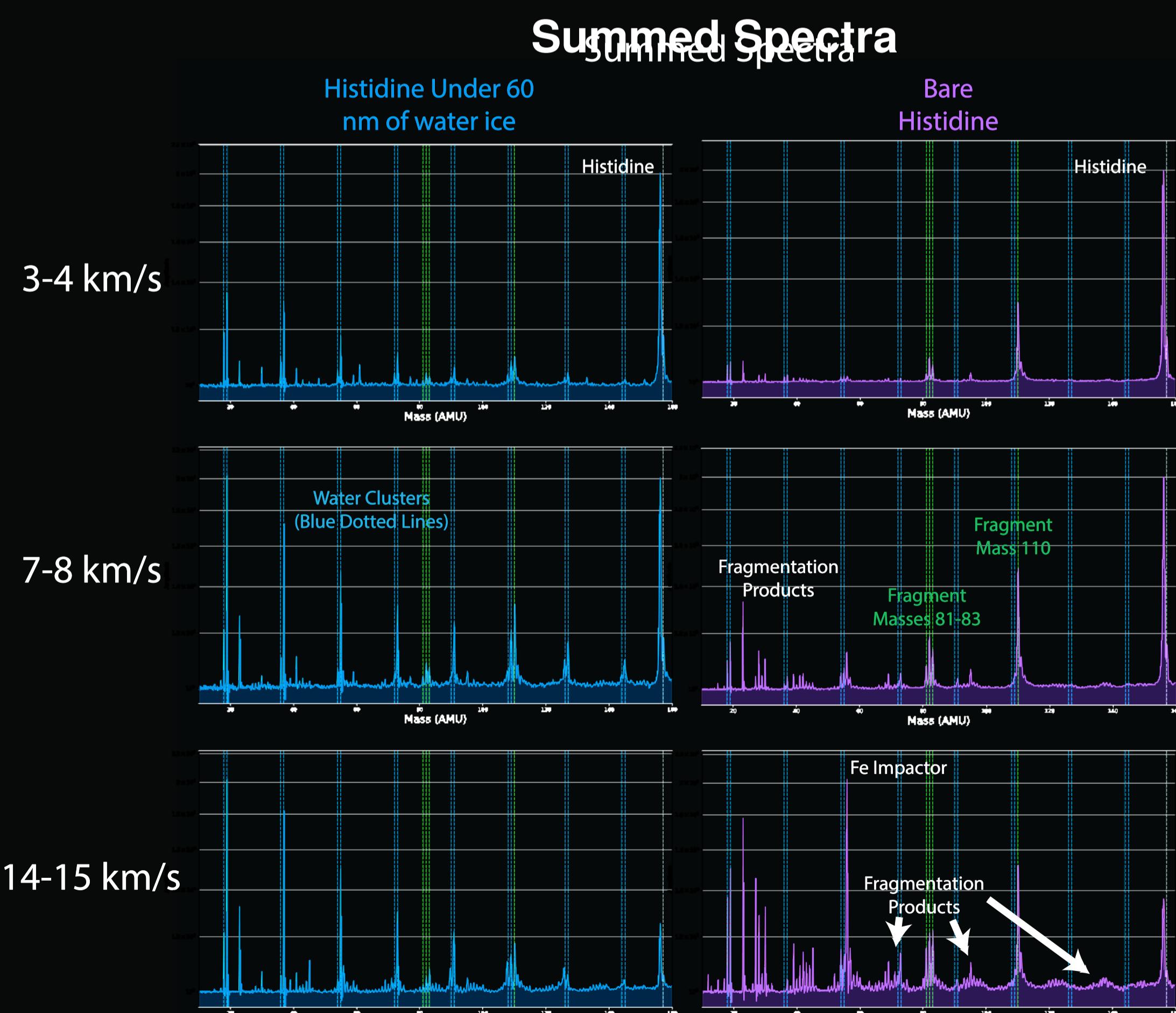
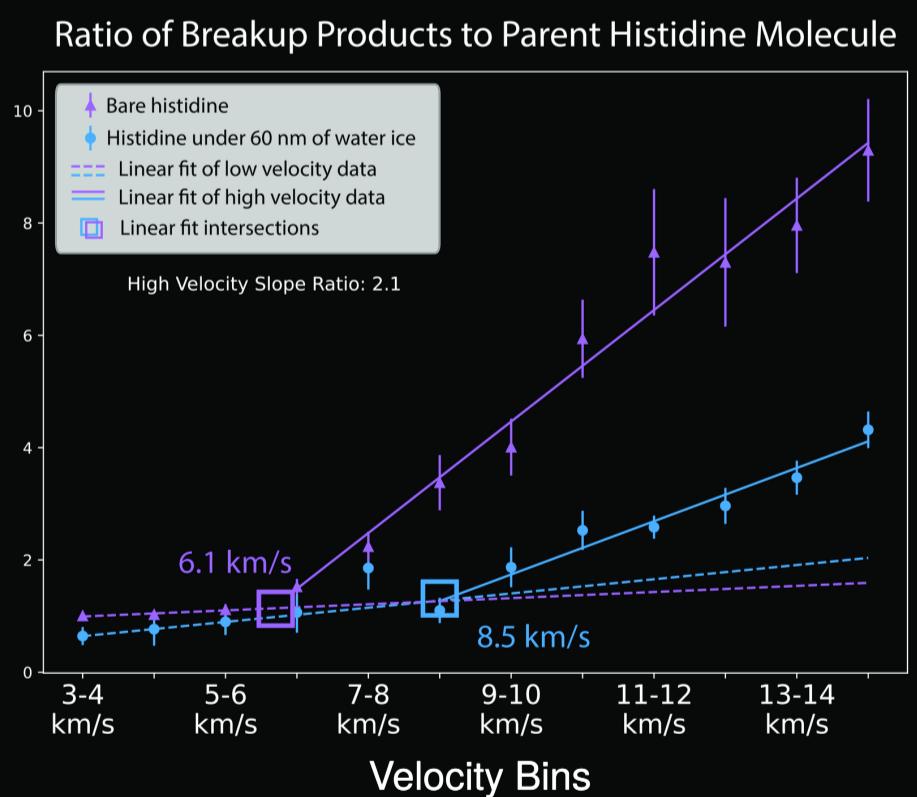
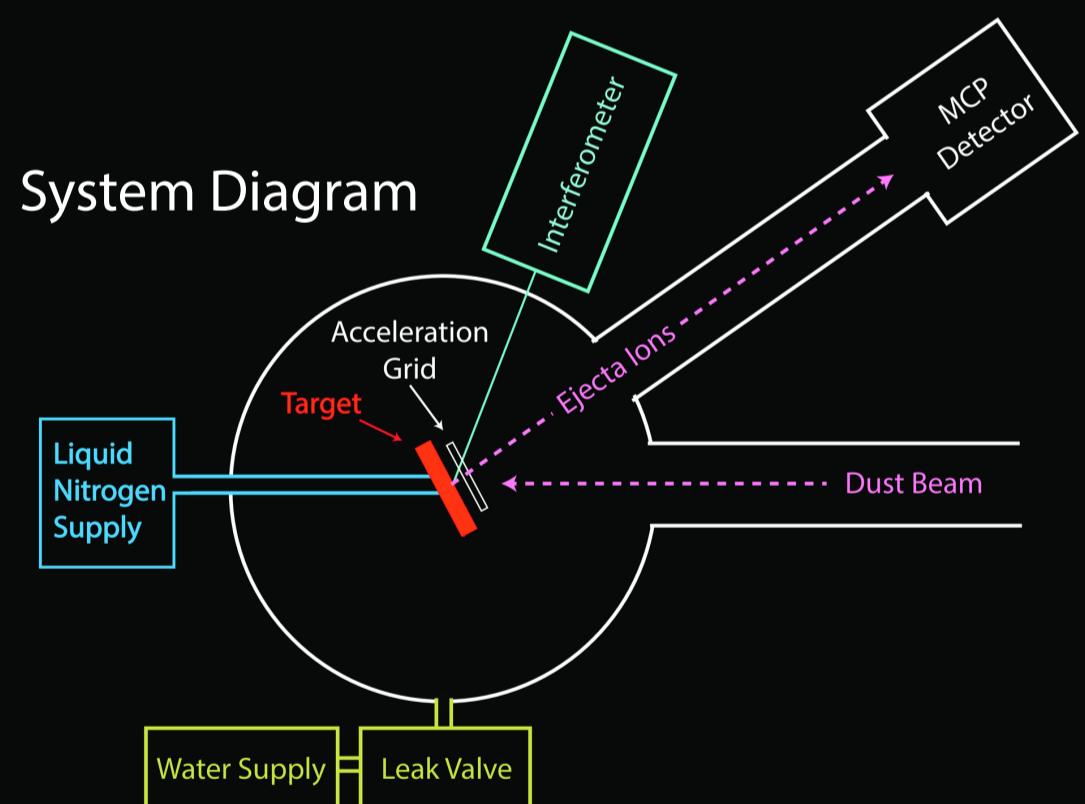
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Read the paper! [1]
Read why it's important! [2]
Read more about the ice target! [3]
Read my thesis! [4]



Experimental Setup

- Laboratory experiments performed at the University of Colorado IMPACT Dust Accelerator
- Micron scale iron dust impacted into histidine surfaces at velocities of 3-15 km/s
- One experiment performed with bare histidine, another with 60 nm of water ice grown on top
- Impact ionization time-of-flight mass spectrometry used to study the resulting impact plume
- Direct sampling of hypervelocity impact plumes with known, physical velocity



Results

- Below 6 km/s, organic fragmentation rates are largely constant
- For bare histidine, fragmentation rates increase dramatically beyond 6.1 km/s
- For histidine under 60 nm of water ice, fragmentation rates increase beyond 8.5 km/s
- The 60 nm water layer reduced fragmentation by a factor of about two
- Fragmentation products correlate with those found in electron ionization spectra (e.g., NIST)
- Characteristic histidine fragments were found at 81-83 and 110 AMU

References:

- [1] Ulibarri, Z., et al. (2023). Detection of the amino acid histidine and its breakup products in hypervelocity impact ice spectra. *Icarus*, 391, 115319. <https://doi.org/10.1016/j.icarus.2022.115319>
- [2] Cable, M., et al. (2021). Plume grain sampling at hypervelocity: Implications for astrobiology investigations. *Bull. AAS*, 53. <https://doi.org/10.3847/25c2cfab.aef1b166>
- [3] Nelson, A. O., et al. (2016). New experimental capability to investigate the hypervelocity micrometeoroid bombardment of cryogenic surfaces. *Review of Scientific Instruments*, 87(2). <https://doi.org/10.1063/1.4941960>
- [4] Ulibarri, Z. (2022). On the Genesis and Measurement of Complex Organics and Isotopic Ratios in Hypervelocity Impact Ice Spectra. PhD Thesis, University of Colorado at Boulder. <https://www.proquest.com/docview/2672014382>