

THE BEAUTY OF SYMMETRY

BY JAMES D. NICKEL

The realm of geometry as an investigation into the structure of space is, indeed, beautiful. From the rudiments of line and rotational symmetry to the multifaceted symmetries hidden in the physical creation (and discovered by modern physics), this wonder humbles the intellect not blinded by naturalism (read carefully Proverbs 25:2).¹



Courtesy of Corel Stock Photos

There is no question that mathematical symmetry plays an important role in art. Geometrical symmetries, sometimes of great subtlety, can be found in decorative patterns (e.g., friezes, tilings, arabesques, or French gardens). In architecture, they are ubiquitous (e.g., the eight-fold symmetry of the rose window or the intricate patterns of the rib work, groins, and vaults in Gothic cathedrals).

The works of God are pleasant (Genesis 2:9). The beauty of God's works gives pleasure to the senses (both cognitive and tactile).

In music, mathematical symmetry is found in the scales of notes (first discovered in the 6th century BC by the Greek mathematician Pythagoras). Symmetry is not only found in these scales (where the ratio of the frequency of a specific note is related in whole numbers to the frequency of another note), but also found in the meter, rhythm, and melody of music.



Courtesy of Dover Publications



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Symmetry is not only found in these scales (where the ratio of the frequency of a specific note is related in whole numbers to the frequency of another note), but also found in the meter, rhythm, and melody of music. In poetry, symmetrical structure exists in the metrical and rhyme schemes. In dance, it appears in the patterns of steps and sometimes in the patterns of the dancers themselves (e.g., observe the marvelous symmetry between the dance pair of Ginger Rogers and Fred Astaire). Symmetry contributes



Courtesy of James Nickel

to the artistic unity of a work, to its balance, proportion, and wholeness. The connection between symmetry and unity is exceedingly important and is applicable to the symmetry of mathematical physics. Symmetry requires all the parts of a pattern to be present (e.g., think of the starfish with one arm cut off) and is therefore a *unifying* principle in the *diversity* of form.

Carefully read these remarks by physics professor Stephen M. Barr:

Many people think that modern science is far removed from God ... in our knowledge of physical nature we have penetrated so far that we can obtain a vision of the flawless harmony which is in conformity with sublime reason.

Stephen M. Barr, *Modern Physics and Ancient Faith* (Notre Dame: University of Notre Dame Press, 2003), p. 109.

¹ Most of these more advanced symmetries are far from obvious and require very sophisticated mathematical tools and concepts in order to understand them.

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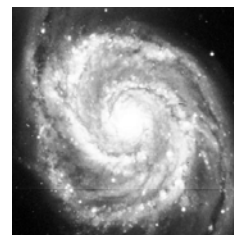
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Principles of symmetry are really at the heart of all of modern physics When we say that these forces [in the physical realm – JN] are “based on” symmetries, we mean several things. Most profoundly, the very fact that there are such forces in nature is a consequence of these symmetries. If nature did not have these symmetries, it would also not have these forces. In addition, the characteristics of these forces are controlled by their symmetries. The structures of mathematical laws governing these forces are to a large extent determined by their underlying symmetries. So much is this the case that modern fundamental physics is not so much driven by the search for new kinds of matter or new forces, *but for the new and more powerful principles of symmetry that are suspected to lie beneath the surface of what is presently understood.*²

If symmetry is found in works of art of every sort, and is an important element in what it is to be beautiful, and if as well the laws of nature are based upon symmetries that are so sophisticated and so deep that while we may study them with the tools of modern mathematics they lie far above our mental

Geometry is the archetype
of the beauty of the world.
Johannes Kepler.

powers to appreciate on an intuitive level—does that not suggest the mind of an artist at work that is far above the level of our own minds? When we contemplate this strange and beautiful universe, well may we



Courtesy of NASA

ask, in the words of the poet Blake, “What immortal hand or eye could frame thy fearful symmetry?”³

A peculiar beauty reigns in the realm of mathematics, a beauty which resembles not so much the beauty of art as the beauty of nature and which affects the reflective mind, which has acquired an appreciation of it, very much like the latter.

E. E. Kummer, *Berliner Monatsberichte*
[1867], p. 395.

Symmetry and beauty are closely related. What God has made (as the ultimate artist) reflects a beauty and a symmetry that stuns and awes the beholder. In their work, mathematicians strive for beauty and symmetry in their equations. Why? This beauty is an element of completeness or unity. To many a mathematician, *the equations must be true because they are so beautiful* (symmetric). It is the glory of a mathematical physicist to construe from the creation the manifold beauty and order of a *universe* (unity in diversity) of the

² Stephen M. Barr, *Modern Physics and Ancient Faith* (Notre Dame: University of Notre Dame, 2003), p. 102. Emphasis added.

³ *Ibid.*, p. 104.

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Triune God's making. There is much more to the study of mathematical symmetry than you may have first thought!

The works of the Lord are great, studied by all who delight in them
(Psalm 111:2).