Claims:

1. A hollow structure 3D Luneburg lens comprising:

a three-dimensional scaffold having multiple junctions, wherein each of the junctions is at least partially metalized,

wherein a center point of the hollow structure lens is formed by the three-dimensional scaffold,

wherein the junctions are positioned from an innermost position of the lens at or near the center point toward an outermost position of the lens at or near an edge of the lens,

wherein each of the junctions resides in an imaginary unit cell, respectively, and the imaginary unit cell is at least partially metalized with a degree of metallization of at least that of the partially metalized junction that resides within the imaginary unit cell, and

wherein a further the partially metalized junction is away from the center point, a less the degree of metallization of the imaginary unit cell.

2. The Luneburg lens of claim 1, wherein the degree of metallization of the imaginary unit cell is calculated by a full-wave finite-element simulation software, to produce a permittivity of the imaginary unit cell being ε_r, wherein $\varepsilon_r = 2 - (\frac{r}{R})^2$, wherein r is the distance of the junction to the center point.

3. The Luneburg lens of claim 1, wherein the lens is adapted for RF frequency.

4. The Luneburg lens of claim 1, wherein the lens comprises a support frame that is 3D printed.

5. The Luneburg lens of claim 1, wherein the lens has a weight of 20 grams or less excluding a support frame.

6. The Luneburg lens of claim 1, wherein the at least partially metalized junction is constructed from at least a partially metalized thin film, thread, fiber, wire, or string.

7. The Luneburg lens of claim 1, wherein the scaffold is constructed by stacking layers of at least partially metalized thin films, wires, or strings such that each layer crisscrosses each other to produce the hollow structure lens.

8. The Luneburg lens of claim 7, wherein the crisscross layers are fixed to a support frame.

9. The Luneburg lens of claim 1, further comprising a support frame that is 3D printed.

10. The Luneburg lens of claim 1, wherein the partially metalized junction is interlocked with at least partially metalized thin film plates.

11. The Luneburg lens of claim 10, wherein at least two of the thin film plates intersect with each other and form the junction.

12. The Luneburg lens of claim 10, wherein the at least partially metalized thin film plates form the at least partially metalized junctions when interlocked.

13. The Luneburg lens of claim 1, wherein a majority of space in the hollow structure lens is free space due to the 3D scaffold.