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## Space

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The Chandra project is one of the most ambitious efforts to explain the universe. The telescope will remain in orbit at least five years, and may help locate and define "dark matter," a mysterious substance thought to provide the gravity that holds galaxy clusters together.

Thanks to space exploration, scientists' understanding of the universe in which we live is growing at incredible rates. Although scientists and theologians caution that space missions neither prove nor disprove the existence of God, they certainly are worthy of believers' attention.

## Century of discovery

Most Americans remember the Apollo missions to the moon or at least have seen Tom Hanks in the movie "Apollo 13." Many people even remember where they were when Neil Armstrong took that first step on the moon July 20, 1969. Eleven astronauts since have walked on the moon.

Subsequent space missions have kept people riveted, though perhaps to a lesser degree.

In July 1997, Pathfinder landed on Mars and sent out the little robot, Sojourner. Area residents packed Rochester's Strasenburgh Planetarium, the region's only sizable public planetarium, in July 1997 to watch the mission on large TV screens, recalled Steve Fentress, planetarium director.

"There is a feeling of participation, of being close to the edge of exploration" because such satellite television programs and Internet enable us to watch the events unfold, Fentress said.

In this decade NASA has mounted about 130 missions, Fentress noted. Of those, nearly 100 are currently in operation, or under study and development. Among those being considered is a return trip to Mars.

"This century, knowledge and science has created enormous technology and has made us do unprecedented things," observed Yervant Terzian, former chairman of the Department of Astronomy and Space Sciences at Ithaca's Cornell University. "We discover more and more every day."

Two of the biggest discoveries this century, he noted, were by American astronomer Edwin Hubble — for whom the Hubble Space Telescope was named — and Albert Einstein. Hubble discovered that galaxies were flying away from us and from each other; Einstein's general theory of relativity indicated the universe was expanding, and thereby also predicted that space-time had a single beginning, the theory now called the "big bang."

## How? Why?

Yet in spite of the growing mass of discoveries, fundamental questions remain about the universe.

Why are we here?

Where did we come from?

What is our future?

Ultimately, Fentress said, certain ques-

"I take  
a great  
deal of  
inspiration  
from  
understanding  
the  
universe"

-Tom Casey



tions must be answered by each individual for him or herself.

"I like to say science deals with those parts of the world that are the same for everybody," he said. "That doesn't mean it answers all the questions people have in getting through a life. Putting it into your own view of what is significant in life is your responsibility. We don't claim to do that. ... Our job as an institution that does science education is to show what the physical evidence is."

Terzian summed up the significance of such physical evidence.

"I think the most important thing is we realize the universe is (potentially) explainable, even though we don't know exactly how it began," he said. "We can explain — in principle — the universe as of about a second after it began, to now."

Clues can be found in various emissions from objects in space. Traveling billions of light-years, these emissions take eons to reach telescopes on earth and positioned in space. Thus, scientists actually are looking back in time when they view these clues with telescopes.

Further, research has shown the universe behaves according to laws — gravitational, electromagnetic and nuclear. Research also is coming closer to pinpointing the age of the universe. It currently is believed to be 12-15 billion years old, and Chandra may help scientists narrow that range even further.

Terzian said space exploration, with the-oretic work, proves that the universe evolved and is expanding.

"What is important is we know it began rather than existed forever," he said.

Some scientists currently believe that the universe will continue to expand, whereas others predict that it eventually will collapse back to its starting point.

"We don't know which model is correct," Terzian said. But thanks to Chandra and other telescopes, the answer may come within five years.

Terzian was cautious in expressing his

personal belief that the universe is likely to stop its expansion and recollapse.

"Science is about doubt," he said. "In science we doubt everything. When we find our predictions are not good enough we make new theories and test those. Science advances by correcting our mistakes, so to speak. Till one day we may have a theory of everything, a T.O.E."

A "T.O.E." probably would please many of the adults Fentress meets as planetarium director. Children, he said, want to know earth's chances of being hit by an asteroid and when the sun will burn out. But adults "seem a little more interested in finding serenity."

Being serene about the universe was easy until this century. People believed that although they would age and die, the universe would not, the noted physicist/astronomer Stephen Hawking wrote in his 1988 book, *A Brief History of Time*. And they took comfort in the thought that the world stays the same. Then came evidence of the big bang and of an expanding universe.

"In an unchanging universe a beginning in time is something that has to be imposed by some being outside the universe; there is no physical necessity for a beginning," Hawking wrote. But if the universe is expanding, he added, there might be physical reasons for a beginning.

"An expanding universe does not preclude a creator," he wrote, "but it does place limits on when he might have carried out his job!"

## Something from nothing

The logic of big-bang theories does not require the existence of a creator, acknowledged Jesuit Father David Toolan, associate editor of *America* magazine and a writer on science and religion.

"You can't make any direct theological inferences," observed the priest, who holds a doctorate in philosophical theology. "Certainly nobody in the church is naive about that anymore."

Yet he finds it fascinating that over a period of 12 billion years the expansion rate of the universe, the evolution of stars and various other forces came together in exactly the correct way to allow human life to begin.

"It's almost as if — and scientists hate this idea — life was programmed from the beginning," Father Toolan said. "Scientists get nervous because it gets too close to religion. It isn't random. It is the most precise thing you can imagine."

In assuming, for example, that a universe with no actual beginning eliminates the need for a creator God, Hawking and other scientists have misunderstood the doctrine of creation, the priest said.

"The doctrine of creation has more to do with why is there something rather than nothing," he said.

Likewise, if there is life on other planets, Father Toolan said, "I don't think it should bother Catholics one iota. It bothers people who take the Bible literally, and Catholics don't. We don't think the book of Genesis is (intended) to tell us science or astronomy."

Pope John Paul II also made this point to

a group of scientists meeting Oct. 3, 1981, at Castelgandolfo.

"The Bible itself speaks to us of the origin of the universe and its makeup, not in order to provide us with a scientific treatise, but in order to state the correct relationships of man with God and with the universe," the pope said. The Bible "does not wish to teach how heaven was made but how one goes to heaven."

## 'Wondrous diversity'

If space exploration poses no threat to Catholics' understanding of creation, why should they pay particular attention to ongoing developments?

Father Toolan answered that question in a talk he gave Nov. 10, 1996, at a U.S. bishops' science workshop. His topic was "Why Care About Cosmology?"

He posited three reasons to care:

- Because Catholic faith and liturgy are "sensuously bound to the symbolism of fire, air, earth and water... Contemporary cosmology can inject new life into our sacramental theology. We somehow lost sight of Aquinas' thesis that it takes the wondrous diversity of a whole universe to manifest the goodness of God. Paying attention to developments in scientific cosmology will help us regain our senses."

- "(B)ecause you care about the glory of God — which the heavens and the earth declare. ... The Creator of 50 billion galaxies across 300 billion light years of expanding space cannot be a small tribal or household god, much less one devoted to feeding the consumer desires of our small personalities."

- And because God's comprehensive "rainbow covenant" with Noah means God cares for all of creation — not just us humans.

The suggestion that "from the very beginning, 50 billion galaxies have been silently working toward us, having no other purpose than to produce us, sounds like an invitation to self-inflation — anthropocentrism gone berserk," Father Toolan said.

He noted that if the universe's history were collapsed into one year, human history would fit into the last 10 seconds and Christ would have appeared two seconds ago.

Fortunately, the first photographs of earth that the Apollo missions produced helped to reinforce a global view of human life, he told the *Courier*.

"It's contributed to this sense of being on a fragile and beautiful planet that we ought to take care of," he said.

The latest study of our origins, he said, "enhances consciousness of how embedded human beings are in a network of energy systems that stretch from the black depths of galactic space down to the plant chloroplasts swimming in our cells."

Further, he stated, "without star energy, without those cellular chloroplasts, we could neither breathe, move a muscle or think a thought."

"If you want a body of overwhelming evidence that we are one body with the earth and the heavens, contemporary cosmology and biology will give it to you."

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