CLAIMS

What is claimed is:

1. A spectrometer comprising:

(a) a broadband infrared signal divided into N wavelength spans $D\lambda_i, i = 1,..,N$ so that each wavelength span only propagates in its fundamental mode; and

(b) means to generate an interferogram via active modulation in silicon waveguides.

2. The spectrometer of claim 1 with a broadband infrared source for the signal integrated on the same integrated circuit as the spectrometer.

3. The spectrometer of claim 1 where the generation of the interferogram via modulation is based on the thermo-optic effect of silicon.

4. The spectrometer of claim 3 with an integrated-on-chip Peltier device with a thermally active side above one of two branches of an included interferometer to effect a modulation of a difference between the refractive index properties of the branches to engage the thermo-optic effect of the waveguides of the branches and effect the active modulation.

5. ~~4.~~ The spectrometer of claim 1 where the generation of the interferogram via modulation is based on the plasma dispersion effect of silicon (Free Carrier Absorption).

6. The spectrometer of claim 1 operating within a range of infrared 1.1 μm - 1.5.0 μm (FTIR range of utility) within which the wavelength spans are contained.

7. The spectrometer of claim 1 where the broadband infrared signal is divided into N wavelength spans using bandpass filters.

8. ~~5.~~ The spectrometer of claim 1 with means to sense temperature to obtain high spectral accuracy.

9. ~~6.~~ The spectrometer of claim 1 with a sample interface integrated on chip using ATR in silicon waveguides in which the light does not leave the waveguide and is only diffracted or coupled out of the waveguide when reaching an infrared detector.

10. ~~7.~~ The spectrometer of claim 1 with a sample interface integrated on chip for external reflectance utilizing a diffraction grating to modulate the angle of light.

11. ~~8.~~ The spectrometer of claim 1 with a free-standing thermal detector microbolometer integrated on the same integrated circuit as the spectrometer.

12. ~~9.~~ The spectrometer of claim 1 implementing an algorithm involving the ADC to incorporate the DDAô sensitivity enhanc

13. ~~10.~~ The spectrometer of claim 1 being an integrated CMOS-FTIR spectrometer.

14. ~~11.~~ The spectrometer of claim 1 being an integrated CMOS-Raman Spectrometer.

15. ~~12.~~ The spectrometer of claim 1 made useful for ~~longer wavelengths,~~ IR wavelengths accommodated in silicon waveguides cladded with SiO2.

16. The spectrometer of claim 1 made useful for IR wavelengths longer than accommodated in silicon waveguides cladded with SiO2 and up to 11µm by using silicon nitride~~, and~~ cladding.

17. The spectrometer of claim 1 made useful for IR wavelengths longer than accommodated in silicon waveguides clad with silicon nitride and up to 15µm by using ~~various~~ cladding materials transparent to infrared wave lengths ~~up to~~ from 11 µm - 15µm and having a refractive index lower than silicon.

18. ~~13.~~ A method comprising:

dividing a broadband infrared signal into N wavelength spans $D\lambda_i, i = 1,..,N$ so that each wavelength span only propagates in its fundamental mode; and

generating an interferogram via active modulation in silicon waveguides of an interferometer of a spectrometer.

19. ~~14.~~ The method of claim ~~13~~ 18 further comprising the step of integrating a broadband infrared source for the signal on the same integrated circuit as the spectrometer.

20. ~~15.~~ The method of claim ~~13~~ 18 further comprising the step of generating the interferogram via modulation based on the thermo-optic effect of silicon.

21. ~~16.~~ The method of claim ~~13~~ 18 where an included Peltier device integrated with the interferometer with a thermally active side above one of two branches of the interferometer heats or cools at least one of the two branches of the interferometer to affect refractive index properties of at least one of the two branches to engage a thermo-optic effect of silicon of the at least one branch and thus effect active modulation.

22. The method of claim 18 further comprising the step of generating the interferogram via modulation based on the plasma dispersion effect of silicon (Free Carrier Absorption).

23. ~~17.~~ The method of claim ~~13~~ 18 further comprising of the step of sensing temperature to obtain high spectral accuracy.

24. ~~18.~~ The method of claim ~~13~~ 18 further comprising a step of interaction of the signal with a sample via a sample interface integrated on chip using ATR in silicon waveguides.

25. ~~19.~~ The method of claim ~~13~~ 18 further comprising the step of interaction of the signal with a sample via a sample interface integrated on chip for external reflectance utilizing a diffraction grating to modulate the angle of light.

26. ~~20.~~ The method of claim ~~13~~ 18 further comprising the use of a free-standing thermal detector microbolometer integrated on the same integrated circuit as the spectrometer for sensing temperature.

27. ~~21.~~ The method of claim ~~13~~ 18 further comprising the implementation of an algorithm involving the ADC to incorpor a t e t h e D D A ô s s e n s i t i v i t the generation of a result from the interferogram.

28. ~~22.~~ The method of claim ~~13~~ 18 further comprising the use of an integrated CMOS-FTIR spectrometer.

29. ~~23.~~ The method of claim ~~13~~ 18 further comprising the use of a CMOS-Raman Spectrometer.

~~24. The method of claim 13 further utilizing silver nitride in the spectrometer of longer wavelengths, up to, and using various materials transparent to infrared wave lengths up to 15µm for longer wavelengths, up to 15µm.~~