GENESIS

Misc. Notes

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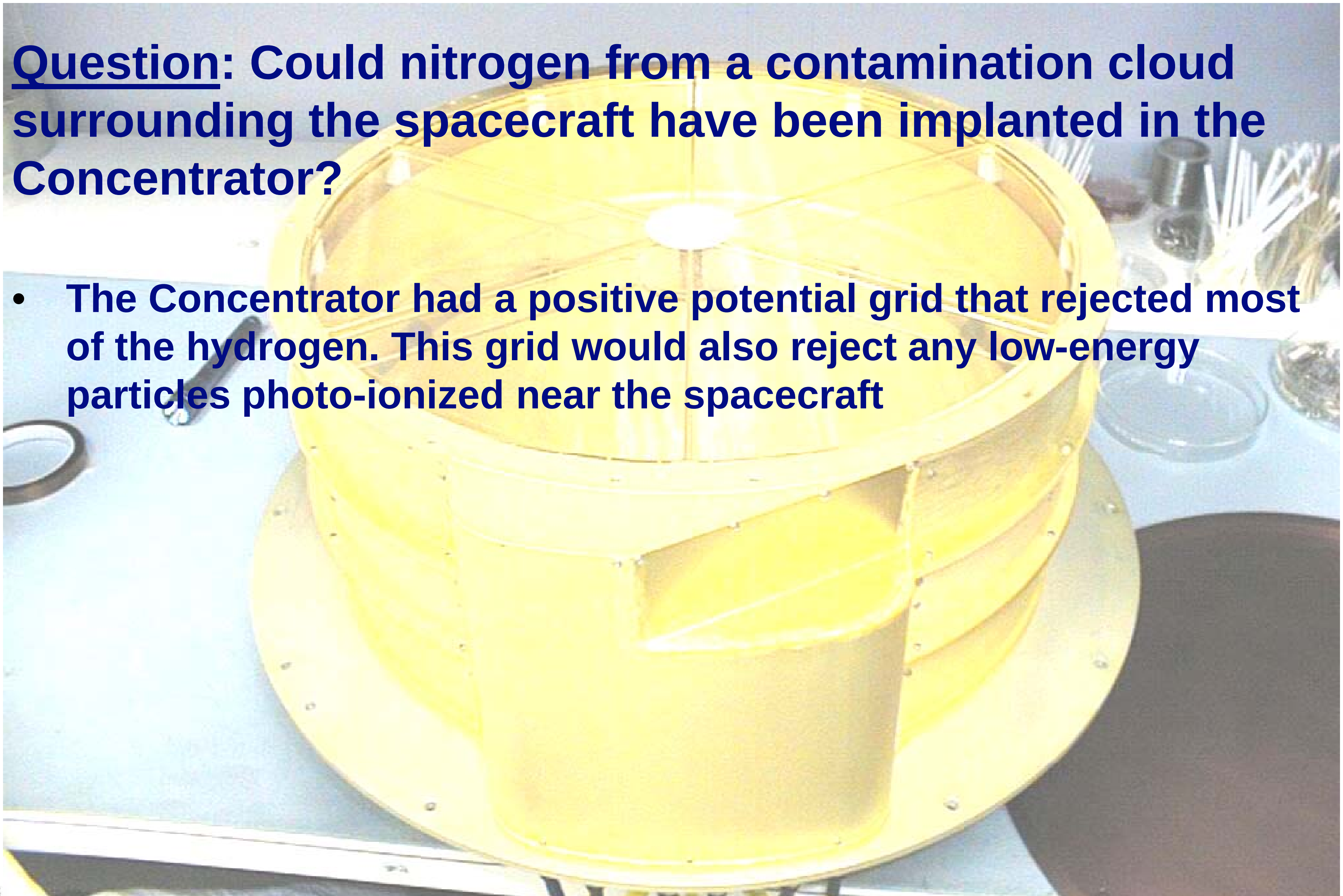
Roger C. Wiens

National Aeronautics and Space Administration
Jet Propulsion Laboratory
Pasadena, California

Los Alamos
NATIONAL LABORATORY
EST. 1943

Nitrogen and the Concentrator



<u>Question</u>: Could nitrogen from a contamination cloud surrounding the spacecraft have been implanted in the Concentrator?

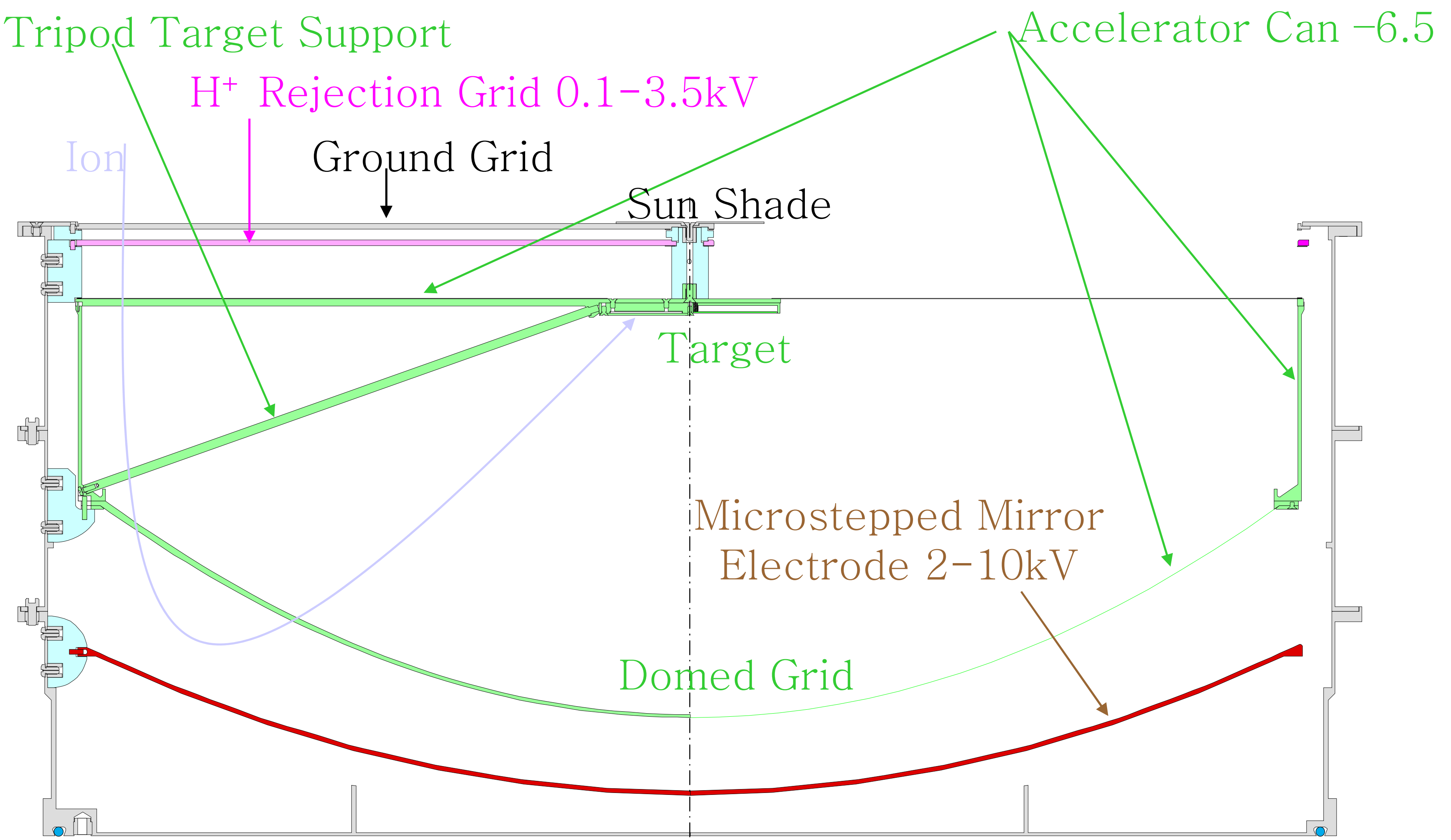
- **The Concentrator had a positive potential grid that rejected most of the hydrogen. This grid would also reject any low-energy particles photo-ionized near the spacecraft**

Nitrogen and the Concentrator

Question: Could nitrogen from the Concentrator structure have been implanted in the Concentrator targets as contamination?

- **The concentrator structure was gold coated to avoid contamination, except for the stainless steel grids**
- **Low-energy ions sputtered from the ground grid would be rejected by the H rejection grid**
- **Low-energy ions sputtered from the acceleration grid and domed grid would not be implanted into the target, which is at the same potential**
- **Low-energy ions sputtered from the H rejection grid would be accelerated and implanted into the target**

Concentrator Cross-section



H Grid Sputtering Calculations

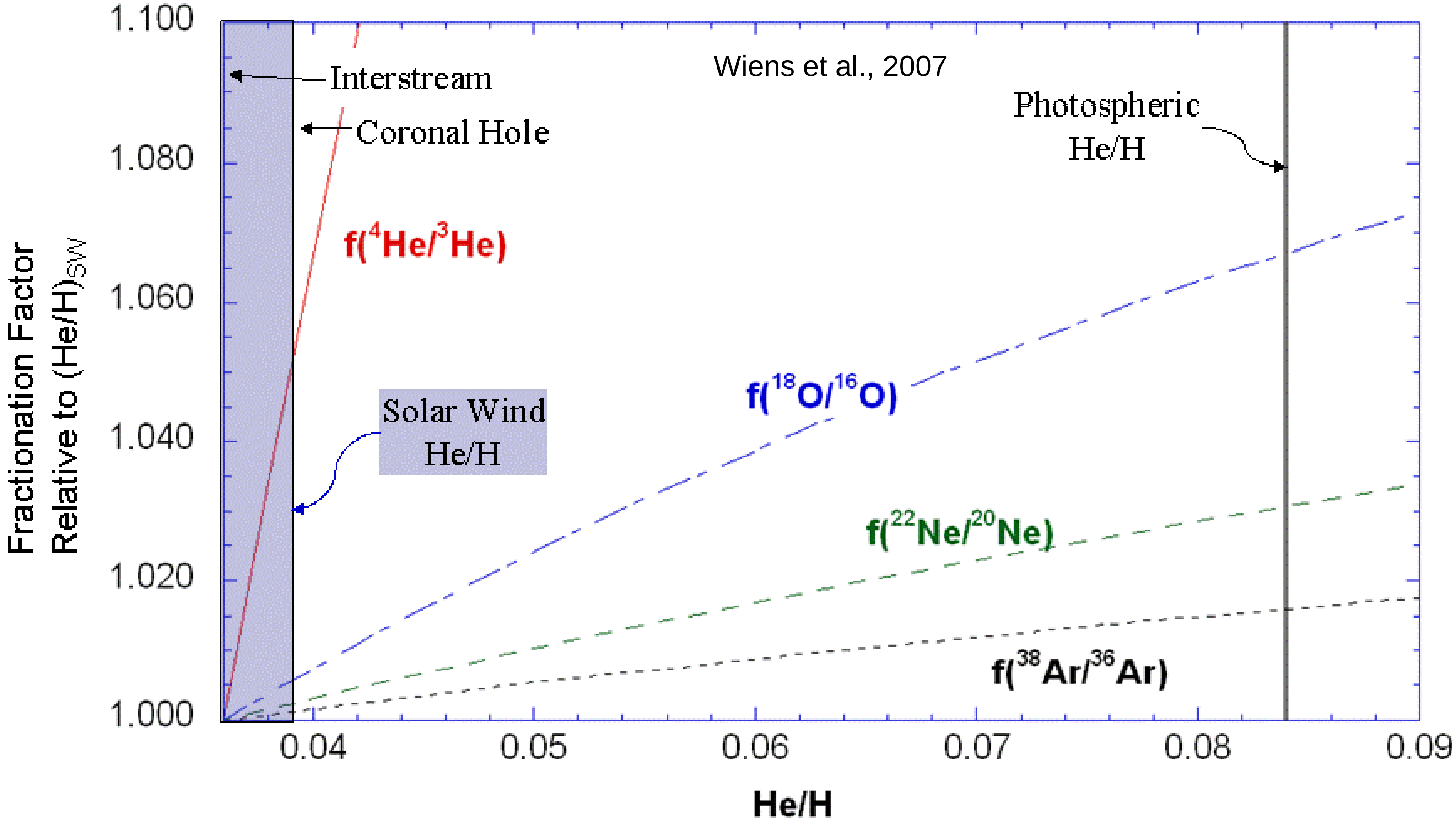
- During the design phase we calculated the potential impact of contaminants sputtered off of the H rejection grid
- Sputtering primaries:
  - 90% of particles pass through the ground grid
  - ~80% of remaining protons are rejected before they get to the H rejection grid. (~20% of protons remain). Essentially all of the heavier particles are available to strike the H rejection grid.
  - The H rejection grid cross section is ~0.1 for particles passing perpendicular to the grid. Slow-moving protons may have higher cross section (0.2 max)
  - Neutral sputtering yield: < 1e-4 for low-energy protons, ~0.1 for He @ 2 keV, ~1 for SW O ~13 keV
    - Sputter yield from Protons impacting H grid:
      (3e8 /cm2/s)(0.9)(0.2)(0.2)(1e-4) = 1.1e3 /cm2/s
    - Sputter yield from He impacting H grid:
      (1.1e7 /cm2/s)(0.9)(1)(0.1)(0.1) = 9.9e4 /cm2/s
    - Sputter yield from heavier ions impacting H grid:
      (2.4e5 /cm2/s)(0.9)(1)(0.1)(1) = 2.2e4 /cm2/s

H Grid Sputtering Calculations (cont.)

- The ion sputtering yield should be order of magnitude of 1% of the neutral sputtering yield.
- For oxygen contamination: assume the grid surface is FeO (50% oxygen worst case). This gives an upper limit of 600 $O^+/cm^2/s$ produced at the grid.
- Solar wind <u>oxygen</u> passing the grid is ~(2.4e5 $/cm^2/s$)$(0.9)^2$, so an <u>upper limit contamination</u> estimate from the grids is <u>0.3%</u>
- For nitrogen, one can use the same calculation but assume 10% of the sputtered species are N, and the solar wind fluence is ~3.1e4 $/cm^2/s$, giving a <u>N contamination estimate</u> from the grids of <u>0.5%</u> relative to the solar wind fluence.

How Do We Constrain SW Isotopic Fractionation?

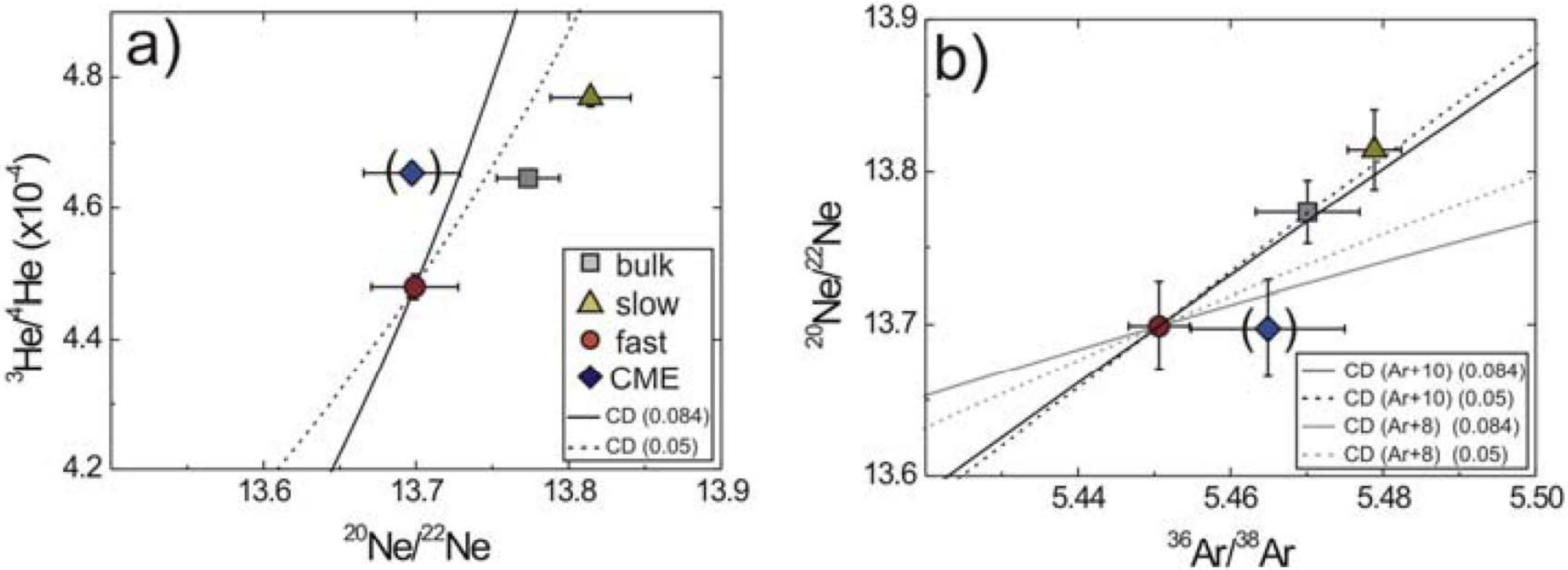
- **Heber et al. data indicate that SW is isotopically fractionated between SW regimes**
- **Isotopic fractionation between regimes is likely to be an indicator of <u>much larger</u> fractionation of SW relative to the photosphere**



Is Coulomb Drag True?

Oh, tell me its not!

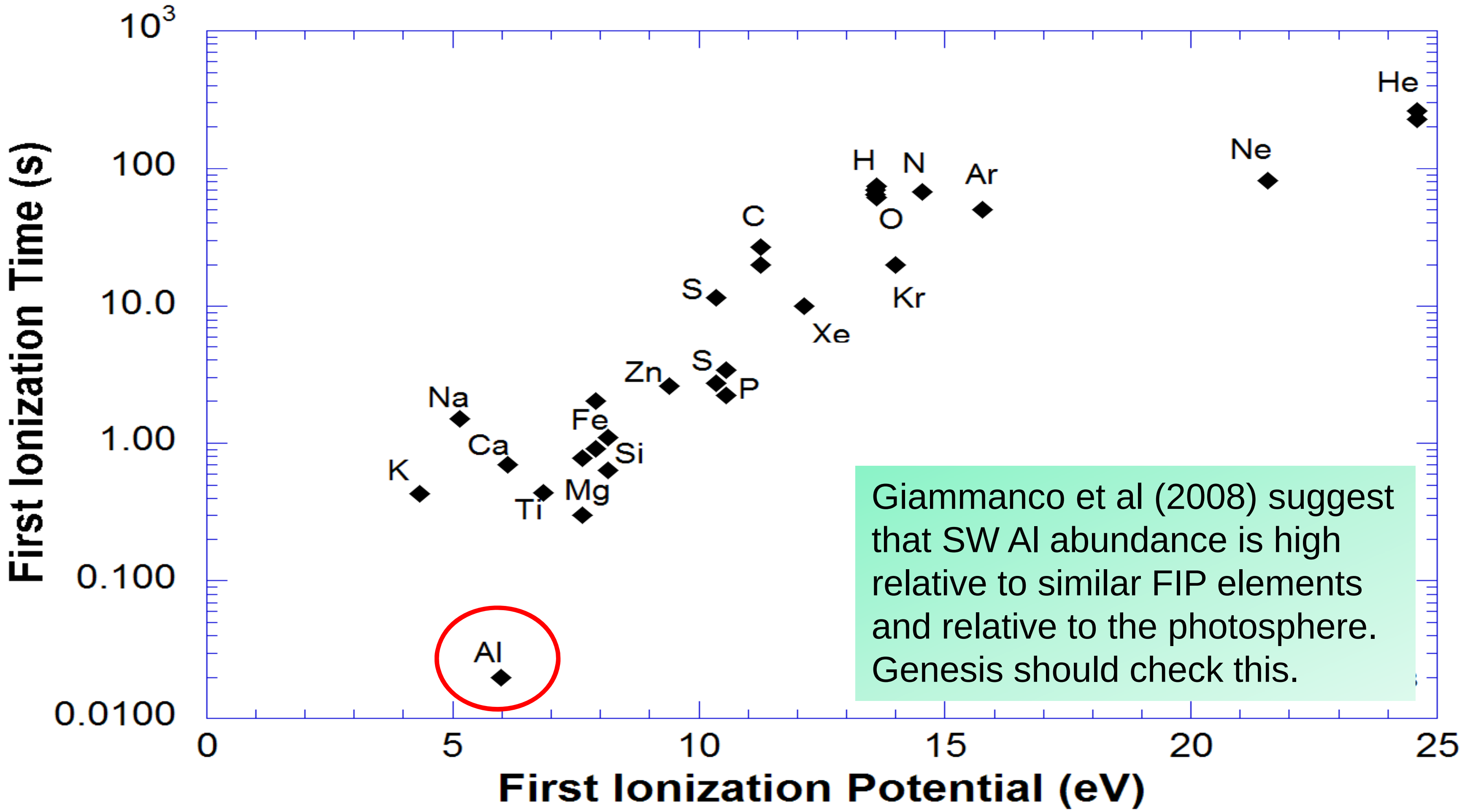
- **Coulomb drag appears partially true, but some of the regime data suggest it should not account for all of the SW He/H fractionation**



(Heber et al., manuscript in preparation)

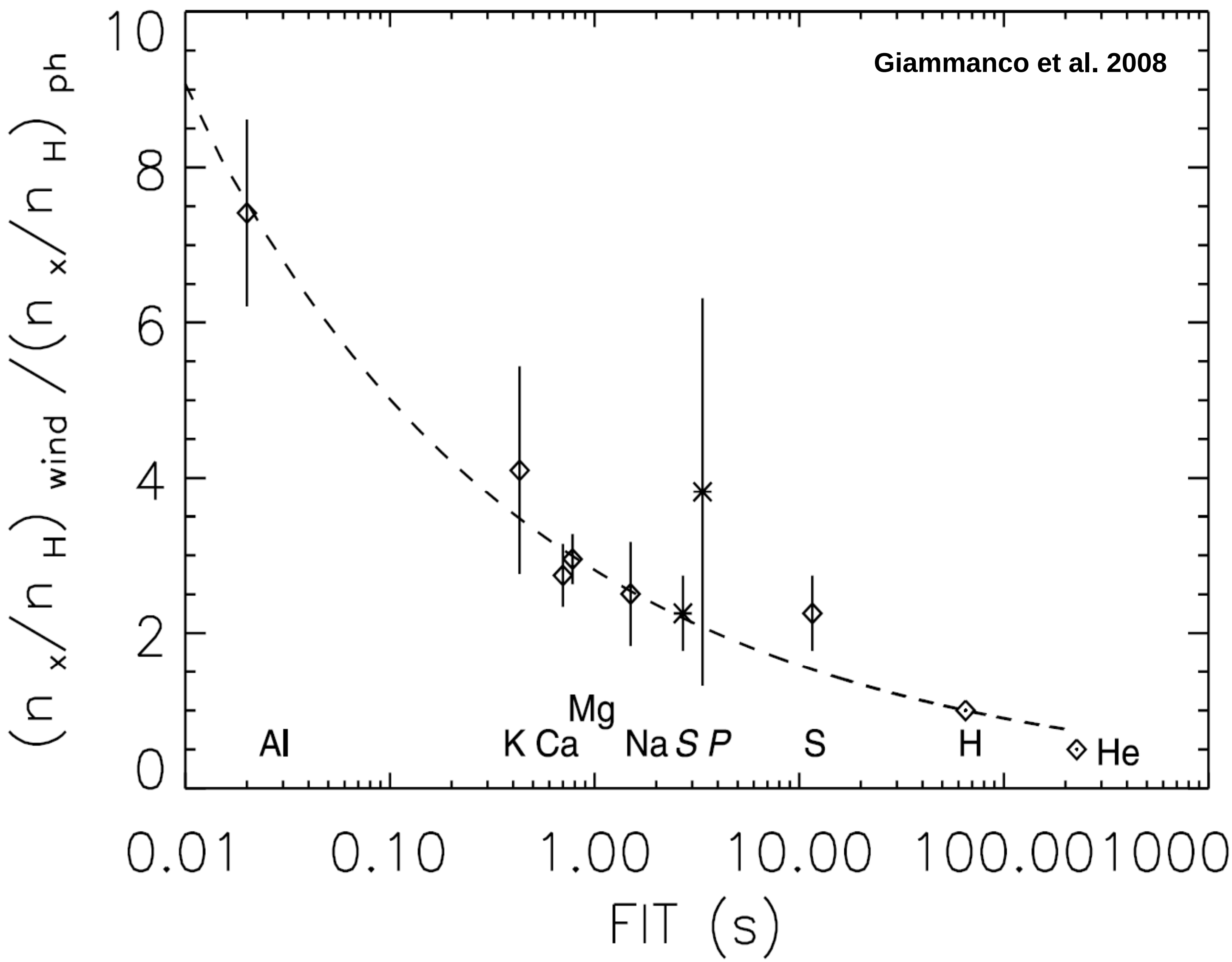
On the Accomplice's Trail…

- Besides Coulomb drag, two other effects that could be responsible for SW He/H fractionation are FIP/FIT effect and wave heating
- First we need a better understanding of FIP effect



Giammanco et al (2008) suggest that SW Al abundance is high relative to similar FIP elements and relative to the photosphere. Genesis should check this.

FIT Fit?


Giammanco et al. 2008
$(n_x/n_H)_{wind}/(n_x/n_H)_{ph}$
FIT (s)
0.01
0.10
1.00
10.00
100.00
1000
0
2
4
6
8
10
Al
K Ca
Mg
Na S P
S
H
He

He/H Depletion due to FIT

- Using Giammanco et al.'s empirical fit gives a He/H depletion due to FIT of 26%
- This is a little less than Veronika's preliminary estimates(?), but in the same range
- The agreement of Giammanco et al with theory (of sorts) appears much better than previous, but there is probably significant uncertainty still in the above estimates.
- …But, these are our best constraints to use for oxygen and other solar wind isotopes.