

individual Catholics who took no part in the Nazi atrocities have nothing to apologize for, and individual Catholics who did take part have no one to apologize to, since the murdered “are hardly in a position to absolve anyone.”

At another level (as when the pope says “the church as such”), Novak observes, a Catholic understands “the church” to refer to its magisterium, or teaching authority. Catholics see that “as expressing God’s will beginning with Scripture and extending into the ongoing development of church doctrine.” Since the magisterium is the highest authority on what is true or false, right or wrong, it cannot be in error—and the church, understood in this sense, therefore cannot apologize for being in error.

That claim may seem arrogant to many outside the fold, Novak notes, but Jews should be able to understand it, since “on this score, Judaism is no different. . . . The Jewish tradition presents itself as the greatest revelation of God’s truth that can be known in the world. That is why we call ourselves ‘the chosen people.’”

In religious traditions such as Judaism and Catholicism, he says, the criticism must

come from within, through reinterpretation of past teachings. While the magisterium cannot err, church teachings can be improperly formulated, leading to, in the pope’s words, “erroneous and unjust interpretations”—and requiring reinterpretation. That is what John Paul II and the Vatican have been doing.

Indeed, Novak writes, they have been doing more: engaging in what the Vatican statement called “an act of repentance,” adding, in parentheses, *teshuvah*, the Hebrew word for repentance. For Catholicism, as for Judaism, Novak observes, “the relationship with God is primarily a communal affair, not merely a relationship between an individual person and God.” So, while there is no *moral* collective responsibility, “there still is an *existential* sense of collective sorrow and shame when other members of the community—even those as estranged from the community as the Nazis were—commit sins, especially sins having great public consequences.”

“To expect an apology rather than *teshuvah*,” Novak concludes, “is to call for something quite cheap when there is the possibility of something much more precious.”

SCIENCE, TECHNOLOGY & ENVIRONMENT

The New Riddle of the Universe

A Survey of Recent Articles

Astronomers have long known that the universe is expanding, and, until now, they assumed that gravity was slowing the enlargement down. But recent observations of distant exploding stars have shown that instead the expansion may be *accelerating*—and this has cosmologists scratching their heads in wonder. Writing in *Scientific American* (Jan. 1999), a half-dozen astronomers and cosmologists ponder the astonishing development.

Craig J. Hogan, Robert P. Kirshner, and Nicholas B. Suntzeff, astronomers at the University of Washington, Harvard University, and Cerro Tololo Inter-American Observatory in La Serena, Chile, respectively, belong to one of the two teams that have tracked a few score of the supernovae (exploding stars), in

galaxies hundreds of millions of light-years away. Such blasts occur when a dead star becomes a natural thermonuclear bomb; these took place four to seven billion years ago. The big surprise was that the supernovae were “fainter than expected,” and therefore farther away, the astronomers say. Though the difference in brightness was slight—only 25 percent less than forecast—it was “enough to call longstanding cosmological theories into question.”

“Taken at face value,” the three astronomers write, “our observations appear to require that expansion [of the universe] is actually accelerating with time.” But that cannot happen if the cosmos is made up exclusively of normal matter, because “gravity must steadily slow the expansion.” It could happen, however, if all the empty space in the uni-

verse were filled with an unknown form of matter or energy whose gravity *repelled* rather than attracted.

That weird idea runs counter to the big bang theory, as well as the inflation theory that shores it up. The big bang theory, which holds that the universe has been expanding for about 12 billion years, assumes that matter is spread out evenly and is governed by only one force, gravity. To correct for certain shortcomings in the theory, cosmologists in the early 1980s adopted inflation theory, which, borrowing ideas from particle physics, holds that there was an early period of very rapid expansion after the big bang.

But a decade ago, notes physicist Lawrence M. Krauss, of Case Western Reserve University, Cleveland, it became clear that when the visible contents of the universe were added up, the collective gravitational force was not enough to bring the outward impulse from the big bang into eventual balance. That balance would be necessary if the universe were to avoid expanding forever or, alterna-

tively, collapse in a fiery “big crunch.” So cosmologists concluded that invisible matter (“dark matter”) must exist in space, exerting sufficient gravitational force to make up the deficit.

But if, as astronomers’ recent observations of exploding stars suggest, the expansion of the universe is speeding up, then even the unseen matter is not enough. A kooky form of antigravity matter or energy apparently must exist, or else the universe will keep expanding forever.

Physicists Martin A. Bucher, of the University of Cambridge, and David N. Spergel, of Princeton University, do not rule out the latter possibility, and contend that inflation theory can be modified to take an eternally expanding universe into account. Krauss, however, believes that the other alternative—that the universe is “filled with an energy of unknown origin”—is more likely. In either case, he observes, “a dramatic new understanding of physics” is now required.

Digging Up Doubt

“Why Settle Down? The Mystery of Communities” by Michael Balter, and “The Slow Birth of Agriculture” by Heather Pringle, in *Science* (Nov. 20, 1998), American Assn. for the Advancement of Science, 1200 New York Ave., N.W., Washington, D.C. 20005.

Archaeologists have long believed that the rise of farming, which occurred about 10,000 years ago, after the last Ice Age ended, led to the first human settlements. As nomads shifted away from hunting and gathering, it was thought, they needed to be near their crops and animals, and so had to stay put and form stable communities. New evidence from digs in Turkey, as well as new discoveries about ancient agriculture around the world, are casting strong doubt on the idea that agriculture and settlements emerged together in a single “Neolithic Revolution.” So report *Science* contributing correspondent Balter and Pringle, a science writer based in Vancouver, British Columbia.

In recent years, an Anglo-American army of 90 excavators has descended on Çatalhöyük, a sprawling, 9,000-year-old village near the modern Turkish city of Konya, and has been slowly sifting through its multi-layered remains. Discovered in 1958, Çatalhöyük was hailed initially as the world’s

oldest known city, with shared institutions, a division of labor (made possible by farm surpluses), and a dependence on agriculture. But today, the archaeologists, led by Ian Hodder of Cambridge University, have tentatively reached a different conclusion: that Çatalhöyük, though it may have harbored as many as 10,000 people, was not a “city” at all but a decentralized community of extended families, with very little division of labor and only limited agriculture. The occupants still heavily relied on hunting and gathering.

Excavations by a University of Istanbul team at another site, a smaller village in Central Anatolia that appears to be about 1,000 years older than Çatalhöyük, have produced even stronger evidence against the idea of a single Neolithic Revolution, Balter notes. This settlement, home to several hundred people at its height, “has a more complex arrangement of buildings than Çatalhöyük. A large collection of mud-brick houses is partly surrounded by a stone wall, and [there is] a