preceding claim wherein dielectric resonator has a dielectric constant with a loss tangent of less than 0.01.

8. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the dielectric resonator has a dielectric constant of greater than five.

9. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the dielectric material is selected from the group consisting of alumina (Al_2O_3) and calcium titanate ($CaTiO_3$).

10. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the ~~plasma is generated in an~~ adjacent gas, ~~the gas comprising~~ comprises nitrogen or air.

11. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the dielectric resonator is a ring or cylindrical annulus having a central opening along the axis.

12. The optical emission spectrometer or the mass spectrometer of claim 11 wherein the ring or cylindrical annulus has a central opening of at least one millimeter in diameter or at least one half inch (0.0127 m) in diameter.

13. The optical emission spectrometer or the mass spectrometer of claim 11 wherein the ring or cylindrical annulus has a central opening which is circular and has a diameter of between 15 mm and 25 mm.

14. The optical emission spectrometer or the mass spectrometer of any of claims 11 to 13 further including a gas port introducing gas into the central opening along an axis of the dielectric resonator.

15. The optical emission spectrometer or the mass spectrometer of any

preceding claim wherein the radiofrequency power source is driven at a frequency which is within two full width at half maximum (FWHM) bandwidths of the resonant frequency of the dielectric resonator structure when the resonator is loaded.

16. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the radiofrequency power source automatically seeks the natural resonant frequency of the dielectric resonator structure to output radiofrequency power at or substantially at the natural resonant frequency of the dielectric resonator structure.

17. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the radiofrequency power source comprises one or more of a magnetron, a solid state oscillator or a vacuum tube oscillator.

18. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the radiofrequency power source output frequency lies within a range from 20 to 1000 MegaHertz.

19. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the radiofrequency power source output frequency lies within one of the following ranges: 1 MHz to 10 GHz, 30 MHz – 300 MHz; 300 MHz – 3 GHz.

20. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein ~~the~~ an approximate output frequency of the radiofrequency power source ~~output frequency~~ is selected from the group consisting of 27MHz, 60MHz, 430MHz, 915MHz, 2450MHz.

21. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the radiofrequency power source provides between 0.5 and 2 kW of power into the plasma.

22. The optical emission spectrometer or the mass spectrometer of any preceding claim

wherein axial surfaces of the dielectric resonator are substantially free from electrical shielding for electromagnetic coupling therethrough.

23. The optical emission spectrometer or the mass spectrometer of any preceding claim wherein the ~~dielectric resonator and the radiofrequency power source are placed within a waveguide and the~~ radiofrequency power source is electrically coupled to the dielectric resonator structure by radiation through ~~the~~ a waveguide.

24. The optical emission spectrometer of any ~~preceding claim~~ one of claims 1-13 and 15-23 further comprising:

a gas port for introducing gas and for introducing material to be studied into a plasma generated by the plasma generator; and

an optical sensor for measuring frequency of light emitted by the material when heated by the plasma.

25. The optical emission spectrometer of claim 24 wherein the optical sensor comprises a dispersive element for dispersing light emitted by the plasma according to the wavelength of the light; and an optical detector for detecting the dispersed light.

26. The optical emission spectrometer of claim 25 wherein the dispersive element comprises a grating.

27. The optical emission spectrometer of claim 24 or claim 25 further comprising one or more of: one or more optical focusing elements; mirrors for changing the direction of one or more beams of light; a focal plane array detector comprising multiple detecting elements for simultaneously detecting light dispersed by the dispersive element, the focal plane array detector forming at least part of the optical detector; a controller for controlling the spectrometer; and a controller for receiving an output from the optical detector.

28. The mass spectrometer of any ~~of claims 1 to 23~~one of claims 1-13 and 15-23 further comprising:

a manifold comprising a gas port suitable for delivering sample material into the plasma generated by the plasma generator;

a sample cone and a skimmer cone;

at least one ion focusing element;

a mass analyzing element; and

an ion detector for detecting sample material ionized by the plasma.

29. The mass spectrometer of claim 28 further comprising at least one ~~a~~ controller for controlling the mass spectrometer and ~~a controller~~ for receiving an output from the ion detector.

30. A method of analyzing a substance comprising the steps of:

generating plasma using a plasma generator including a dielectric resonator structure and a radiofrequency power source electrically coupled to the dielectric resonator structure to promote an alternating polarization current flow at a natural resonant frequency of the dielectric resonator structure about the axis to generate plasma in an adjacent gas,

introducing a gas into a region adjacent to the dielectric resonator structure;

exciting the dielectric resonator structure at a natural resonant frequency to generate plasma in the introduced gas;

introducing substance to be analyzed into the plasma;

dispersing light emitted by the substance according to the wavelengths of the light or separating ions of the substance created by the plasma according to their mass to charge ratio;

detecting either light emitted by the substance according to the wavelengths of the light or ions of the substance created by the plasma according to their mass to charge ratio; and

determining the elemental composition of the substance either from the wavelengths of light detected or from the mass to charge ratio of the ions detected.

31. The method of claim 30 wherein in ~~step (c)~~ the step of exciting the dielectric resonator structure at a natural resonant frequency to generate plasma in the introduced gas, the plasma is generated in the introduced gas by an electric field wherein the electric field is substantially only coupled by induction, there being negligible capacitive coupling.

32. The method of claim 30 or claim 31 wherein the introduced gas comprises nitrogen or air.

33. The method of any of claims 30 to 32 wherein in the step of exciting the dielectric resonator structure at a natural resonant frequency to generate plasma in the introduced gas, ~~step (c)~~ the radiofrequency power source automatically seeks the natural resonant frequency of the dielectric resonator structure to output radiofrequency power at or substantially at the natural resonant frequency of the dielectric resonator structure.