

The Cosmic Lights of Hannukah

The flames of the Hannukah candles recall that historic, holy miracle when light illuminated the darkness of the moment. I'm not talking about the miracle of the Macabbees, although our candles certainly do recall those events. I mean the miracle of the Creation. The light of "Let there be light!" carries the same religious message, but highlights something else: the insights of modern science.

From the time of the Macabbees until the 1930's virtually all theologians and scientists adopted the Greek view: the universe is eternal and unchanging. But in 1929, Edwin Hubble discovered that galaxies are moving away from us, and Einstein's theory of relativity explained those motions as cosmic expansion. The universe was created in the remote past in a "big bang," a blaze of light from an infinitesimal speck, and has expanded since. Today astronomers know with certainty that the universe is neither eternal nor unchanging.

A few Jewish philosophers, most eloquently Maimonides, rejected the Greek view. He argued that, "everything except God has been brought into existence out of nonexistence."

Four centuries after Rambam, the Kabbalists of Safed, building on their long mystical tradition, explicated the first word of the bible, "In the beginning [in Hebrew: B' Resheit]." They wove an intricate account of how the universe was created with light from an infinitesimal speck, and its expansion since. They called that speck "the Resheit" – hence the first word of Torah literally means "With the Resheit."

Astronomers now understand that light in the hot embryonic cosmos was scattered like headlights in a fog. About 380,000 years after Creation, once things had cooled and atoms could assemble, light traveled freely. That same light is seen today as the "cosmic microwave background radiation." Discovered in 1965, that light has become, like the motions of galaxies, a key scientific diagnostic of what happened way back then. The Nobel Prize in Physics went last year to two astronomers who measured this radiation, which shows that the Creation occurred 13.73 billion years, plus or minus about 1%.

The Hannukah lights are not only a reminders of events past, they are a moral guide to the future. They teach the lesson that people have the ability to affect change. We can reject idolatry. We can, by our deeds, shine light into the darkness of the world, and make life better. What is less appreciated is that the cosmic lights of creation have taught a similar message. The universe is *not* unchanging – it is evolving, and therefore we can make a difference to its progress.

The Kabbalists explain that imperfections were embedded in the fabric of the newborn universe. Humanity's task, they say, is *tikkun olam*, healing or repairing these breaches in the world through righteous deeds. By our engagement in *tikkun*, we invoke the spirit of the light of that creation.

Modern science recognizes that light – from the Creation or from our Hannukah menorahs – is much more than just the visible glow of electromagnetic radiation we see with our eyes. The

electromagnetic radiation we currently measure with our instruments spans nearly eighty octaves – from the longest radio wavelengths to the shortest X-rays wavelengths. The visible portion is merely one octave. If light were music, then the music of the visible that we can perceive comes from the 12 keys in one octave of a piano whose remaining octaves and keys stretch the length of a football field. There is more, much more, to the lights of Hannukah than meets the eye.

Science's precise, self-consistent methodology likewise prompts a holiday reflection. Its intellectual openness and quantitative inquiry have been wonderfully productive, and are worthy of emulation by us all. Astronomy has uncovered deep new puzzles: the existence of "dark matter," for example, and an outward acceleration of the distant cosmos. But both the answers and questions increase our confidence in the methods of science. The new questions also compel humility: we do not know it all.

"Not by conflict, and not by power, but by My spirit." This is the ethical message that the rabbis see in the Hannukah season. May the lights of our candles and our deeds, like the miraculous light of creation, illuminate the darkness. Let there be light.

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