at least one controller configured to control the plurality of CMOS fabricated field-generating components to generate at least one electric or magnetic field having a sufficient strength to interact with at least one sample suspended in the fluid.

2. The apparatus of claim 1, wherein the at least one controller is configured to control the plurality of CMOS fabricated field-generating components to generate a plurality of programmable spatially or temporally variable electric or magnetic fields having a sufficient strength to interact with the at least one sample suspended in the fluid.

3. The apparatus of claim 2, further comprising at least one processor coupled to the at least one controller, the at least one processor configured to control the at least one controller so as to facilitate at least one of manipulation, detection, imaging and characterization of the at least one sample via the plurality of electric or magnetic fields.

4. The apparatus of claim 3, wherein the at least one processor is configured to facilitate programmable automated manipulation of the at least one sample based on detection of the at least one sample.

5. The apparatus of claim 1, wherein the at least one controller includes a plurality of CMOS fabricated field control components forming an integrated circuit chip together with the plurality of CMOS fabricated field-generating components.

6. The apparatus of claim 5, wherein the microfluidic system is coupled integrally with the integrated circuit chip to form a CMOS/microfluidic hybrid system.

7. The apparatus of claim 6, wherein the microfluidic system includes at least one polyimide layer, disposed above the CMOS fabricated field-generating components, in which at least one microfluidic channel or reservoir is formed.

8. The apparatus of claim 6, wherein the microfluidic system includes at least one epoxy layer, disposed above the CMOS fabricated field-generating components, in which at least one microfluidic channel or reservoir is formed.

9. The apparatus of claim 6, wherein the microfluidic system includes at least one polydimethylsiloxane (PDMS) mold, disposed above the CMOS fabricated field-generating components, in which at least one microfluidic channel or reservoir is formed.

10. The apparatus of claim 5, wherein the plurality of field control components includes:

a plurality of programmable switching or multiplexing components; and

a plurality of current or voltage sources.

11. The apparatus of claim 10, wherein the plurality of field control components further includes a plurality of high frequency detection components configured to facilitate at least one of detection, imaging and characterization of the at least one sample suspended in the fluid via the generated at least one electric or magnetic field.

12. The apparatus of claim 11, further comprising at least one CMOS fabricated temperature regulation component forming the integrated circuit chip together with the plurality of CMOS fabricated field control components and the plurality of CMOS fabricated field-generating components.

13. The apparatus of claim 12, further comprising at least one processor coupled to the at least one controller, the at least one processor configured to control the at least one controller so as to facilitate at least one of manipulation, detection, imaging and characterization of the at least one sample via the generated at least one electric or magnetic field.

14. The apparatus of claim 13, wherein the at least one processor is configured to facilitate programmable automated manipulation of the at least one sample based on detection of the at least one sample.

15. The apparatus of claim 1, wherein the plurality of CMOS fabricated field-generating components includes a plurality of microcoils.

16. The apparatus of claim 15, wherein the plurality of microcoils are arranged as a two-dimensional array.

17. The apparatus of claim 15, wherein each microcoil includes at least two axially concentric spatially separated portions of conductor turns.

18. The apparatus of claim 15, wherein the at least one controller includes a plurality of switching or multiplexing components and a plurality of current or voltage sources coupled to the plurality of microcoils.

19. The apparatus of claim 18, wherein the at least one controller further includes a plurality of radio frequency (RF) detection components coupled to the plurality of microcoils.

20. The apparatus of claim 19, wherein the plurality of RF detection components includes a frequency locked loop configured to facilitate at least one of detection, imaging and characterization of the at least one sample suspended in the fluid.

21. The apparatus of claim 20, wherein the frequency locked loop includes at least one bridge circuit, the at least one bridge circuit including at least one microcoil of the plurality of microcoils, the at least one bridge circuit configured to generate at least one signal representing a change in an inductance of the at least one microcoil due to a presence of the at least one sample in proximity to the at least one microcoil.

22. A method, comprising an act of:

A) generating at least one electric of magnetic field from a plurality of CMOS fabricated field-generating components, the at least one electric or magnetic field having a sufficient strength to interact with at least one sample suspended in a fluid contained in a microfluidic system in proximity to the plurality of CMOS fabricated field-generating components.

23. The method of claim 22, wherein the act A) includes an act of:

A1) generating a plurality of programmable spatially or temporally variable electric or magnetic fields having a sufficient strength to interact with the at least one sample suspended in the fluid.

24. The method of claim 23, further comprising an act of:

B) controlling the plurality of electric or magnetic fields so as to facilitate at least one of manipulation, detection, imaging and characterization of the at least one sample.

25. The method of claim 24, wherein the act B) comprises an act of:

controlling the plurality of electric or magnetic fields so as to facilitate automated manipulation of the at least one sample based on detection of the at least one sample.

26. The method of claim 24, wherein the act Al) comprises an act of: