

## On Christmas Day Peace on Earth, as it is in heaven?

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During this holiday season, as we pray for peace on Earth with renewed earnestness, we often invoke an image common to many religions: the paradigm of heavenly peace. In the Bible, for example, God "makes peace in His high places (Job 25:2)." But what does peace in heaven mean? For some of us, perhaps the vision is one of lions and lambs lying together; for others, it may be a more mundane wish for prosperity and political stability.

But is there a literal image of "peace in heaven" that had clear connotations for our forebears?

I'm an astronomer. I can imagine my ancestors looking up at the night sky and praying for a world with the order, predictability, eternity and quiescence of the stars in the dark and silent night sky. Perhaps the prophets, poets and philosophers of antiquity had such tranquillity in mind.

But in truth, the heavens are none of these things.

The cosmos is filled with stupendous patterns, from the clustering of stars and nebulae in our Milky Way galaxy, to the aggregation of thousands of galaxies into incredible filamentary superstructures. But none of these is arranged in rows or columns, or even in simple numerical relationships. They are found where the interplay of gravity and the other forces of nature leaves them - spectacular and beautiful, but in no order.

Nor are the motions of heavenly bodies entirely predictable. By and large they are chaotic, meaning that it is impossible to know with certainty precisely where anything will be found in the distant future. Even the planets in our solar system, the archetypical clockwork mechanism of nature, are in principle chaotic in their motions. They interact in ways that, although governed by known rules of cause and effect, are complex and sensitive. Small perturbations can grow so large over time that even supercomputers have no chance of predicting the location of the Earth in the future.

As for eternal permanence, thank God that this is not the case - our lives depend on it. Stars die. Massive ones expire in tremendous explosions, called supernovae, that seed the universe with their ashes. These elements, remnants of nuclear reactions that burned during the stars' lifetimes, are the bases of life. They include carbon, oxygen and nitrogen, none of which existed when the universe was born. Only hydrogen and some helium existed back then, in the beginning. Without the subsequent birth and death of stars, we would not exist. No, there is no permanence in the universe.

Which brings me to quiescence. The cosmos is not a tranquil place. The death of stars is only the beginning. Our Sun erupts in flares that eject energetic particles into space, threatening astronauts; only the Earth's thin atmosphere protects us from their devastation. Other kinds of stars spew X-rays or gamma

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rays, or collide in massive conflagrations, or fling each other out into space if their orbits happen, through chaos, to come too close. Galaxies smash into each other, triggering the massive black holes at their centers to launch prodigious jets of matter and energy. Even the universe itself was created in an explosive event, the "big bang," about 13 billion years ago, leaving in its wake hydrogen and helium atoms.

So, what could "peace in heaven" possibly mean today? Religion offers some answers. The Jewish mystical school called Kabbalah, whose innovative theology flourished during the 14th through the 16th centuries, had a tradition that the universe was created in an explosive burst. Science and most schools of theology did not abandon their picture of an eternal, static universe until the mid-1900s, when the big-bang explanation became overwhelmingly convincing.

The Kabbalists interpreted the first word of the Bible, "In the beginning," as implying a dynamic, evolving universe born from a singular event in time. In such a universe, there naturally was birth and death, harmony and discord, conflict, confusion, beauty and even destruction.

The view of the Kabbalists was wonderfully optimistic. In the old, unchanging universe, what purpose is there for humanity? Things will ever be as they are now. But in a world that was created and evolves, say the Kabbalists, we can make a difference. *Tikkun olam*, repairing the world, is our task - to use love, good deeds and righteousness to make the world a better place.

The cosmic story is not over. Humanity is God's partner in creation.

I suggest that when we pray for peace as it is in heaven this season, we neither rely on supernatural intervention nor hope to replicate the fictitious vision of a sterile cosmos, but rather kindle a mindfulness that what we do matters.

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