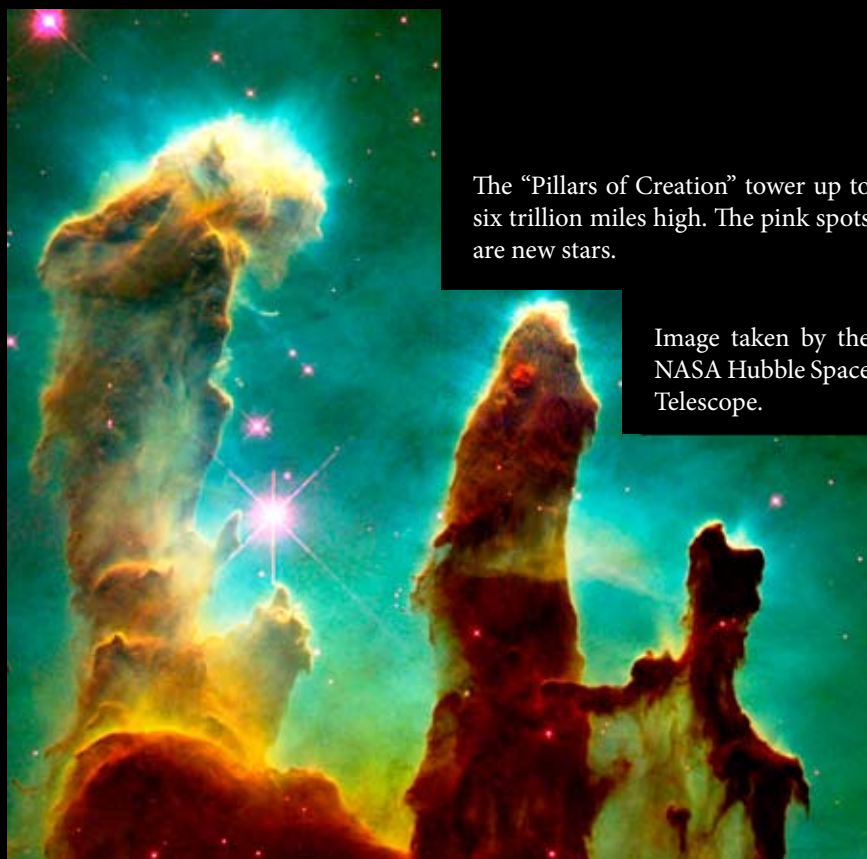


A Taste of
ATOMS
EINSTEIN and the
UNIVERSE



The “Pillars of Creation” tower up to six trillion miles high. The pink spots are new stars.

Image taken by the NASA Hubble Space Telescope.

ROBERT L. PICCIONI

Author of *Everyone’s Guide to Atoms, Einstein, and the Universe*



Stars are born from the collapse of immense gas clouds. One such cloud seen in green in the upper left corner is the Eagle Nebula, with talons in front and wings that span 200 trillion miles. Image by NASA Spitzer. [A more complete description can be found on page 136 of *Everyone's Guide to Atoms, Einstein, and the Universe.*]



The collapse of a nebula generally forms a group of stars, a *star cluster*, as seen in this NASA Hubble image of NGC 3603. These new stars are less than 2 million years old and are 20,000 *light-years* from Earth. A light-year is a convenient measure of cosmic distances; it is the distance light travels in 1 year, about 6 trillion miles. Thus NGC 3603 is 120,000,000,000,000,000 miles away, which isn't very far by cosmic standards. [pg. 136]

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Stars are generally found in immense assemblies called *galaxies*. This is M51, the Whirlpool Galaxy, which is 65,000 light-years across, contains 160 billion stars, and is 23 million light-years away. M51 lies just in front of its smaller companion galaxy NGC 5195. Image by NASA Hubble. [pg. 57]



The Cat's Eye Nebula, 3000 light-years away, was formed from a dying star's castoff outer layers that now surround its collapsed core, a *white dwarf*, that is seen as the white dot at the center of this image by NASA Hubble. [pg. 170]



The Sombrero Galaxy is 28 million light-years away and has a mass of 800 billion suns. The light seen in this NASA Hubble image has taken 28 million years to reach us. So this is not an image of what the Sombrero looks like today; this is what it looked like 28 million years ago—long before humans existed. This ancient image has been preserved in the time capsule of light traveling across the vastness of space. *Telescopes are time machines*—they take us back in time and let us see the past as it *is happening* in real time. [pg. 208]



Image of the Mice Galaxies by NASA Hubble. Blue light comes from new, massive stars created by a “recent” collision of these galaxies that are 300 million light-years away. We see the Mice as they were 300 million years ago, before the first dinosaurs roamed the Earth. [pg. 206]

Is Life Merely an Accident?

Modern science has discovered that the conditions necessary for life are extraordinarily improbable. Let's divide the requirements into four categories, all of which are essential for the existence of life: a viable universe; the right atoms; a habitable environment; and an effective genetic code.

Albert Einstein said: "What really interests me is whether God had any choices in the creation of the universe." I believe his quandary was: do the laws of nature and mathematics allow the existence of universes quite different from ours? Fifty years later,...