Science and the Sense of Wonder

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Essay published in 1983 by Prometheus Books in an excellent Asimov collection titled 'The Roving Mind'. The essay is renamed 'Science and Beauty' in the collection, pp 113-115. The Whitman poem 'When I heard the learn'd astronomer,' first appeared in 1865 in a collection of poems titled 'Drum-Taps'. The poem then appeared in the 1867 and later editions of 'Leaves of Grass'.

By ISAAC ASIMOV
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When I heard the learn'd astronomer,
When the proofs, the figures, were ranged in columns before me,
When I was shown the charts and diagrams, to add, divide, and measure them,
When I sitting heard the astronomer where he lectured with much applause in the lecture room,
How soon unaccountable I became tired and sick,
Till rising and gliding out I wander'd off by myself,
In the mystical moist night-air, and from time to time,
Look'd up in perfect silence at the stars.

I imagine that many people reading these lines from one of Walt Whitman's best-known poems tell themselves, exultantly, "How true! Science just sucks all the beauty out of everything, reducing it all to numbers and tables and measurements! Why bother learning all that junk when I can just go out and look at the stars?"

That is a very convenient point of view since it makes it not only unnecessary, but downright esthetically wrong, to try to follow all that hard stuff in science. Instead, you can just take a look at the night sky, get a quick beauty-fix, and go off to a nightclub.

The trouble is Whitman is talking through his hat, but the poor soul didn't know any better.

I don't deny that the night sky is beautiful and I have in my time spread out on a hillside for hours looking at the stars and being awed by their beauty (and receiving bug-bites whose marks took weeks to go away).

But what I see with my eye - those quiet, twinkling points of light - is not all the beauty there is. Should I stare lovingly at a single leaf and willingly remain ignorant of the forest? Should I be satisfied to watch the sun glinting off a single pebble and scorn any knowledge of a beach?

Those bright spots in the sky that we call planets are worlds. There are worlds with thick atmospheres of carbon dioxide and sulfuric acid; worlds of red-hot liquid with hurricanes that could gulp down the whole Earth; dead worlds with quiet pockmarks of craters; worlds with volcanoes puffing plumes of dust into airlessness; worlds with pink and desolate deserts - each with a weird and unearthly beauty that boils down to mere specks of light if we just gaze at the night sky.

Those other bright spots, that are stars rather than planets, are actually suns. Some of them are of incomparable grandeur, each glowing with the light of a thousand suns like ours; some of them are merely red-hot coals doling out their energy stingily. Some of them are compact bodies as massive as the Sun, but with all that mass squeezed into a ball smaller than the Earth. Some are more compact still, with the mass of the Sun squeezed down into the

volume of a small asteroid. And some are more compact still, with their mass shrinking down to a volume of zero, the site of which is marked by an intense gravitational field that swallows up everything and gives back nothing; with matter spiraling into that bottomless hole and giving out a wild death-scream of X-rays.

There are stars that pulsate endlessly in a great cosmic breathing; and others that, having consumed their fuel, expand and redden until they swallow up their planets if they have any (and someday, billions of years from now, our Sun will expand and Earth will crisp and sere and vaporize into a gas of iron and rock with no sign of the life it once bore). And some stars explode in a vast cataclysm whose ferocious blast of cosmic rays, harrying outward at nearly the speed of light, reaching across thousands of light years to touch the Earth and supply some of the driving force of evolution through mutations.

Those paltry few stars we see as we look up in perfect silence (some 2,500, no more, on even the darkest and clearest night) are joined by a vast horde we don't see, up to as many as three hundred billion - 300,000,000,000 - to form an enormous pinwheel in space. This pinwheel, the Milky Way Galaxy, stretches so wide that it takes light, moving at 186,282 miles each second, a hundred thousand years to cross it from end to end; and it rotates about its center in a vast and stately turn that takes 200 million years to complete - and the Sun and Earth and we ourselves all make that turn.

Beyond our Milky Way Galaxy are others, a score or so of them bound to our own in a cluster of galaxies; most of them small, with no more than a few billion stars in each; but with one at least, the Andromeda Galaxy, twice as large as our own.

Beyond our own cluster, other galaxies and other clusters exist; some clusters made up of thousands of galaxies. They stretch outward and outward as far as our best telescopes can see, with no visible sign of an end - perhaps a hundred billion of them in all.

And in more and more of those galaxies, we are becoming award of violence at the center - of great explosions and outpourings of radiation, marking the death of millions of stars, perhaps. Even at the center of our own galaxy there is incredible violence, masked from our own solar system far in the outskirts by enormous clouds of dust and gas that lie between us and the heaving center.

Some galactic centers are so bright that they can be seen from distances of billions of light years; distances from which the galaxies themselves cannot be seen so that only the bright starlike centers of ravening energy show up - as quasars. Some of these have been detected from over 10 billion light-years away.

All these galaxies are hurrying outward from each other in a vast universal expansion that began 15 billion years ago when all the matter in the universe was in a tiny sphere that exploded in the hugest conceivable shatter to form the galaxies.

The universe may expand forever or the day may come when the expansion slows and turns back into a contraction to re-form the tiny sphere and begin the game all over again so that the whole universe is exhaling and inhaling in breaths that are a trillion years long perhaps.

And all of this vision - far beyond the scale of human imaginings - was made possible by the works of hundreds of learn'd astronomers. All of it; all of it was discovered after the death of Whitman in 1892 and most of it in the last 25 years, so that the poor poet never knew what a stultified and limited beauty he observed when he look'd up in perfect silence at the stars.

Nor can we know or imagine now the limitless beauty yet to be revealed in the future - by science.