What is claimed is:

1. An apparatus comprising:

a cavity comprising interior surfaces or reflecting elements;

one or more transmitters configured to receive an electrical signal, transform the electrical signal into an electromagnetic wave signal, and introduce the electromagnetic wave signal into an inside of the cavity; and

one or more receivers configured to retrieve the electromagnetic wave signal, transform the electromagnetic wave signal to a corresponding electrical signal, and transmit the corresponding electrical signal to the outside of the cavity,

wherein the electromagnetic wave signal is contained within the inside of the cavity by undergoing a series of reflections or traversals between the interior surfaces or the reflecting elements of the cavity.

2. The apparatus of Claim 1, further comprising:

one or more regenerators configured to re-amplify, re-shape, or re-time the electromagnetic wave signal traveling within the inside of the cavity.

3. The apparatus of Claim 1, further comprising:

a vacuum pump configured to maintain the inside of the cavity substantially under a vacuum condition.

4. The apparatus of Claim 1, wherein the electromagnetic wave signal comprises a modulated laser beam.

5. The apparatus of Claim 1, wherein the electromagnetic wave signal comprises a Gaussian beam.

6. The apparatus of Claim 1, wherein the electromagnetic wave signal comprises a spatial mode.

7. The apparatus of Claim 1, wherein the interior surfaces of the cavity are made at least in part of mirrors, reflecting coatings, gratings, or photonic microstructure materials configured to reflect or regenerate or separate or process the incident electromagnetic wave signal.

8. The apparatus of Claim 1, further comprising at least one of lenses, gratings, metamaterials, and optical materials configured to refocus or reshape the electromagnetic wave signal traveling within the inside of the cavity.

9. The apparatus of Claim 1, wherein the reflecting elements comprise a plurality of first parallel plates positioned within the inside of the cavity, wherein at least a portion of each side of each one of the first parallel plates comprises a reflective surface or a surface with a reflective element disposed thereon.

10. The apparatus of Claim 9, wherein the first parallel plates are positioned substantially equidistant from each other.

11. The apparatus of Claim 9, wherein the reflecting elements further comprise a plurality of second parallel plates positioned perpendicular to the first parallel plates and a plurality of third parallel plates positioned perpendicular to the first and second parallel plates such that the first, second and third parallel plates define a plurality of sub-cavities within the inside of the cavity, wherein at least a portion of each side of each one of the second and third parallel plates comprises a reflective surface or a surface with a reflective element disposed thereon and the electromagnetic wave signal is contained within an inside of at least one of the sub-cavities until retrieved.

12. The apparatus of Claim 11, wherein the second parallel plates are positioned substantially equidistant from each other.

13. The apparatus of Claim 12, wherein the third parallel plates are positioned substantially equidistant from each other.

14. The apparatus of Claim 1, further comprising a signal focusing device placed on, or adjacent to, one or more of the interior surfaces or reflecting elements of the cavity and configured to separate two adjacent overlapping electromagnetic wave beams and focus them to separate points on the reflective interior surfaces or reflecting elements.

15. The apparatus of Claim 14, wherein the signal focusing device comprises a gradient index material, a photonic crystal structure, a mirror structure, or a diffraction structure.

16. The apparatus of Claim 1, wherein:

the cavity comprises a cubic cavity; and

portions of the interior surfaces for two opposing faces of the cubic cavity comprise mirrors configured to reflect the incident electromagnetic wave signal such that the electromagnetic wave signal travels in a zig-zag manner within a first plane substantially perpendicular to the two opposing faces of the cubic cavity.

17. The apparatus of Claim 16, wherein each of the mirrors is configured to reflect the incident electromagnetic wave signal by an angle $\alpha = \sin^{-1}(s/(2\sqrt{(c^2+s^2)}))$, wherein c is a side length of the cubic cavity and s is a transversal spot size of the electromagnetic wave signal.

18. The apparatus of Claim 16, further comprising a signal directing element configured to direct the electromagnetic wave signal to travel within a second plane, which is substantially parallel and adjacent to the first plane.

19. The apparatus of Claim 16, further comprising a signal directing element configured to direct the electromagnetic wave signal to travel within a second plane, which is substantially perpendicular to the first plane.

20. A method using an electromagnetic wave storage device comprising a cavity having interior surfaces or reflecting elements, one or more transmitters and one or more receivers, the method comprising the steps of:

receiving, by the one or more transmitters, an electrical signal;

transforming, by the one or more transmitters, the received electrical signal into an electromagnetic wave signal;

introducing, by the one or more transmitters, the electromagnetic wave signal into an inside of the cavity, wherein the electromagnetic wave signal is contained within the inside of the cavity by undergoing a series of reflections or traversals between the interior surfaces or the reflecting elements of the cavity;

retrieving, by the one or more receivers, the electromagnetic wave signal;

transforming, by the one or more receivers, the retrieved electromagnetic wave signal to a corresponding electrical signal; and

transmitting, from the one or more receivers, the corresponding electrical signal to the outside of the cavity.

21. The method of Claim 20, wherein the electromagnetic wave storage device further comprises a signal focusing device, which is placed on, or adjacent to, one or more of the interior surfaces or reflecting elements of the cavity and configured to separate two adjacent overlapping electromagnetic wave beams and focus them to separate points on the reflective interior surfaces or reflecting elements, the method further comprises the steps of:

focusing, by using the signal focusing device, the incident electromagnetic wave signal; and

redirecting, by using the signal focusing device, the electromagnetic wave signal to an opposite direction.