

of the Universe is as critical a value as the amount of power in a rocket. If the Big Bang were less powerful, the rate of expansion would be much slower. The pull of gravity would quickly take over and bring the galaxies crashing back together in a Big Crunch. There would not be enough time for stars to burn and cool to form heavier elements which make up planets like Earth. The crash would occur before even the basic elements of life could be formed.

Similarly, if the Big Bang were more powerful, the initial rate of expansion would be too fast. The energy and material would blast away so rapidly that gravitational attraction could not bring clumps of matter together to form stars and galaxies. Like a rocket that is too powerful, the mission would be lost in empty space.

Alan Lightman, writing in the October issue of *Science* 82 emphasized the importance of the cosmological condition: "Since living structures apparently require complex atoms, and complex atoms were made in stars, the cosmological parameter in a life-supporting universe could not have been much different than it is."³

Other seemingly "determined" parameters are the gravitational coupling constant and the residual heat radiation from the Big Bang. If either of these mysterious conditions varied in essential orders of magnitude, it would drastically change the life-supporting capabilities of the Universe.

Have there been other universes in the past? There is no evidence whatsoever. Will a new universe exist in the future? Science can only speculate. But what has emerged out of the theoretical investigation is highly relevant. There are many very fundamental properties that our Universe "just happens" to possess. There is no logical reason or statistical probability that has determined these basic conditions to be what they are, except one: we are here. And we are asking questions such as: Who instituted the critical cosmological conditions so that they would be exactly right to produce galaxies, stars, and, more importantly, at least one habitable planet? Who designed the nuclear and electromagnetic forces to produce just the "right" atoms with the "proper" characteristics that could be chemically combined into water and the compounds of carbon that form organic molecules?

The evidence now suggests that hypothetical universes that could sustain even a semblance of life are statistically very improbable. The evidence is that our Universe is one of a kind. And its fundamental laws and properties seem not only to be determined, but also designed for us. With this in mind, let us now consider research on the mysterious origin of our Universe.