

## From Kepler To Martineau: Polyhedral Models Of Our Solar System Make A Quantum Jump In Accuracy

by Bruce Rawles

Many students of both astronomy and mathematics may be familiar with the classic nested polyhedra models of the solar system proposed by Johannes Kepler. This model depicts the orbits of the inner planets as a series of spheres circumscribing each of the Platonic Solids, with the next sphere inscribed inside the prior solid. The sequence was an outer sphere (the orbit of Saturn), an inscribed cube, another sphere (the orbit of Jupiter), an inscribed tetrahedron, another sphere (the orbit of Mars), an inscribed dodecahedron, another sphere (the orbit of Earth), an inscribed icosahedron, another sphere (the orbit of Venus), an inscribed octahedron, and finally, another sphere (the orbit of Mercury). Illustrations of these models appear, among other places, at:

[http://es.rice.edu/ES/humsoc/Galileo/Images/Astro/Conceptions/kepler\\_spheres.gif](http://es.rice.edu/ES/humsoc/Galileo/Images/Astro/Conceptions/kepler_spheres.gif)  
and <http://www.georgehart.com/virtual-polyhedra/kepler.html>

These models were elegant in simplicity and artistry ... but unfortunately not very accurate. The mystical Kepler, it turns out, was on the right track, and in addition to greatly expanding the world's knowledge of the solar system, pointed in the right direction with his passion for planets and polyhedra ...

A contemporary geometer, John Martineau, author of "A Little Book of Coincidence" describes a number of models that one imagines would have thrilled Kepler. Although most of the models illustrated and described in Martineau's book require only two dimensions, a couple of them involve the two of the most beautiful of the three dimensional solids ascribed to Plato; the Dodecahedron and Icosahedron.

### The Earth/Mars Icosahedron Model

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An icosahedron (Plato's symbol for water) has 20 triangles, and 12 vertices, and these vertices define 12 spheres that exactly touch each other, when centered on each vertex. Martineau discovered that the centers of these 12 spheres (also identical to the sphere circumscribing the icosahedron) defines a sphere representing the orbit of Earth, and another sphere circumscribing all the 12 spheres (outside all of them, but just touching) is the orbit of Mars. Using the astronomical data at <http://visitastronomy.com/coupling.txt> , the Mars/Earth AU ratio is: 1.5233 From Martineau's model, the outer vertex circumsphere to Icosahedron circumsphere ratio is: 1.5257  
The ratio of these two numbers gives: 99.84 % accuracy! Much better than Kepler's accuracy!

### The Venus/Mars Dodecahedron Model

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Martineau also shows another highly accurate polyhedra model in his book. The circumsphere which just touches each of 20 spheres which each touch each other, whose 20 centers are the vertices of a dodecahedron (Plato's symbol for ether), define the Mars (circumsphere) and Venus (dodecahedron insphere) orbit radii. Again from <http://visitastronomy.com/coupling.txt> , Mars/Venus AU ratio is: 2.1075 From Martineau's model, the dodecahedron vertex sphere outer/inner ratio is: 2.1095 The ratio of these two numbers gives: 99.91% accuracy!!

Many of the other two dimensional models (such as the simple triangle/circle relationship between the orbits of Mercury and Venus, and the square/circle relationship between the orbits of Jupiter and Mars, would become an ideal choice for standard mnemonic devices. Grade school teachers could give students a tangible way to visualize the distances between the planets with these brilliantly simple relationships. Many of Martineau's models achieve 99.9% accuracy, which is certainly sufficient for any good mnemonic, and, perhaps more importantly, enough to evoke a sense of awe for the mystery of creation !

I think Martineau will (some day, hopefully soon!) be heralded among Kepler, Galileo, Newton and Einstein for the astronomical discoveries he has made. I HIGHLY recommend John's book if you haven't seen it. I have a link to it from my website ([www.GeometryCode.com](http://www.GeometryCode.com))

Here is the original image from John Martineau's book, on page 35:

I have created artistic models inspired by Martineau's exquisite geometric models, using POV-Ray ray-tracing software ([www.povray.org](http://www.povray.org)) at:

<http://www.geometrycode.com/gallery/martineau/index.shtml>

Venus/Mars Model - Artistic Interpretation

Earth/Mars Model - Artistic Interpretation

To see larger (and full color) images of these models, visit:

<http://www.zazzle.com/products/product/product.asp?product%5Fid=228726024690315220>

<http://www.zazzle.com/products/product/product.asp?product%5Fid=228061596542878734>

and click the "super" button below the image.

references:

<http://members.cruzio.com/~devarco/life.htm>

[http://usuarios.advance.com.ar/simetriaddelespacio/symmetry\\_space/chapter%207.htm](http://usuarios.advance.com.ar/simetriaddelespacio/symmetry_space/chapter%207.htm)

<http://www.halexandria.org/dward116.htm>