Claims:

1. A device comprising:

a volume comprising ferroelectric nematic liquid crystal-forming fluid and means for containing said fluid, said fluid comprising molecules having one or more electric dipoles having a nonzero local unidirectional average orientation and spontaneously forming a ferroelectric polarization density that has a nonzero magnitude and a vectorial direction in said volume.

2. The device of claim 1 for electrical control of an electromagnetic field, wherein said device includes one or more electrodes for application of an electric field to said volume, and the electromagnetic field propagates in said volume, said electric field causing said ferroelectric polarization density to change in magnitude, thereby producing a change in the electromagnetic field.

3. The device of claim 1 for electrical control of an electromagnetic field, wherein said device includes one or more electrodes for application of an electric field to said volume, and an electromagnetic field to be controlled propagates in said volume, said electric field causing the vectorial direction of said ferroelectric polarization density to change, thereby producing a change in the electromagnetic field.

4. The device of claim 1 for producing electrically-driven motion, wherein said device includes one or more electrodes for application of an electric field to said volume, said electric field causing said ferroelectric polarization density to change in the vectorial direction and/or the magnitude, thereby producing a physical motion of or change of shape of said volume.

5. The device of claim 1 for performing mechanical sensing, wherein said device includes one or more electrodes for measuring the electric potential or current flow

within said volume, said electric potential and/or current flow generated by change in said ferroelectric polarization density, said change due to a variation in stress within said volume or change of shape of at least a portion of said volume.

6. The device of claim 1 for thermally generating a charge density, wherein said device includes one or more electrodes for measuring an electric potential or obtaining a current flow within said volume, said electric potential and/or current flow generated by a change in said ferroelectric polarization density, said change of said ferroelectric polarization density produced by a change in temperature of said volume.

7. The device of any of claims 1-6, wherein said volume is contained between parallel surfaces.

8. The device of claim 7, wherein an electric field is applied parallel to said parallel surfaces.

9. The device of claim 7, wherein the vectorial direction of the ferroelectric polarization density is parallel to said parallel surfaces.

10. The device of claim 3, wherein
said volume is contained between parallel surfaces; and
said electromagnetic field propagates parallel to the parallel surfaces.

11. The device of claim 2 or claim 3 wherein said electric field, the vectorial direction of the said ferroelectric polarization density, and a propagation of said electromagnetic field are along the same line.

12. The device of claim 3, wherein the electromagnetic field comprises one or more of microwave, infrared, visible, ultraviolet, and x-ray light, propagating in or reflecting from said device.

13. The device of claim 1 for performing electric dipole scavenging, wherein said ferroelectric polarization density produces local molecular scale cavities, said molecular scale cavities binding molecules having electric dipoles in said volume.

14. The device of any of claims 1-13 where said ferroelectric nematic liquid crystal-forming fluid comprises dimeric, oligomeric, or polymeric material.

15. The device of any of claims 1-13 where said ferroelectric nematic liquid crystal-forming fluid comprises elastomeric material.

16. The device of any of claims 1-13 where said ferroelectric nematic liquid crystal-forming fluid comprises a glass.

17. The device of any of claims 1-16, wherein the molecules comprise features suitable for the stabilization of a ferroelectric nematic phase comprising one or more of (1) a rod shape having a molecular long axis suitable for nematic liquid crystal ordering; (2) a substantial net electric dipole parallel to the molecular long axis, said electric dipole stabilizing head-to-tail chaining of said molecules; (3) molecular sub-components along the molecular length giving localized charges of alternating sign distributed along said molecular long axis; (4) minimal flexible tails to enable dipolar charges to interact, but provide enough flexibility to suppress crystallization; and (5) lateral groups to control the relative positions along the director of side-by-side molecules, to promote their polar order.

18. The device of any of claims 1–17, wherein the magnitude and the vectorial direction extend over a length scale that exceeds 100 micrometers.