Illinois Wesleyan University Magazine

Volume 13
Issue 1 *Spring 2004*

Article 12

2004

Exploring out galactic backyard

Linda French
Illinois Wesleyan University, iwumag@iwu.edu

Exploring our galactic backyard

Humanity can learn much about our Universe without enduring the risks of spaceflight.

By Linda French, Associate Professor of Physics (shown above)

"...To boldly go where no one has gone before...."

At least once a week Patrick Stewart's Shakespearean voice intones those familiar words on my family's television set. By now we've seen almost all of the *Star Trek: The Next Generation* episodes multiple times, along with the other series incarnations of the *Star Trek* Universe. The vision of a mission to explore our Galaxy — shared among genders, races, and even species — inspires my teenage daughter as much as it did those of us who came of age in the late 1960s.

Exploring the real Universe, however, is far more difficult and dangerous than could be conveyed by any number of phaser battles or hostile alien creatures conjured by our imaginations. Simply put, space is big, cold, and dark. We humans are fragile, and our needs for oxygen, water, and food mean that any space-travel missions involving humans will necessarily cost hundreds, if not thousands, of times as much as unmanned missions with the same goals. In the *Star Trek* stories, we are clearly given to understand that war, poverty, and hunger have been eliminated (along with, apparently, national boundaries) by the time of the *Enterprise*'s mission. It is well that we remember how much the idealistic conditions differ from those of our present world.

Why does an astronomer sound so bleak about the prospects for manned spaceflight? Don't we need to send people into space to learn more about our galactic neighborhood — our Solar System, our Galaxy, and beyond?

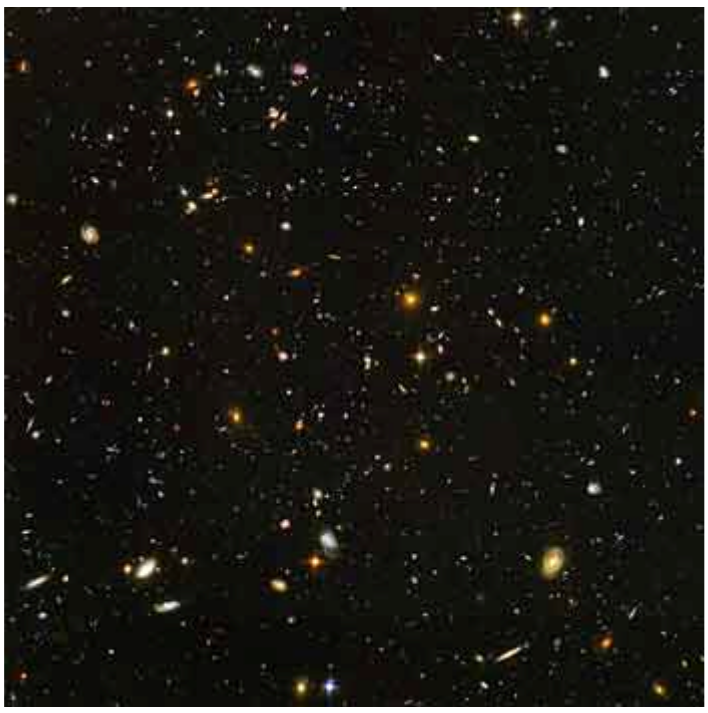
This panoramic image mosaic taken by the Mars Exploration Rover Spirit, shows the rover's destination toward the hill range nicknamed "Columbia Hills." (NASA)

History suggests otherwise. In my lifetime, the other eight planets have gone from being points of light in telescopes, with surface conditions we understood only vaguely, to real worlds. The recent triumphs of the *Spirit* and *Opportunity* landers have shown us the surface of Mars in microscopic detail (although perhaps the planet's gentle pink sky may be the most striking reminder that we are, indeed, looking at another world). Both chemical and mineralogical data are consistent with an environment that was once rich in water. Where has the water gone? How much is left? Could life have arisen on Mars?

The fascination that these questions hold for both scientists and the general public shows an interest in exploration akin to that of the crew of the Enterprise at a fraction of the cost, and at no risk to human life. Unmanned probes have shown us that the surface of Venus, under its dense clouds of carbon dioxide and sulfuric acid, is geologically active. Its 800-degree surface temperature, so different from that of our Earth, is caused by a runaway greenhouse effect. The research which led to this understanding has helped us better comprehend the implications for greenhouse gases in our own atmosphere. Unmanned probes have shown us the rings and moons of the great giant planets Jupiter, Saturn, Uranus, and Neptune. We have seen a moon with more than a dozen active volcanoes (Jupiter's Io), a moon with an ocean of liquid nitrogen (Saturn's Titan, soon to be visited by a probe from the *Cassini* spacecraft), and perhaps most evocatively, a moon with an ocean of liquid water protected by a frozen crust (Jupiter's Europa). Only Pluto has yet to be visited by a spacecraft, and that mission is planned within the next 20 years.

Many other exciting discoveries have come from old-fashioned ground-based astronomy, aided by the incredibly successful orbiting Hubble Space Telescope. An entirely new solar system population, the Kuiper Belt, has been discovered far from the Sun; there are probably millions of these objects, and astronomers literally cannot keep up with them. The collision of Comet Shoemaker-Levy 9 with Jupiter in 1994 made clear that collisions do happen in the Solar System today; a network of small telescopes has made great strides in finding and cataloging objects which could someday crash into the Earth.

Using Hubble instruments, humans have even been able to determine the age of the Universe to be 13.7 billion years. We have also learned that most of the mass of the Universe is not contained in the objects we see. Instead, stars and planets make up only a few percent of the mass of the Universe — the rest is some mysterious "dark matter," the existence of which has been suspected for decades. Most perplexing of all, recent work — again using the Hubble telescope — has confirmed that the Universe is expanding, a theory first suggested in the early part of the 20th century. The shocking new result: the expansion is actually speeding up, as though the stars and galaxies we see were pushing away from each other.



This view of nearly 10,000 galaxies is the deepest visible-light image of the cosmos. Called the Hubble Ultra Deep Field, this galaxy-studded view represents a "deep" core sample of the Universe, cutting across billions of light-years. (NASA)

Perhaps, if you have read this far, I do not need to justify such research, but I would like to share why I find it so exciting. I have always had an interest in what's going on in my backyard. Is that a purple finch or a house finch at the feeder? Is the tree with the nice colors a red maple or a silver maple? What star is so bright right overhead at sunset during the summer? For me, and for many others, this curiosity about our surroundings naturally extends outward and upward. If one knows just where to look, our nearest large galactic neighbor, the Andromeda Galaxy, can be seen with the naked eye. This faint, fuzzy patch leads us to contemplate the swirling conglomeration of galaxies of which our planet is but an infinitesimal part.

When we look at astronomical objects, we ask not only "What is that?" but also "What was the Universe like at an earlier time?" When I study asteroids and comets, I am sampling material from the earliest days of the Solar System. When astronomers study the expansion of the Universe, they use telescopes as "time machines" to peer back billions of years, observing what the first galaxies looked like. These questions, I submit, are in the same spirit of adventure that drives the fictional crew of the *Enterprise,* at far less cost and risk to human life.

Am I saying that we — the citizens of Earth — should not consider a return to the Moon, or an eventual mission to Mars? Absolutely not. But missions like these are enormous, and only the combined mental and physical resources of an entire planet are likely to be able to carry them off. In the meantime, as we work together to settle our differences, we humans can learn much about our world through collaboration in unmanned missions and traditional observing programs

that will enlighten and inspire us all to go, cautiously and prudently, where no humans have gone before.