SAND2019-13314O

Sandia National Laboratories

Measuring Atoms on Mars and on Earth – Compare the Data

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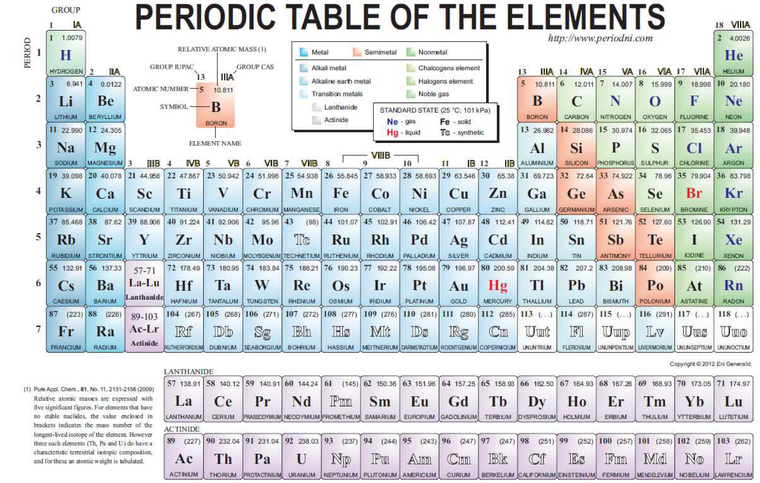
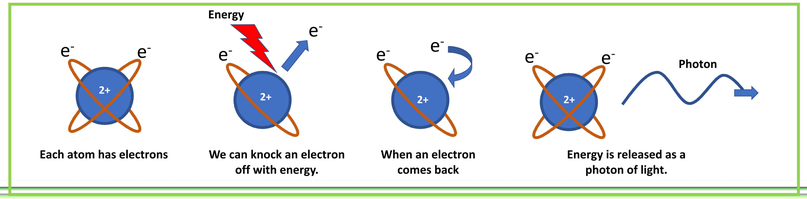
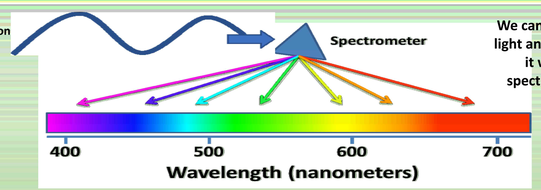
The Periodic Table Lists All the Elements We Know [1]



One way to measure an atom is to detect it's emission.





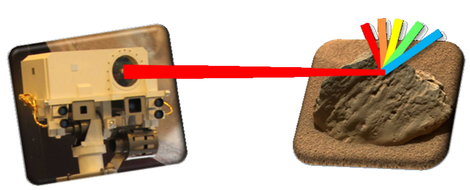
We can catch the light and measure it with a spectrometer.

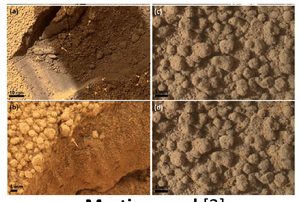
References

1) Generalic, Eni. "Download printable materials." *EniG. Periodic Table of the Elements*. KTF-Split, 14 Feb. 2016. Web. 12 Apr. 2016. <http://www.periodni.com/download.html>.
2) WWW resource: http://www.msl-chemcam.com/index.php#.Vw3VV032apo, 2015.
3) P.Y. Meslin et al, Soil Diversity and Hydration as Observed by Chemcam at Gale Crater, Mars, in *SCI*, vol. 341, pp. 2013.
4) A. Cousin et al, Compositions of Coarse and Fine Particles in Martian Soils at Gale: A Window into the Production of Soils, in *Icarus*, vol. 249, pp. 22-42, 2015.
5) Mowry, C.; Milofsky, R.; Collins, W.; Pimentel, A. S., Laser-Induced Breakdown Spectroscopy for Qualitative Analysis of Metals in Simulated Martian Soils. J Chem Educ 2017, 94 (10), 1507-1511.

How does Curiosity Measure Atoms on Mars?

NASA's Mars Science Laboratory (MSL) is a robotic explorer nicknamed Curiosity.[2] It has a "LIBS" analyzer, Laser Induced Breakdown Spectrometer called ChemCam, which is used for detecting chemical elements in Martian rocks and soils – without touching them!



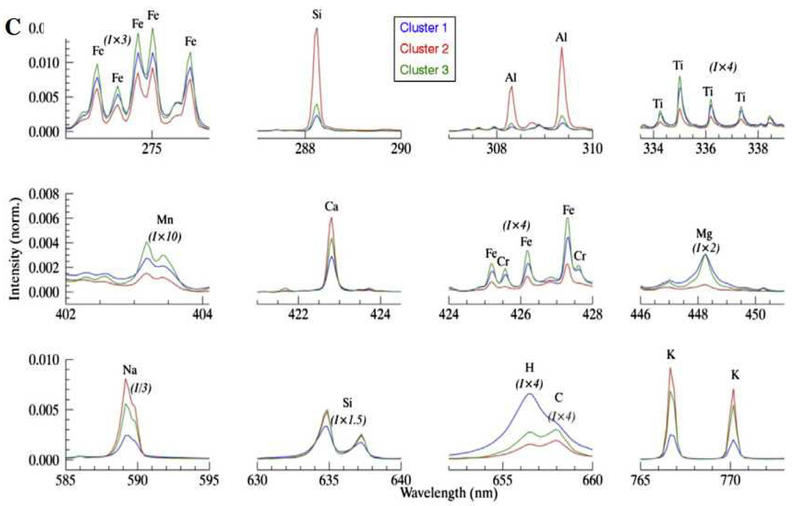


Martian sand [3]

- The laser rapidly *melts* the rock or sand, creating a plasma that emits light.
- Most elements typically emit many different wavelengths (colors).

Over 175 Martian days, Curiosity tested about 24 sands.

Clusters 1, 2, and 3 are general sand types found at different locations on Mars. [4]

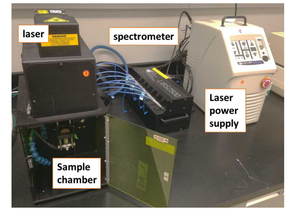


Look to the periodic table to figure out the abbreviations.

How do We Measure Atoms on Earth?

On Earth, we can use the same laser as Curiosity to provide energy to a rock or dirt

side

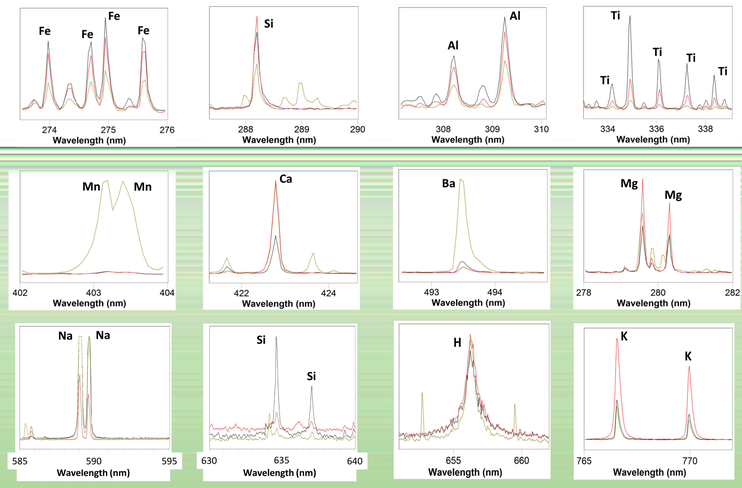


front

- The laser rapidly *melts* the rock or sand, creating a plasma that emits light.
- Most elements typically emit many different wavelengths (colors).

Earth sand - compare to the elements in Martian sand.

In our earth lab we have measured earth sand of different colors: RED, BLACK, and YELLOW shown here. We can detect many elements, and the amount varies in each sand [5]. Can you see any differences? How is this dirt different than Mars dirt?



Use the spectrum at left to determine the colors of the light.

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