WE CLAIM:

1. An optical microscanner, comprising:

a moveable mirror optically coupled to receive an incident beam and operable to reflect the incident beam to produce a reflected beam;

a Micro Electro-Mechanical System (MEMS) actuator coupled to the moveable mirror to cause a linear displacement of the moveable mirror; and

a curved reflector operable to produce an angular rotation of the reflected beam based on the linear displacement of the moveable mirror;

wherein the etched bodies of moveable mirror, the MEMS actuator and the curved reflector are etched together in a substrate in a single lithography step using Deep Reactive Ion Etching (DRIE) technology such that the etched bodies of moveable mirror, the MEMS actuator and the curved reflector are self-aligned.

2. The optical microscanner of Claim 1, wherein the moveable mirror is the curved reflector and wherein the curved reflector is moveable in a linear motion to cause the incident beam to experience a different angle of incidence for each position of the curved reflector.

3. The optical microscanner of Claim 1, wherein the curved reflector is in a fixed position such that the curved reflector is oriented to receive the reflected beam reflected from the moveable mirror and to reflect the reflected beam to produce a second reflected beam.

4. The optical microscanner of Claim 1, wherein the fixed position of the curved reflector is oriented with respect to the moveable mirror such that the linear displacement of the moveable mirror produces a lateral displacement of the reflected beam incident on the curved reflector and the curved reflector transforms the lateral displacement of the reflected beam into an angular rotation of the second reflected beam.

5. The optical microscanner of Claim 1, further comprising:

an optical source for directing the incident beam towards the moveable mirror, the linear displacement of the moveable mirror being perpendicular to a plane of a main propagation direction of the incident beam.

6. The optical microscanner of Claim 1, wherein the moveable mirror is fixed at an angle with respect to a plane of the incident beam.

7. The optical microscanner of Claim 6, wherein the angle is 45 degrees.

8. The optical microscanner of Claim 1, wherein the moveable mirror is one of a flat mirror or a curved mirror.

9. The optical microscanner of Claim 1, wherein the curved reflector has one of a convex or a concave shape.

10. A two-dimensional optical scanner, comprising:

a first moveable mirror moveable in a first plane and a second moveable mirror moveable in a second plane orthogonal to the first plane;

a first MEMS actuator coupled to the first moveable mirror to cause a linear displacement of the first moveable mirror and a second MEMS actuator coupled to the second moveable mirror to cause a linear displacement of the second moveable mirror; and

a curved reflector;

the first moveable mirror is oriented with respect to an optical source and the second moveable mirror to receive an incident beam from the optical source and reflect the incident beam towards the second moveable mirror to produce a first reflected beam;

the second moveable mirror is oriented with respect to the first moveable mirror and the curved reflector to receive the first reflected beam from the first moveable mirror and reflect the first reflected beam towards the curved reflector to produce a second reflected beam; and

the curved reflector is oriented with respect to the second moveable mirror to receive the second reflected beam and reflect the second reflected beam to produce a third reflected beam having an angular displacement in the first and second planes produced as a result of the respective linear displacements of the first and second moveable mirrors.

11. A method for fabricating an optical microscanner, comprising:

providing a silicon on insulator (SOI) wafer including a top surface and a bottom surface;

photolithographically defining in a single step within the top surface of the SOI wafer, using a Deep Reactive Ion Etching (DRIE) process, a moveable mirror optically coupled to receive an incident beam and operable to reflect the incident beam to produce a reflected beam, a Micro Electro-Mechanical System (MEMS) actuator coupled to the moveable mirror to cause a linear displacement of the moveable mirror and a curved reflector operable to produce an angular rotation of the reflected beam based on the linear displacement of the moveable mirror, the single step enabling the moveable mirror, the curved reflector and the MEMS actuator to be self-aligned; and

etching between the top surface of the SOI wafer and the bottom surface of the SOI wafer to release the moveable mirror and the actuator.

12. An optical imager, comprising:

a moveable mirror optically coupled to receive an incident beam and operable to reflect the incident beam to produce a reflected beam;

a Micro Electro-Mechanical System (MEMS) actuator coupled to the moveable mirror to cause a linear displacement of the moveable mirror; and

a curved reflector operable to produce an angular rotation of the reflected beam based on the linear displacement of the moveable mirror;

a detector optically coupled to receive the reflected beam from the moveable mirror and operable to measure pixels of an image of the object, the linear displacement of the moveable mirror operating to project one additional pixel at a time onto the detector to produce a sequential data stream representing the image.

wherein the movable mirror, the curved reflector and the MEMS actuator are integrated on a substrate; and

an optical axis of the incident beam lies in-plane with respect to the substrate; and

the incident beam includes light from an object to be imaged that is incident on the curved reflector, the curved reflector reflecting the incident beam towards the moveable mirror.

13. The optical imager of Claim 12, further comprising:

an additional moveable mirror optically coupled to produce an additional reflected beam from an additional incident beam reflected from the curved reflector, the additional reflected beam being directed towards the detector to produce an additional sequential data stream representing a different portion of the image; and

an image processor for producing the image of the object based on the sequential data streams.

14. The optical imager of claim 13, further comprising:

an additional detector optically coupled to receive the additional reflected beam and operable to produce the additional sequential data stream corresponding to the different portion of the image.

15. A two-dimensional imager, comprising:

a first moveable mirror moveable in a first plane and a second moveable mirror moveable in a second plane orthogonal to the first plane;

a first MEMS actuator coupled to the first moveable mirror to cause a linear displacement of the first moveable mirror and a second MEMS actuator coupled to the second moveable mirror to cause a linear displacement of the second moveable mirror; and

a curved reflector optically coupled to receive an incident beam and operable to reflect the incident beam towards the first moveable mirror to produce a first reflected beam;

the first moveable mirror is optically coupled to receive the first reflected beam and operable to reflect the first reflected beam towards the second moveable mirror to produce a second reflected beam;

the second moveable mirror is optically coupled to receive the second reflected beam and operable to reflect the second reflected beam to produce a third reflected beam; and further comprising:

a detector optically coupled to receive the third reflected beam from the second moveable mirror and operable to measure pixels of a two-dimensional image corresponding to the third reflected beam, the linear displacement of the first and second moveable mirrors operating to project one additional pixel at a time in two dimensions onto the detector to produce a sequential data stream representing the two-dimensional image.

16. An optical dispersive spectrometer, comprising:

a moveable mirror optically coupled to receive an incident beam and operable to reflect the incident beam to produce a reflected beam;

a Micro Electro-Mechanical System (MEMS) actuator coupled to the moveable mirror to cause a linear displacement of the moveable mirror; and

a curved reflector operable to produce an angular rotation of the reflected beam based on the linear displacement of the moveable mirror;

a diffraction grating optically coupled to receive the incident beam and diffract the incident beam to produce a plurality of incident beams directed towards different positions on the curved reflector, each of the plurality of incident beams having a different wavelength range; and

a detector optically coupled to receive the reflected beam corresponding to one or more of the plurality of incident beams from the moveable mirror, the linear displacement of the moveable mirror operating to reflect one or more of the plurality of incident beams at a time onto the detector to produce a sequential data stream.

17. The optical dispersive spectrometer of Claim 16, wherein the wavelength range for each of the plurality of incident beams includes a single different wavelength and the moveable mirror has a size substantially equivalent to a size of a slit in the diffraction grating.

18. The optical dispersive spectrometer of Claim 17, wherein the wavelength range for each of the plurality of incident beams includes multiple overlapping wavelengths, and further comprising:

a processor for calculating the intensity of each of the wavelengths using differentiation of the sequential data stream.

19. The optical dispersive spectrometer of Claim 18, wherein the detector is oriented with respect to the reflector to receive a first portion of the plurality of incident beams reflected from the curved surface and further comprising:

an additional detector optically coupled to receive a second portion of the plurality of incident beams reflected from the curved surface and operable to produce an additional complementary sequential data stream, the processor calculating the intensity of each of the

wavelengths using differentiation of the sequential data stream and the additional complementary sequential data stream.

WE CLAIM:

1. An optical microscanner, comprising:

a moveable mirror optically coupled to receive an incident beam and operable to reflect the incident beam to produce a reflected beam;

a Micro Electro-Mechanical System (MEMS) actuator coupled to the moveable mirror to cause a linear displacement of the moveable mirror; and

a curved reflector operable to produce an angular rotation of the reflected beam based on the linear displacement of the moveable mirror.

2. The optical microscanner of claim 1, wherein the moveable mirror is the curved reflector and wherein the curved reflector is moveable in a linear motion to cause the incident beam to experience a different angle of incidence for each position of the curved reflector.

3. The optical microscanner of claim 1, wherein the curved reflector is optically coupled to receive the reflected beam reflected from the moveable mirror and operable to reflect the reflected beam to produce a second reflected beam.

4. The optical microscanner of claim 3, wherein the linear displacement of the moveable mirror produces a lateral displacement of the reflected beam incident on the curved reflector, and the curved reflector transforms the lateral displacement of the reflected beam into an angular rotation of the second reflected beam.

5. The optical microscanner of claim 1, further comprising:

an optical source for directing the incident beam towards the moveable mirror, the linear displacement of the moveable mirror being perpendicular to a plane of the optical source.

6. The optical microscanner of claim 1, wherein the moveable mirror is fixed at an angle with respect to a plane of the incident beam.

7. The optical microscanner of claim 6, wherein the angle is 45 degrees.

8. The optical microscanner of claim 1, wherein the moveable mirror is one of a flat mirror or a curved mirror.

9. The optical microscanner of claim 1, wherein the curved reflector has one of a convex or a concave shape.

10. The optical microscanner of claim 1, wherein the optical microscanner is an imaging device, and wherein the incident beam includes light from an object to be imaged that is incident on the curved reflector, the curved reflector reflecting the incident beam towards the moveable mirror, and further comprising:

a detector optically coupled to receive the reflected beam from the moveable mirror and operable to measure a pixel of an image of the object, the linear displacement of the moveable mirror operating to project one pixel at a time onto the detector to produce a sequential data stream representing the image.

11. The optical microscanner of claim 10, further comprising:

an additional moveable mirror optically coupled to produce an additional reflected beam from an additional incident beam reflected from the curved reflector, the additional reflected beam being directed towards the detector to produce an additional sequential data stream representing a different portion of the image; and an image processor for producing the image of the object based on the sequential data streams.

12. The optical microscanner of claim 11, further comprising:

an additional detector optically coupled to receive the additional reflected beam and operable to produce the additional sequential data stream corresponding to the different portion of the image.

13. The optical microscanner of claim 1, wherein the optical microscanner is a dispersive element spectrometer, and further comprising:

a diffraction grating optically coupled to receive the incident beam and diffract the incident beam to produce a plurality of incident beams directed towards different positions on the curved reflector, each of the plurality of incident beams having a different wavelength range; and

a detector optically coupled to receive the reflected beam corresponding to one of the plurality of incident beams from the moveable mirror, the linear displacement of the moveable mirror operating to reflect one of the plurality of incident beams at a time onto the detector to produce a sequential data stream.

14. The optical microscanner of claim 13, wherein the wavelength range for each of the

plurality of incident beams includes a single different wavelength and the moveable mirror has a size substantially equivalent to a size of a slit in the diffraction grating.

15. The optical microscanner of claim 13, wherein the wavelength range for each of the plurality of incident beams includes multiple overlapping wavelengths, and further comprising:

a processor for calculating the intensity of each of the wavelengths using differentiation of the sequential data stream.

16. The optical microscanner of claim 15, further comprising:

an additional detector optically coupled to receive the plurality of incident beams reflected from the curved surface and operable to produce an additional complementary sequential data stream, the processor calculating the intensity of each of the wavelengths using differentiation of the sequential data stream and the additional complementary sequential data stream.

17. The optical microscanner of claim 1, wherein the optical scanner is a two-dimensional scanner, and wherein:

the moveable mirror includes a first moveable mirror moveable in a first plane and a second moveable mirror moveable in a second plane orthogonal to the first plane;

the first moveable mirror is optically coupled to receive the incident beam and operable to reflect the incident beam towards the second moveable mirror to produce a first reflected beam;

the second moveable mirror is optically coupled to receive the first reflected beam and operable to reflect the first reflected beam towards the curved reflector to produce a second reflected beam; and

the curved reflector is optically coupled to receive the second reflected beam and operable to reflect the second reflected beam to produce a third reflected beam having an angular displacement in the first and second planes produced as a result of the respective linear displacements of the first and second moveable mirrors.

18. The optical microscanner of claim 1, wherein the optical scanner is a two-dimensional imaging device, and wherein:

the moveable mirror includes a first moveable mirror moveable in a first plane and a second moveable mirror moveable in a second plane orthogonal to the first plane;

the curved reflector is optically coupled to receive the incident beam and operable to reflect the incident beam towards the first moveable mirror to produce a first reflected beam;

the first moveable mirror is optically coupled to receive the first reflected beam and operable to reflect the first reflected beam towards the second moveable mirror to produce a second reflected beam;

the second moveable mirror is optically coupled to receive the second reflected beam and operable to reflect the second reflected beam to produce a third reflected beam; and further comprising:

a detector optically coupled to receive the third reflected beam from the second moveable mirror and operable to measure a pixel of a two-dimensional image corresponding to the third reflected beam, the linear displacement of the first and second moveable mirrors operating to project one pixel at a time in two dimensions onto the detector to produce a sequential data stream representing the two-dimensional image.

19. The optical microscanner of claim 1, wherein the curved reflector and the moving mirror are aligned and fabricated in a single lithography step.

20. A method for fabricating an optical microscanner, comprising:

providing a silicon on insulator (SOI) wafer including a top surface and a bottom surface;

photolithographically defining within the top surface of the SOI wafer a moveable mirror optically coupled to receive an incident beam and operable to reflect the incident beam to produce a reflected beam, a Micro Electro-Mechanical System (MEMS) actuator coupled to the moveable mirror to cause a linear displacement of the moveable mirror and a curved reflector operable to produce an angular rotation of the reflected beam based on the linear displacement of the moveable mirror; and

etching between the top surface of the SOI wafer and the bottom surface of the SOI wafer to release the moveable mirror and the actuator.