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CLAIMS:

1. An optical spectroscopy probe comprising:
a probe head having optical elements for coupling to an excitation fiber
for receiving laser energy therefrom and generating a collimated excitation light
5 beam; and
a sample optic adjacent to the probe head, the sample optic having at
least one optical element with two non-parallel surfaces to receive the
collimated excitation light beam, to transmit the collimated excitation light beam
to a sample, and to collect at least one afocal returning scattered light beam
10 that is reflected from the sample.
2. The probe of claim 1, wherein the at least one optical element comprises
at least one wedged window that is disposed between the probe head and the
sample and has two surfaces that are tilted with respect to one another to
transmit a substantially collimated excitation light beam to the sample and
15 receive at least one substantially collimated afocal returning scattered light
beam without inducing an interferometric fringing or etaloning pattern in a
resulting spectrum that is generated from the at least one substantially
collimated afocal returning scattered light beam that is reflected from the
sample.
- 20 3. The probe of claim 2, wherein the at least one optical element comprises
a plurality of wedged windows arranged in a serial or parallel configuration.
4. The probe of any one of claims 1 to 3, wherein the at least one optical
element comprises at least one diverging lens that is disposed between the
probe head and the sample, the at least one optical element having one or more
25 non-planar surfaces that are adapted to cause the collimated excitation light
beam to diverge during transmission to the sample and receive the at least one
afocal returning scattered light beam thereby preventing an interferometric
fringing/etaloning pattern in a resulting spectrum that is generated from the
at least one afocal returning scattered light beam that is reflected from the sample.

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5. The probe of claim 4, wherein the at least one optical element comprises a plurality of diverging lenses that are arranged in a serial or parallel configuration.

6. The probe of any one of claims 1 to 5, wherein the at least one optical
5 element comprises at least one axicon lens that is disposed between the probe head and the sample, the at least one axicon lens having one or more conical surfaces that are adapted to cause the collimated excitation light beam to converge afocally during transmission to the sample and receive the at least one afocal returning scattered light beam thereby preventing an interferometric
10 fringing/etaloning pattern in a resulting spectrum that is generated from the at least one afocal returning scattered light beam that is reflected from the sample.

7. The probe of claim 6, wherein the at least one optical element comprises a plurality of axicon lenses arranged in a serial or parallel configuration.

8. The probe of claim 1, wherein the sample optic comprises a reimager
15 having first and second optical elements disposed on either side of a spatial filter, the spatial filter being disposed at an intermediate focal point thereby preventing off-axis light from entering the probe head and contaminating a resulting spectrum that is generated from a substantially collimated afocal returning scattered light beam that is reflected from the sample.

20 9. The probe of claim 8, wherein the first and second optical elements are spaced apart from the spatial filter and have focal lengths to provide the reimager with a reimaging ratio of 1:1.

10. The probe of claim 8, wherein the first and second optical elements are spaced apart from the spatial filter and having focal lengths to provide the
25 reimager with a reimaging ratio that is: (a) greater than 1:1 to increase a diameter of the collimated excitation beam at the sample or (b) smaller than 1:1 to decrease a diameter of the collimated excitation beam at the sample.

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11. The probe of any one of claims 8 to 10, wherein at least one of the first and second optical elements are lenses.

12. The probe of any one of claims 8 to 10, wherein at least one of the first and second optical elements are cylindrical or toroidal lenses to reshape the collimated excitation beam along one axis relative to a perpendicular axis.

13. The probe of any one of claims 8 to 10, wherein at least one of the optical elements is a curved mirror, an anamorphic prism, or another optical element which acts as a lens and causes the collimated excitation beam to change shape, change direction, or to diverge or converge.

14. The probe of any one of claims 8 to 13, wherein the sample optic is contained within an enclosure that provides a sealed volume for the sample optic and contains at least one gas with spectral lines or bands in a spectrometer spectral range for use as a spectral calibration reference.

15. The probe of any one of claims 8 to 13, wherein the sample optic is contained within an enclosure that provides a sealed volume for the sample optic and contains at least one gas with no spectral lines or bands in a spectrometer spectral range to prevent interference with spectral measurement of the sample.

16. The probe of any one of claims 8 to 13, wherein the sample optic is contained within an enclosure that provides a sealed volume for the sample optic and contains a low-density gas or an effective vacuum to prevent interference with spectral measurement of the sample.

17. An optical spectroscopy probe comprising:
a probe head having optical elements for coupling to an excitation fiber for receiving laser energy therefrom and generating a collimated excitation light beam; and

a sample optic adjacent to the probe head, the sample optic having at least one optical element that is adapted to receive the collimated excitation

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light beam, to transmit the collimated excitation light beam to a sample, and to collect at least one afocal returning scattered light beam that is reflected from the sample,

wherein the at least one optical element has two surfaces that are arranged so
5 that the at least one optical element does not inherently act as a resonant cavity for the collimated excitation or the at least one afocal returning scattered light beam.

18. The probe of claim 17, wherein the probe is further defined according to any one of claims 1 to 16.