What is claimed is:

1. An apparatus for igniting a combustible mixture, comprising:

a coaxial cavity resonator configured to create a plasma discharge;

a radio frequency power source coupled to the coaxial cavity resonator;

a direct current power source coupled to the coaxial cavity resonator;

a combustion process feedback module configured to sense a condition in a combustion environment by measuring a characteristic of the coaxial cavity resonator; and

a controller configured to modulate operation of the coaxial cavity resonator based at least in part on combustion process feedback information from the combustion process feedback module.

2. The apparatus of claim 1, further comprising an internal combustion engine and wherein the combustion environment is a cylinder of the internal combustion engine.

3. The apparatus of claim 2, wherein the controller is further configured to modulate operation of the coaxial cavity resonator during a single combustion cycle based at least in part on the combustion process feedback information from the combustion process feedback module.

4. The apparatus of claim 3, further comprising a motor vehicle configured to be powered by the internal combustion engine.

5. The apparatus of claim 4, wherein the motor vehicle is an automobile that includes a chassis supporting the internal combustion engine, a transmission driven by the internal

combustion engine, a drive axle driven by the transmission, at least two drive wheels operatively coupled to the drive axle, a steering mechanism, at least two steering wheels operatively coupled to the steering mechanism, and a body attached the chassis.

9. An apparatus comprising:

a coaxial cavity resonator;

a radio frequency power source coupled to the coaxial cavity resonator;

a direct current power source coupled to the coaxial cavity resonator;

an operation feedback module configured to sense a condition of the coaxial cavity resonator by measuring a characteristic of the coaxial cavity resonator; and

a controller configured to modulate ignition of a combustible mixture in a combustion environment based at least in part on operation feedback information from the operation feedback module.

10. The apparatus of claim 9, further comprising an internal combustion engine and wherein the combustion environment is a cylinder of the internal combustion engine.

11. The apparatus of claim 10, further comprising a motor vehicle configured to be powered by the internal combustion engine.

12. The apparatus of claim 11, wherein the motor vehicle is an automobile that includes a chassis supporting the internal combustion engine, a transmission driven by the internal combustion engine, a drive axle driven by the transmission, at least two drive wheels operatively coupled to the drive axle, a steering mechanism, at least two steering wheels operatively coupled to the steering mechanism, and a body attached the chassis.

13. An apparatus comprising:

a coaxial cavity resonator;

a radio frequency power source coupled to the coaxial cavity resonator;

a direct current power source coupled to the coaxial cavity resonator;

an operation feedback module configured to sense a condition of the coaxial cavity resonator by measuring a characteristic of the coaxial cavity resonator; and

a controller configured to modulate ignition of a combustible mixture in a combustion environment based at least in part on operation feedback information from the operation feedback module.

14. The apparatus of claim 13, further comprising a combustion feedback module configured to sense a condition of the combustion environment.

15. The apparatus of claim 14, wherein the controller is further configured to modulate operation of the coaxial cavity resonator based at least in part on combustion feedback information from the combustion feedback module.

16. The apparatus of claim 15, further comprising an internal combustion engine and wherein the combustion environment is a cylinder of the internal combustion engine.

17. The apparatus of claim 16, further comprising a motor vehicle configured to be powered by the internal combustion engine.

18. The apparatus of claim 17, wherein the motor vehicle is an automobile that includes a chassis supporting the internal combustion engine, a transmission driven by the internal combustion engine, a drive axle driven by the transmission, at least two drive wheels operatively coupled to the drive axle, a steering mechanism, at least two steering wheels operatively coupled to the steering mechanism, and a body attached the chassis.

19. A method, comprising:

measuring at least one of a voltage value and a current value of a coaxial cavity resonator in a combustion environment;

determining a condition of the coaxial cavity resonator by comparing the measured value to a known possible condition state; and

modulating operation of the coaxial cavity resonator based at least in part on the determined condition.

20. The method of claim 19, wherein the combustion environment is a cylinder of an internal combustion engine.

21. The method of claim 20, further comprising measuring a condition of the combustion environment by using an auxiliary sensor.

22. The method of claim 21, wherein modulating operation of the coaxial cavity resonator is based at least in part on a condition measurement of the combustion environment by the auxiliary sensor.

What is claimed is:

1. An apparatus for igniting a combustible mixture, comprising: a coaxial cavity resonator configured to create a plasma discharge; a radio frequency power source coupled to the coaxial cavity resonator; a direct current power source coupled to the coaxial cavity resonator; a combustion process feedback module configured to sense a condition in a combustion environment by measuring a characteristic of the coaxial cavity resonator; and a controller configured to modulate operation of the coaxial cavity resonator based at least in part on combustion process feedback information from the combustion process feedback module.

2. The apparatus of claim 1, further comprising an internal combustion engine and wherein the combustion environment is a cylinder of the internal combustion engine.

3. The apparatus of claim 2, wherein the controller is further configured to modulate operation of the coaxial cavity resonator during a single combustion cycle based at least in part on the combustion process feedback information from the combustion process feedback module.

4. The apparatus of claim 3, further comprising a motor vehicle configured to be powered by the internal combustion engine.

5. The apparatus of claim 4, wherein the motor vehicle is an automobile that includes a chassis supporting the internal combustion engine, a transmission driven by the internal combustion engine, a drive axle driven by the transmission, at least two drive wheels operatively coupled to the drive axle, a steering mechanism, at least two steering wheels operatively coupled to the steering mechanism, and a body attached the chassis.

6. An apparatus comprising: a coaxial cavity resonator; a radio frequency power source coupled to the coaxial cavity resonator; a direct current power source coupled to the coaxial cavity resonator; an operation feedback module configured to sense a condition of the coaxial cavity resonator by measuring a characteristic of the coaxial cavity resonator; and a controller configured to modulate ignition of a combustible mixture in a combustion environment based at least in part on operation feedback information from the operation feedback module.

7. The apparatus of claim 6, further comprising an internal combustion engine and wherein the combustion environment is a cylinder of the internal combustion engine.

8. The apparatus of claim 7, further comprising a motor vehicle configured to be powered by the internal combustion engine.

9. The apparatus of claim 8, wherein the motor vehicle is an automobile that includes a chassis supporting the internal combustion engine, a transmission driven by the internal combustion engine, a drive axle driven by the transmission, at least two drive wheels operatively coupled to the drive axle, a steering mechanism, at least two steering wheels operatively coupled to the steering mechanism, and a body attached the chassis.

10. An apparatus comprising : a coaxial cavity resonator; a radio frequency power source coupled to the coaxial cavity resonator; a direct current power source coupled to the coaxial cavity resonator; an operation feedback module configured to sense a condition of the coaxial cavity resonator by measuring a characteristic of the coaxial cavity resonator; and a controller configured to modulate ignition of a combustible mixture in a combustion environment based at least in part on operation feedback information from the operation feedback module.

11. The apparatus of claim 10, further comprising a combustion feedback module configured to sense a condition of the combustion environment.

12. The apparatus of claim 11, wherein the controller is further configured to modulate operation of the coaxial cavity resonator based at least in part on combustion feedback information from the combustion feedback module.

13. The apparatus of claim 12, further comprising an internal combustion engine and wherein the combustion environment is a cylinder of the internal combustion engine.

14. The apparatus of claim 13, further comprising a motor vehicle configured to be powered by the internal combustion engine.

15. The apparatus of claim 14, wherein the motor vehicle is an automobile that includes a chassis supporting the internal combustion engine, a transmission driven by the internal combustion engine, a drive axle driven by the transmission, at least two drive wheels operatively coupled to the drive axle, a steering mechanism, at least two steering wheels operatively coupled to the steering mechanism, and a body attached the chassis.

16. A method, comprising: measuring at least one of a voltage value and a current value of a coaxial cavity resonator in a combustion environment; determining a condition of the coaxial cavity resonator by comparing the measured value to a known possible condition state; and modulating operation of the coaxial cavity resonator based at least in part on the determined condition.

17. The method of claim 16, wherein the combustion environment is a cylinder of an internal combustion engine.

18. The method of claim 17, further comprising measuring a condition of the combustion environment by using an auxiliary sensor.

19. The method of claim 18, wherein modulating operation of the coaxial cavity resonator is based at least in part on a condition measurement of the combustion environment by the auxiliary sensor.