SNOWFLAKES, MARIAN STARS, AND THE GREAT CHAIN OF BEING – SEXAGRAM GEOMETRY AT THE PAŽAISSLIS CAMALDOLESE MONASTERY

Key words: Pažaislis, Camaldolese Order, symbolic geometry, geometric cosmology, six-pointed stars, Marian star, Christopher Sigismund Pac, scala naturae

Referring to the entirety of creation and the Almighty, the Holy Scriptures stated: “Thou hast ordered all things in measure and number and weight.” (Wisdom of Solomon 11:20) Independently of the Bible and of their own accord Plato (426-348 BCE), Aristotle (384-322 BCE), and Plotinus (204/5-270 BCE) postulated that everything, from the most simple things to the most complex, whether animate or inanimate, material or spiritual, was hierarchically linked and arranged. Christian thinkers like St. Augustine (354-430) and Boethius (480-524) then further developed this attractive idea by asserting that deep affinities bridged and connected the physical realm to the sacred realm. St. Augustine’s interpretation of the Biblical passage above became the “keyword of the medieval world view.”

The scholastics of the Middle Ages were convinced that all things had their proper place in the scala naturae, Latin for a stairway or a ladder of nature. For them mathematics and geometry were
transcendental tools, enabling the human intellect to link the entire physical world and all living beings to their Creator. They believed that everything fit somewhere in the grand picture of God's creation. Scala naturae subsumed all things and creatures of the natural and supernatural realms, admitting no exceptions whatsoever. This broad notion is now called the Great Chain of Being. Although modern science has abandoned the idea of a universal, all-encompassing ordering system, less ambitious, smaller-scaled systems have proved their worth, for instance, the Systema Naturae of Carl Linnaeus (1707-1778), which nested hierarchies of mineral, plant, and animal kingdoms, also the Periodic Table of chemical elements, which Dmitri Mendeleev (1834-1907) arranged on the basis of increasing atomic weights and valences.

A few illustrations taken from the works Ramon Lull (1232-1315), Didacus Valades (1533-?), and Robert Fludd (1574-1637), will represent some of the ways the scala naturae / Great Chain of Being was visualized in the 16th and 17th centuries. Each author categorized living creatures and inanimate things, placing them into separate and distinct levels or spheres. Beings or inanimate matter of a given type possessed more attributes than those placed on the lower level, but fewer attributes than the beings or things placed on the next higher level. God at the top was followed by angelic beings, then by humans, animals, plants, minerals, dirt, minute particles, and nothingness at the very bottom.

Christian theologians explained that angelic beings did not possess the divine attributes of omnipotence, omniscience, and omnipresence. Like humans, they could think, love, and speak, but did not have bodies, did not experience passions, and were immortal. Angels were hierarchically arranged into several classes, which some authors called triads, others called orders or ranks. Angels in any given level had more powers than those in the level below. St. Thomas Aquinas (1225-1274) stated in the Summa theologica that angels existed in three hierarchies, each hierarchy having three ranks. In the highest hierarchy Seraphim occupied the highest rank; Cherubim and Ophanim were in the lower two ranks. Dominations, Virtues, and Powers occupied the middle...
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hierarchy; Principalities, Archangels, and Angels, belonged in the lowest hierarchy.

God and the angels on the highest levels had authority over humanity and the rest of the animate and inanimate worlds, while humans had authority on beings and things below their level. Among humans, kings had the highest rank because they were God’s lieutenants on earth. This had far-reaching political implications. Rebellion against a monarch became an immoral act against divine right and God’s will. Similarly for the rest of society. It was against the natural order for anyone to rebel, to question the authority of those in higher levels, or to rise above their station, just as it was immoral for humans of any rank to degrade themselves by acting contrary to ethical norms.

Aristotle’s analysis of the five classical elements – earth, water, air, fire, aether, provide analogies to social order and political stability. In De Generatione et Corruptione he explained that each element had its proper place and that the elements did not mix. Earth, at the center of the universe, is encompassed by water, which, in turn, is encompassed by air. Fire is in next larger sphere, extending to and including the moon’s orbit. If an element is moved, it falls back into its proper place. Earthly things sink, while air bubbles ascend. Rain falls, but flames rise. Aether, a heavenly sphere encompassing all the other elements, was the realm of the eternal and perfect planets and stars.

Gothic art pictured God the Creator as the artful architect (elegans architectus), often showing him with a compass and composing the universe in agreement with geometrical laws. As the sanctuaries of Christian ecclesiastical buildings were the interface between the sacred and the worldly realms, it was appropriate to design them using symbolic geometry, proportions, and mathematical ratios. Conforming to ideal parameters, cathedrals, churches, and chapels, were meant to please God as earthly, architectural analogues of the cosmos.

The numerical, geometrical, and proportional relationships, which the ancient Greek and the later Christian philosophers alike invested with
metaphysical significance, were discovered, not invented, by man. Renaissance geometers and mathematicians continued investigating the intriguing properties of Platonic solids. (Fig. 5). Their characteristics existed from the beginning of time and will remain valid to the end of days, regardless whether the human intellect grasps or formulates all their possible mathematical inter-relationships and establishes all their geometrical proofs. Likewise for the fundamental laws governing the design of the heavens, which exist irrespective of human ability to uncover and formulate the universally operative astrophysical principles.

Around 1600 Tycho Brahe (1546-1601), Galileo Galilei (1564-1642), and Johannes Kepler (1571-1630), the pre-eminent astronomers of the age, made landmark discoveries about the design of the heavens and the solar system. Kepler, for example, found that geometry configured the movements of the planets, the distances between them, and the shape of their orbits. In the Mysterium cosmographicum he demonstrated that the distances between the planets known at the time corresponded to a particular nesting of the five Platonic geometric forms. One of the last geometrical cosmologists, Kepler was convinced that this particular group of regular polyhedrons unlocked the solar system’s divine blueprint. He was certain that his discoveries, supplementing Aristotle’s Metaphysics and De caelo, provided independent and secular confirmation of Biblical truths. Since the equilateral triangle was the basic building block for four out of the five Platonic polyhedrons, the armature of the solar system was thus, for the most part, reducible to the equilateral triangle. (Figs. 5, 6). Previously a philosophical
and a theological symbol, the equilateral triangle became a transcendental intermediary, simultaneously suffusing the solar system and alluding to the immaterial, spiritual realm.

In an earlier study we proposed that symbolic geometries based on the equilateral triangle established the site plan of the Pažaislis Camaldolese monastery near Kaunas and, additionally, the layout of that ensemble’s centerpiece Church of Holy Mary’s Visitation.6 An equilateral triangle and a hexagram provided the most appropriate geometries for generating the design of the church and its immediate entourage because it was dedicated to the Blessed Virgin and to the Trinity. (Fig. 7). It must be noted that Camaldolese monastic churches in Italy, France, Austria, Hungary, Slovakia, and Poland typically followed the basilica format, even if they were dedicated to the Blessed Virgin. The hexagonal plan of the Church of Holy Mary’s Visitation deviates entirely from the order’s customary rectangular church plans. A more radical break is hard to imagine. Consecrated in 1674, the unusual hexagonal and domed church at Pažaislis rejected six centuries of Camaldolese architectural tradition. We suggested that the powerful and compelling rationale firmly grounded in symbolic geometry validated that repudiation.

In that earlier article we drew attention to the multiple allusions and symbolic references invested in hexagons and hexagrams. In heraldry, the armorial of the Camaldolese order features a hexagram star, while a hexagon and a hexagram can be discerned as underlying the armorial of Christopher Sigismund Pac (1621-1684), founder and benefactor of the Pažaislis monastery. In Roman Catholic symbolism the hexagram alludes to the chi-rho monogram; the equilateral triangle, to the Trinity. In the context of geometric cosmology the equilateral triangle is the primary form for Johannes Kepler’s astrophysical postulates.

Our earlier study suggested the symbolic richness of triadic geometries at cosmic scale. We now wish to draw attention to the triadic geometries of miniature snowflakes at microscopic scale. The optical microscope was devised in the Netherlands late in the 16th century; the refracting telescope, early in the 17th century. In the decades circa 1600 both instruments opened up theoretical and experimental pathways to important discoveries and insights. The geometry of miniscule and macrocosmic realms confirmed from different perspectives the venerable belief in the omnipresence of the Creator. Geometry conveyed theology.

The six-fold symmetry of snowflakes is an intriguing example of perfect geometry in natural form. Initially miniature ice crystals, solid snowflakes lose their shape as the temperature rises, dissolve into formless liquid, and eventually evaporate into thin air. The ancient Greeks would have noted that snowflakes possess qualities belonging to earth, water, and air – three of the basic elements. In the 16th and 17th centuries snowflakes attracted increasing scientific attention. For example, in 1555 the Swedish writer and archbishop Olaus Magnus (1490-1557) published Historia de gentibus septentrionalibus, which contained the earliest diagrammatic depictions of snowflakes. And around 1611 Johannes Kepler became fascinated by the perfect six-fold symmetry of snowflakes, which fall from the heavens and look like stars. In the Strena seu de nive sexangula
he attempted to describe and explain why they have six points, rather than five or seven.7 (The questions Kepler posed in that slim book were answered just recently by X-ray crystallographic analyses, powerful computers providing supportive mathematical proofs.) In the mid-1630’s the French philosopher Rene Descartes (1596-1650) used only his naked eyes to devise a fairly accurate description of snow crystal morphologies. (Fig. 8). Robert Hooke (1635-1703), an English scientist, architect, and polymath, soon followed up with a microscope, focusing its magnifying lenses on just about everything at hand. In 1665 he published his observations in *Micrographia*, a scientific best-seller of the time.8 The chapter “Of several kinds of frozen figures” contained sketches, included here, showing the intricate, filigree beauty of six-pointed snowflakes. (Figs. 9-10).

A Marian Star is a sexagram, that is a radially symmetrical six-pointed, star polygon.9 The proportions of Marian star vertices are not fixed, but their spoke ratios are always less than the 0.58 spoke ratio of a regular hexagram, commonly called the Star of David, or Star of Solomon. Though the spoke ratios of Marian stars vary in diverse artistic depictions, all Marian Stars have six convex vertices and six...
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concave vertices, comprising a total of twelve vertices. (Fig. 11). In Roman Catholic usage it is a symbol most often associated with the Blessed Virgin Mary. Admittedly, artists have sometimes used five-pointed, seven-pointed, and eight-pointed stars for the same purpose. However, since Mary and Joseph, each through their own kin, were from the House of David, the six-pointed sexagram Marian Star conveys her links to King David and tribe of Judah more vividly than any of the other multi-pointed stars.

Salus Populi romani (Protectress of the Roman People) is a Byzantine icon of the Madonna and Christ Child now displayed above the altar of the Pauline Chapel in the Santa Maria Maggiore Basilica. (Fig. 12). It is one of the earliest and most influential Marian icons in Rome. Allegedly there since the 4th century, apocryphal oral traditions alleged that it had been painted by St. Luke the Evangelist, and that it had been brought to Rome by St. Helena, mother of emperor Constantine the Great. The four Greek
letters near the icon’s top identify the half-length portrait figure of Mary as the majestic “Mother of God,” a typical usage in Byzantine representation. Christ holds a book in his left hand, blessing the onlooker with his right hand.

From the 15th century onwards *Salus Populi romani* was considered miraculous. The most recent restoration of this repeatedly over-painted icon highlighted a six-pointed filigree star on the Blessed Virgin Mary’s gold-trimmed dark blue mantle. The much-replicated *Salus Populi romani* icon helped disseminate the image of the sexagram star throughout Europe. Of the Marian stars found in the pictorial patrimony of Lithuania it will suffice and serve our purposes to call attention to *The Virgin Mary and Child*, Fig. 13 (Lithuanian: Švč. Dievo Motina su Kūdikiu), painted in the 16th century,11 and the silver-gilt cladding of the *Aurora Gate Madonna*, Fig. 14 (Lithuanian: Aušros Vartų Dievo Motina,), dated 1670-1745.12

Over the centuries the Blessed Virgin Mary has inspired countless works of devotional art, poetry, music, and literature. Crowns of twelve stars, haloes with twelve stars, roses, lilies, irises, and the *fleur-de-

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*Fig. 14. Aurora Gate Madonna. Tempera and oil on wood, 17th century. Gilt framing, late 17th to 18th centuries. Church of St. Theresa, Vilnius*

*Fig. 15. The universe as a hierarchy of elements, planetary spheres, and the Christian heaven. Woodcut in Konrad von Megenburg. Das buch der natur, Augsburg, 1499. Illustrated by S. K. Heninger, Jr., The Cosmographical Glass – Renaissance Diagrams of the Universe, 1977, p. 33*
Christian philosophers accepted the idea first postulated in ancient Greece that everything, from the most simple to the most complex, animate or inanimate, material or spiritual, was hierarchically linked and arranged. During the middle ages this basic notion was formulated as \textit{scala naturae}, now termed the Great Chain of Being. It persisted well into the renaissance. In the history of ideas the concept of geometric cosmology enjoyed similar longevity, extending from the Babylonian times into the 17th century and, for instance, was firmly held by thinkers such as Johannes Kepler. The earliest observations made by the microscopes and telescopes of the early 17th century seemed to confirm the venerable grand hypotheses.

Before the invention of the telescope the six-pointed sexagram was commonly used as visual...
shorthand for celestial objects such as comets and stars. (Figs. 15-17). The similar geometry of miniature snowflakes became known with the invention of the microscope. The coincidence of graphic conventions and scientific observation disseminated the sexagram image and gave it widespread currency. In such usage the sexagram is neutral; it is not encumbered by the symbolic references accruing to it when used in the context of Christian ecclesiastical art. The point is that the sexagram was not some obscure geometric form, but was part of the common visual culture of the time. Together with circles, squares, ellipses, hexagons, hexagrams, and equilateral triangles, the
Marian star sexagram would be known to architects and certainly their ecclesiastical patrons.

The armorial of the Camaldolese Congregation in San Michele, Venice is just partly visible in the faded cartouche above the main entrance to the Church of Holy Mary’s Visitation. Fig. 18 shows the complete armorial — a Marian star sexagram above a chalice flanked by two doves. Together with Halina Kairiūkštė-Jaciniene we are inclined to believe that Lodovico Fredo (?–1686) conceived the layout of Pažaislis, worked and was buried there. Earlier associated with the San Michele congregation, research in its archives might finally clarify his role at Pažaislis. Meanwhile, in the context of scala naturae, we can consider the role of ecclesiastical architecture mediating between heaven and earth; in the case of Pažaislis, ponder the various ways Marian stars suffuse the Church of Holy Mary’s Visitation. Figs. 19-21.

Notes
4 Simson, op. cit., p. 31-39.
9 A sexagram and a hexagram both mean a six-pointed, geometrical star figure. *Sexagram* is derived from Latin; *hexagram*, from Greek. We use the term sexagram to distinguish the Marian star from a hexagram, and, also, because it is more akin to Johannes Kepler’s title for his booklet on six-cornered snowflakes – *Strena seu de nive sexangula*.

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SNAIGĖS, MARIJOS ŽVAINŽDĖS IR DIDŽIOJI BŪTIES GRANDINĖ – ŠEŠIĄKAMPĖ GEOMETRIJA PAŽAISLIO KAMALDULIŲ VIENUOLYNE

Reikšminiai žodžiai: Pažaislis, kamaldulių ordinas, šešiakampė žvaigždė, Marijos žvaigždė, simbolinė geometrija, Kristupas Zigmantas Pacas, geometrinė kosmologija, scala naturae

Santrauka

Švenčiausios Mergelės Marijos Apsilankymo bažnyčia, pašventinta 1674 m., yra Pažaislio kamaldulių vienuolyno ansamblio, esančio netoli Kauno (Lietuva), centre. Vienuolynų statymo tvarka Italiuje ir Prancūzijoje nuo XI a. iki
III. SIMBOLIKA IR PUOŠYBA


Didžiojo būties grandinė yra platą sąvoka, kilusi iš Platono ir Aristotelio, teigiant, kad viskas, nuo paprastiausio iki sudetingiausio, gyvi ir negyvi, materialūs ir dvasiniai dalykai yra hierarchiškai susieči ir išdėstytai tam tikra tvarka. Viduramžių mąstymo ją vadino *scala naturae*, tapusią pagrindinė ir viduramžių gamtos mokslų sąvoka. Buvo tikima, kad viskas egzistuoja Didžiojoje būties grandine.


1596 m. pasirodžiusiame veikale *Mysterium cosmographicum* (Šventosios visatos paslaptis) Johannes Kepleris teigė, kad planetų skaičius, dydis ir orbita tuometineje žemės sistemėje atitinka tam tikrus Platono formų lizdus, kurių dauguma yra sudaryti iš lygiakraščių trikampių. Tokiu būdu senovės tikybos buvo grindžiamas, kad visata yra sudėtiota geometriškai. Sukurta tos pačios geometrijas, kuri akivaizdžiai valdo dangų, Pažaislio bažnyčia buvo atitinkama žemiškoji dieviškosios visatos kopija.

Bažnyčios suplanavimas taip pat primena mikroskopinio ir tarpinio lygmens geometrinį išdėstymą. 1611 m. Johannes Kepleris išleido *De nive sexangula* (Apie šešiakampę snaigę), ankstyvąsio kristalų ir šešiakampių kūnų studiją. 1617 m. išleistas Roberto Fluddo *Utriusque cosmic maioris* frontispise pavaizduota tobuloji Didžiojo būties grandinė. Žymiausime 1655 m. Roberto Huko *Micrographia* moksliniame veikale pavaizduotas snaigės, patrūdžiausios šešiakampių ir heksagramidžių radialinę simetriją.


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