The Octavia Lab designed ornaments this year with the help of lab volunteer Francis Fayard. The lab used both the 3D printer and the laser cutter to achieve ornaments that were distinctive to each technology.

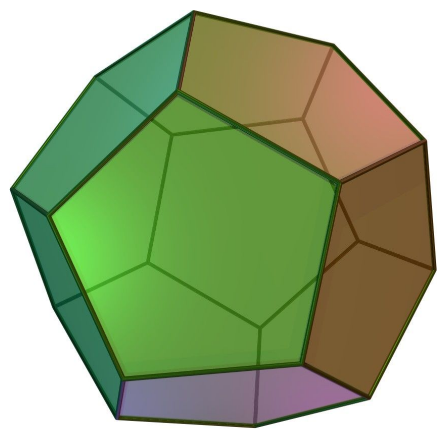
With the laser cutter, we created designs that mimicked the designs in the central part of the rotunda ceiling. We researched spirograph forms, mandalas and other geometric shapes.

With the 3D printer, we printed spheres that were reminiscent of the rotunda globe chandelier, early designs had us printing globes. We opted instead for a different design challenge: to print as large as possible given the maximum allowance of the 3D printer (roughly shoebox size) and to print as economically as possible, without the use of supports, which would then have to be removed (a time and material waste).

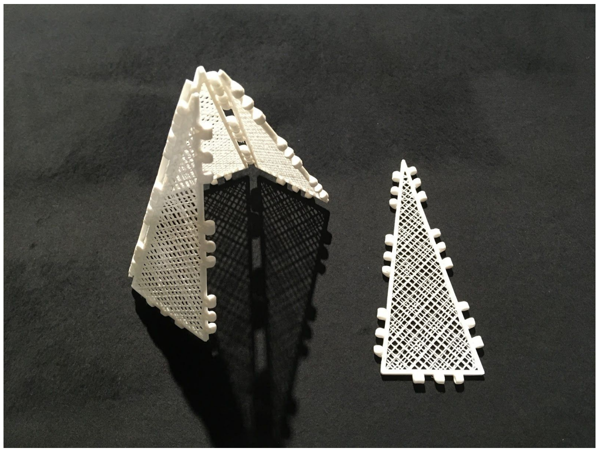
For the tree topper, we had the design problem of wanting to build larger than the allowable size of the 3D printer.

TREE TOPPER - 3D Printer

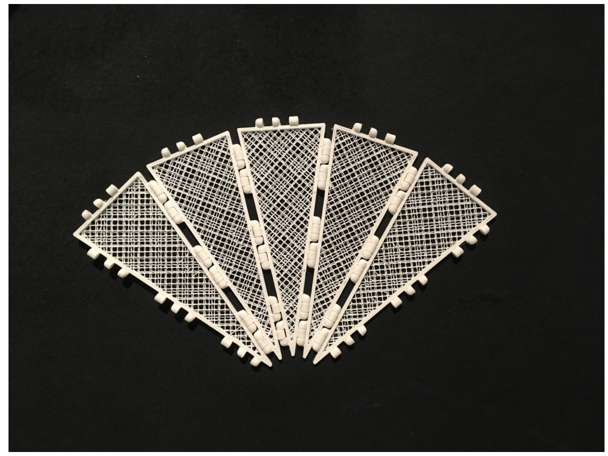
The tree topper is based on a regular dodecahedron, a 12-sided pentagon solid, with 5-sided pyramids that come out of each pentagonal side of the dodecahedron.



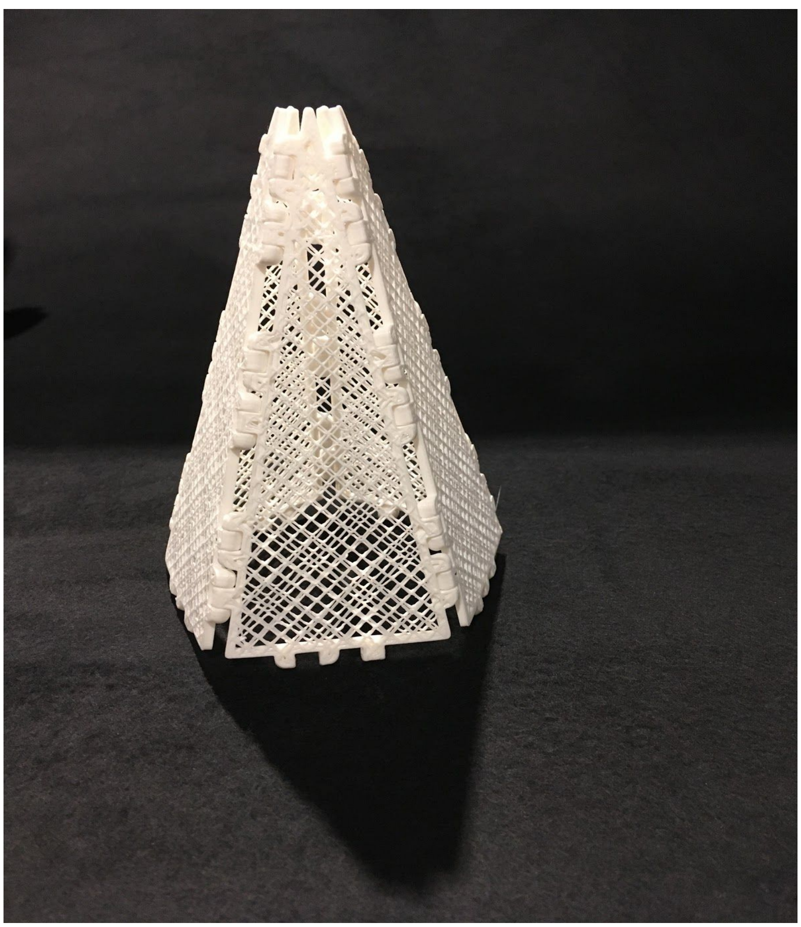
Francis based this on Devin Montes' Polypanels (https://www.makeanything.design/polypanels), modular low-waste 3D printed building pieces. Frances modified Montes' design to create triangles with sides fitted to form a pyramid and its base could then form a pentagon.



Four panels interlocked and one piece lying flat.

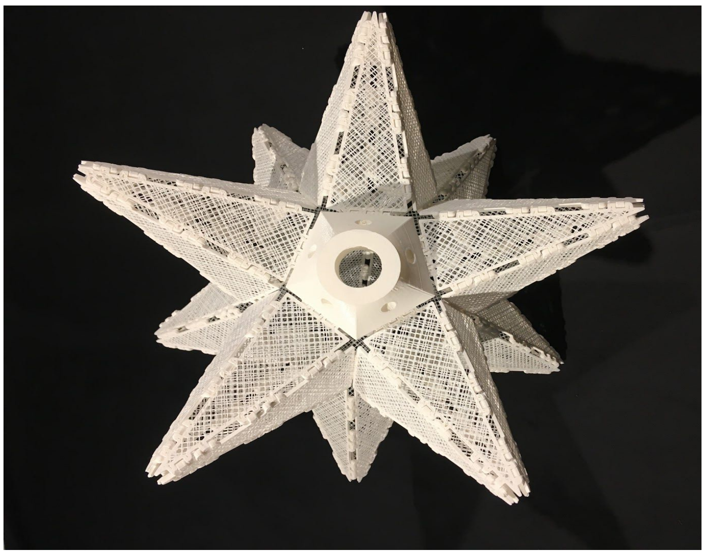


The five panels interlocked and made to lie flat.

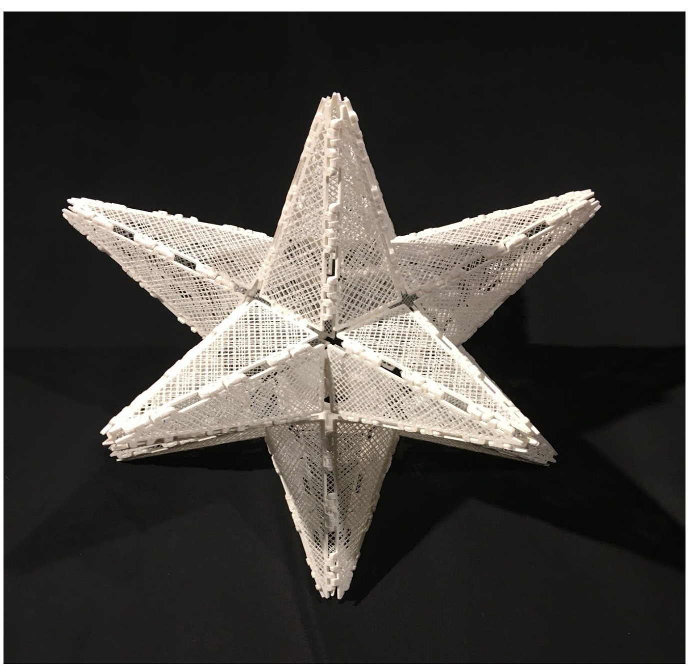


A completed point of our tree topper.

The tree topper was printed as 12 separate jobs. For 11 of the sides of the dodecahedron, we printed the five sides of the pyramid and for the 12th time, we printed the base that would attach to the tree. Each of the 12 print jobs were designed to print in as little time as possible. The “lace” pattern for the pyramid was a design decision to minimize printing time and still have a pattern.



The bottom base piece visible.

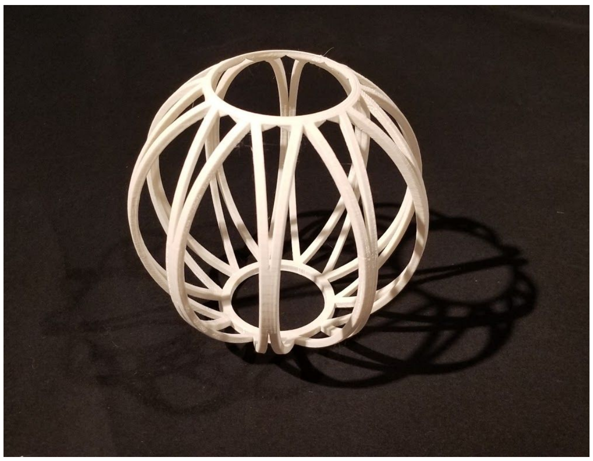


The ornament from the side.

SPHERICAL ORNAMENTS - 3d printed

Francis designed us three spherical ornaments that were 1) printed without using supports, 2) created with minimal physical prototyping and 3) played off the patterns within the rotunda. The spheres are roughly 6” in diameter, because the largest possible sphere that could be printed was limited by the smallest dimension that could be printed within the 3D printer.

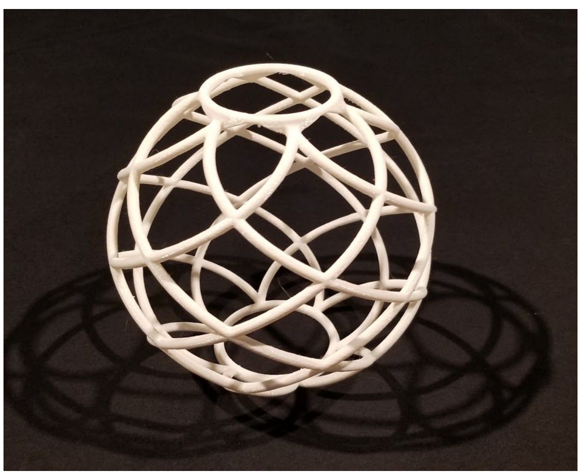
Star



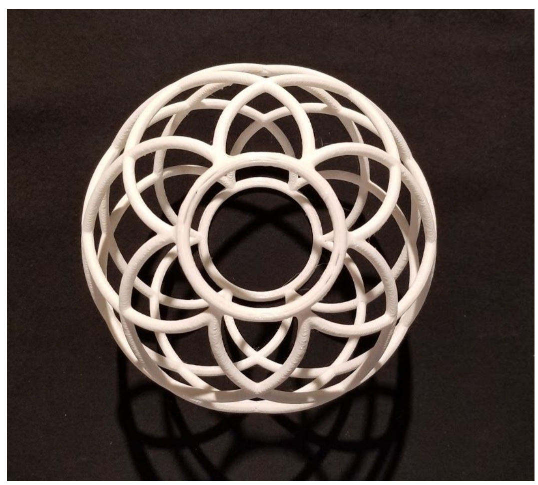
View from side.

View from above.

Helical



View from side.



View from above.

Wave

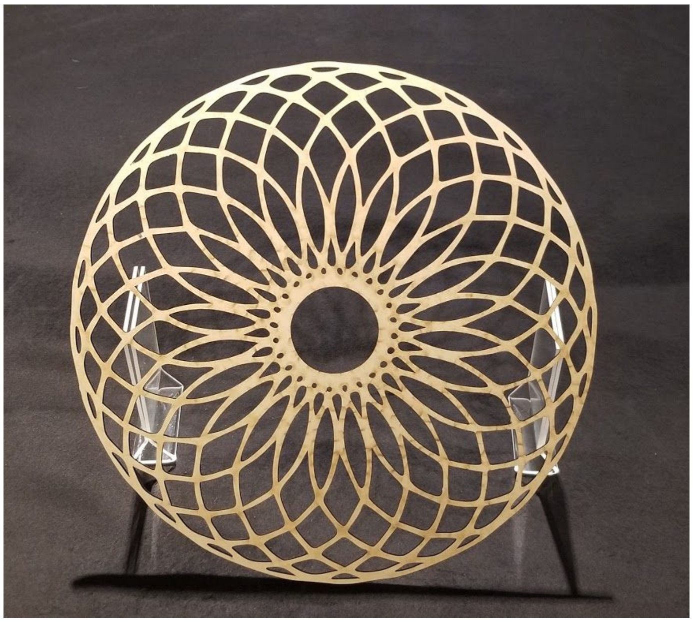
View from the side.

LASER CUTTER ORNAMENTS

In order to create a laser cutter file, you first must start with a drawing. From that drawing, the lines need to be converted into vectors (basic lines, curves and polygons) that can be rescaled and reshaped without loss of fidelity. With these vectors, a laser cutter can cut a variety of materials, such as acrylic, paper and wood.

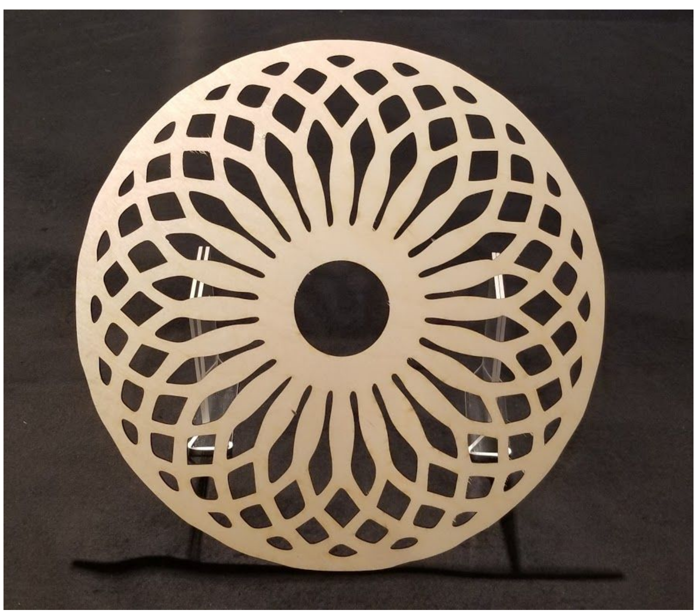
Sample vector graphic file image. The very faint red lines (specifically R-255, G-0, B-0) instructs the laser cutter to cut the image.

With our ornaments, a design decision was made to build circles that were of the maximum dimensions possible in the laser cutter. All shapes are therefore, slightly smaller than 12” in diameter. They are all cut from pieces of 12” x 12” x 1/8" birch sheets. Each finished pattern takes roughly 4-10 minutes to cut, depending on pattern complexity.

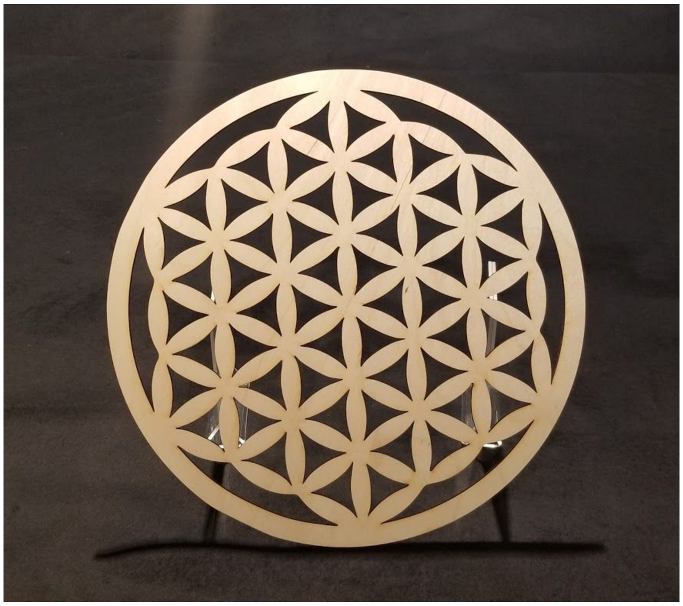


This ornament works from a repeating oval pattern that overlaps. In math terms, it is a hypotrochoid. It is drawn from inside a bounds of a circle using a non-center constant point from a smaller circle.

If you remember spirographs, this is one of those patterns.

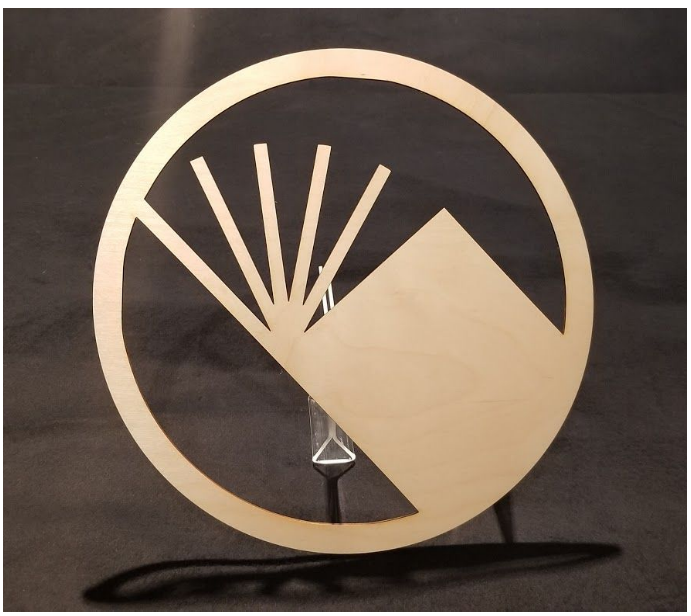


Same idea as previous, but with thicker lines.

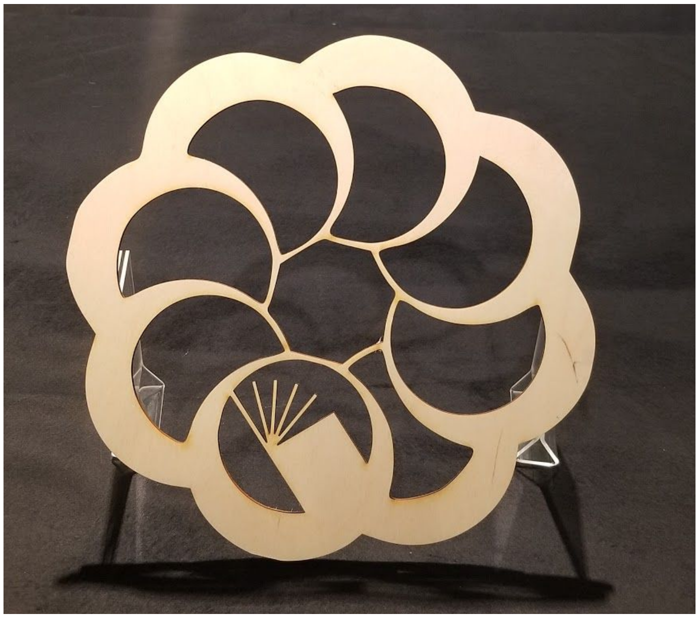


Overlapping circles in a hexagonal pattern. The center of each circle is on the circumference of six surrounding circles of the same diameter. It is made up of 19 complete circles and 36 partial circular arcs, enclosed by a large circle.

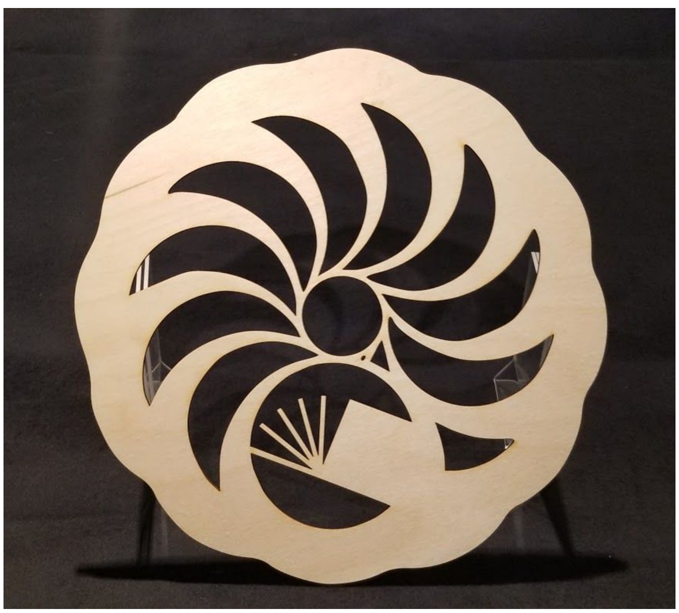
This pattern is found throughout ancient cultures of the world.



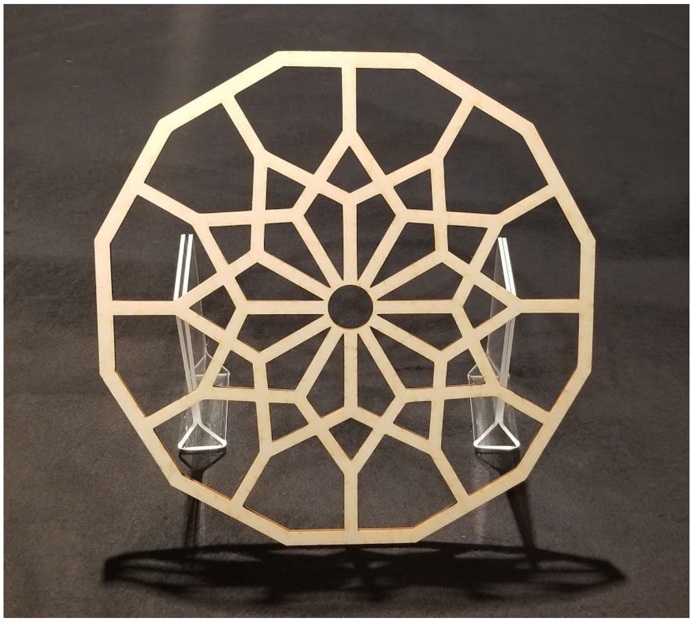
Library logo.



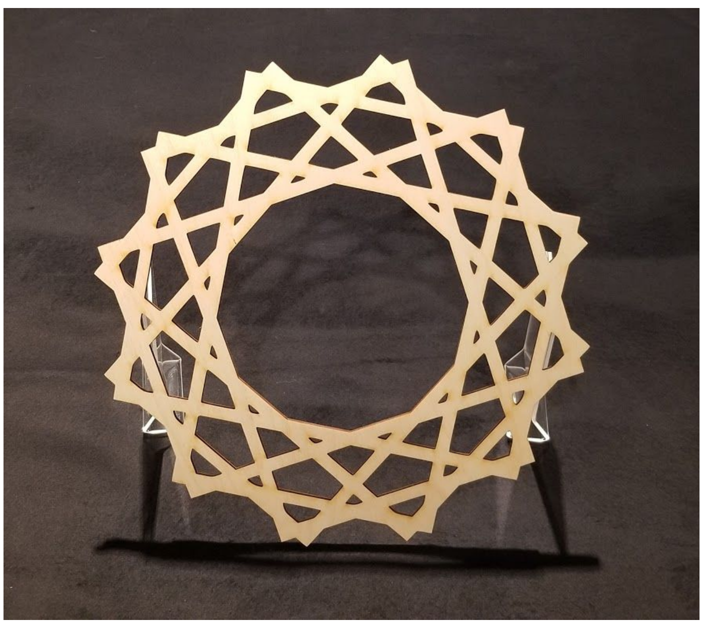
Library logo embedded into a pattern of overlapping circles. We realized we could add the logo into the patterns AFTER we already started going into production with the first two patterns.



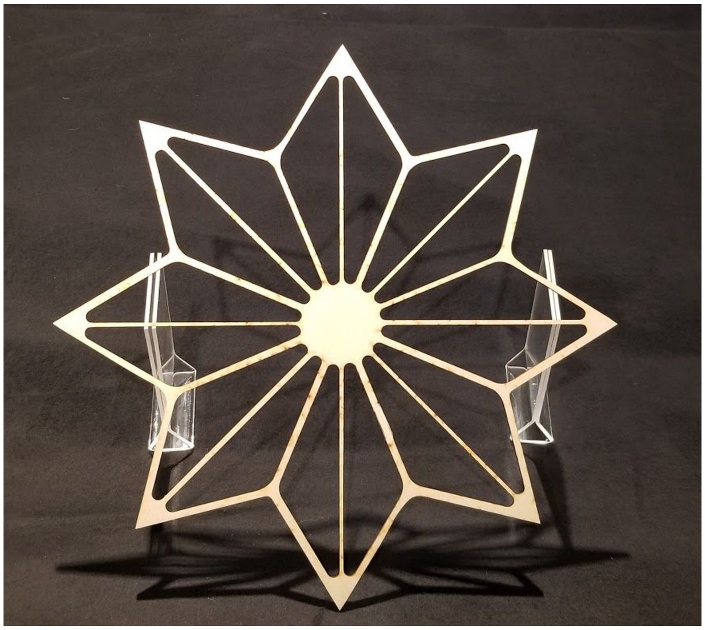
Radiating arcs with the library logo nested inside.



Research of Julian Garnsey's ceiling work showed influence from Islamic geometric patterns. The four basic shapes, or "repeat units," from which the more complicated patterns are constructed are: circles and interlaced circles; squares or four-sided polygons; the ubiquitous star pattern, ultimately derived from squares and triangles inscribed in a circle; and multisided polygons.



Another Islamic geometry pattern, overlapping rotating rectangles.



10-pointed star pattern simplified from one of the carpet ornamentations of the Children's Literature department.

Pattern developed from the oculus of the old Philharmonic Auditorium. Pattern built from overlapping circles out of radiating spokes, using a 30 degree angle. Centering ovals and circles were added afterwards.