

## Mars: Are We Alone?

On January 17, Dr. Bryan Hynek of the Department of Geological Sciences and laboratory for Atmospheric and Space Physics at UC Boulder gave this presentation at Café Scientifique's meeting at the Wynkoop Brewing Company in LoDo, Denver. The Café Scientifique idea started in England a few years ago, based on the French Café Philosophique. At Café Scientifique, people come together in a convivial pub after work and hear an informal (no PowerPoint!) introduction to an interesting current scientific topic, led by an expert. They take a short break for refreshments, meet new people, and chat, and then return for questions and answers and general discussion. Admission is free. The Denver Café began in November 2003, making it one of the oldest in the Americas, and it is now one of the largest in the world. The Wynkoop Brewing location is due to a graduate student, who was babysitting for the former owner and now Governor of Colorado, John Hickenlooper; this provided an entrée.

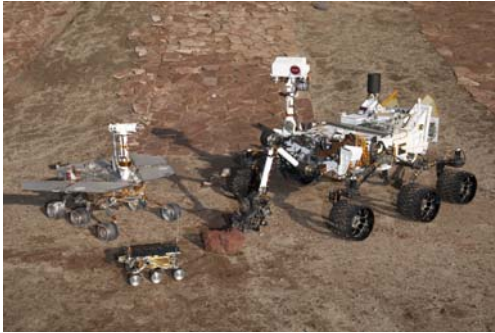
There is a second Café Scientifique in town called Café Sci2! It meets on variable days of the week, at the sports restaurant Brooklyn's, on Auraria Parkway, just across from the Auraria Campus downtown.

Dr. Hynek began his presentation by discussing Mars' place in history. Early humans noticed that the planet did not follow the path of the stars in the cosmos, and sometimes reversed itself (retrograde motion). Its red color led to its designation as the God of War. Primitive telescopes were later able to show that Mars was a disk rather than a point of light. The nineteenth-century Italian Astronomer Giovanni Schiaparelli described the straight lines he observed on Mars as "canali" or channels. This was mistranslated as canals and led to the general perception that there were canals on Mars. In America, Percival Lowell viewed Mars through his telescope in Flagstaff, Arizona and wrote a book in 1906 called *Mars and its Canals*, with drawings of a network of canals on the planet. He speculated that they conveyed water from the North Pole to the deserts on the Martian equator. In the same year, the New York Times published a headline saying that life had been found on Mars. Lowell's 24 inch refracting telescope was subsequently used by Clyde Tombaugh to discover Pluto in 1930.

Dr. Hynek moved on to modern exploration of Mars using space probes. It is a difficult challenge, with two thirds of the Mars missions ending in failure. This is typified by the recent Russian Fobos-Grunt, which crashed into the Pacific. (The Russians attributed the failure to imported electronic components which were not sufficiently radiation-hardened). Fobos-Grunt's mission was to return samples from Phobos. It also carried the Chinese Mars orbiter Yinghuo-1.

Dr. Hynek described the increasing complexity and technical capability of the Mars vehicles. The initial Mars rover, Sojourner was the size of a Laser Printer, while the Curiosity rover, recently launched by the Mars Science Laboratory Mission, has the approximate dimensions of a Mini-Cooper. The most significant operational successes

were the Mars Exploration rovers Spirit and Opportunity, launched in 2003. The Opportunity rover is still operational.



Front and center is the flight spare for the first Mars rover, Sojourner (2 ft long), which landed on Mars in 1997 as part of the Mars Pathfinder Project. On the left is a Mars Exploration Rover Project test rover (5.3 ft long) that is a working sibling to Spirit and Opportunity, which landed on Mars in 2004. On the right is a Mars Science Laboratory test rover the size of that project's Mars rover, Curiosity (10ft. long), which is on course for landing on Mars in August 2012. (Image and text from the NASA website)

Dr Hynek mentioned the three chemical experiments carried out by the Viking Landers in the 1970s to look for life. Two were negative, and the third gave inconclusive results that were not repeatable, and are still the subject of controversy.

Exploration has found evidence of water by geologic features, although the current temperatures and atmospheric pressure do not allow water to exist in its liquid form. In 2004, NASA's Opportunity rover found hematite pebbles embedded in a rock outcrop. Professor Marjorie Chan of the University of Utah proposed in an article in *Nature* that they might be similar to "blueberries" found in southern Utah, formed by fluids leaching the iron. A theory exists that Mars had oceans in its early life, but these were lost along with most of its atmosphere. Mars does not have a magnetic field and it is suspected that its lack of an atmosphere may be related to this fact.



"Blueberry" found by the author on a sandstone outcrop in the Paradox Basin of Utah (ruler in inches)

The capabilities of the recently launched Curiosity rover are much improved. Instead of using the relatively weak solar energy that reaches Mars, as with earlier rovers, this mission will be powered by a small capsule of plutonium 238. According to NASA's website, the radioactive decay of this element will power the mission for one Mars year (687 earth days). In addition to supplying 110 watts of electricity, it will provide heat to keep the system at an acceptable operating temperature. A questioner asked about power sources for the Russian Fobos-Grunt mission. The Russians were secretive about this, but the rocket fuel was the highly toxic chemical hydrazine. It is hoped that it burnt up before

reentry into the Pacific. The US destroyed one of their failed satellites, containing hydrazine, with a ballistic missile, before it could return to earth. It was a spy satellite, so safety may not have been the only concern. NASA's Planetary Protection Office will not allow Curiosity to land on areas of Mars most likely to contain life in order to avoid potential contamination with earth organisms. Spores transported from earth on the lunar missions were found to still be viable after being exposed to that hostile environment for years.

An instrument on Curiosity called ChemCam will use laser pulses to vaporize thin layers of material from Martian rocks that are up to 23 ft. away. It will include both a spectrometer to identify the type of atoms excited by the beam and a telescope to capture detailed images of the area illuminated by the beam.

The next meeting of Cafe Scientifique will be on Tuesday, February 21, where Dr George DeMartino of the Josef Korbel School of International Studies, University of Denver will discuss "Do Economists Need Ethics?"