CLAIMS

1. A method of supplying reactant activation energy to a sub-micron area, comprising:

providing a first photon energy beam having a central non-depleted region and a surrounding depleted region and a full width of about 40 nm;

providing a second photon energy beam having a central non-depleted region and a surrounding depleted region and a full width of about 40 nm; and

positioning the central non-depleted region of the first photon energy beam and the central non-depleted region of the second photon energy beam to overlap in a first overlap region, wherein an area of the first overlap region is less than an area of either the central non-depleted region of the first photon energy beam or the central non-depleted region of the second photon energy beam.

2. The method of claim 1, further including:

providing a workpiece having a first and second work location on a surface of the workpiece,

positioning the workpiece so that the first overlap region extends over the first work location;

causing an energy-related effect to the first work location of the workpiece, and then

moving the workpiece relative to the first and second photon energy beams so that the first and second photon energy beams overlap in a second overlap region, wherein the second overlap region extends over the second work location.

3. The method of claim 2, wherein, during the movement of the workpiece, the first and second photon energy beams do not overlap.

4. The method of claim 1, further including pulsing at least one of the first and second photon energy beams.

5. The method of claim 2, wherein the second work location partially overlays the first overlap region.

6. The method of claim 1, wherein the first photon energy beam and the second photon energy beam are parallel and overlap along at least a portion of a length of each photon energy beam.

7. The method of claim 1, wherein the first photon energy beam and the second photon energy beam intersect at the first overlap region.

8. An apparatus for the formation of sub-micron features on a workpiece, comprising:

a first stimulated emission depleted beam generator;

a second stimulated emission depleted beam generator;

a moveable substrate support; and

optics defining a beampath between the moveable substrate support and the first and second stimulated emission depleted beam generators, wherein the optics include a blanking shutter.

9. The apparatus of claim 8, wherein the blanking shutter is a moveable mirror.

10. The apparatus of claim 8, wherein the blanking shutter is operable to cause a beam from the first or the second stimulated emission depleted beam generator to change between an overlapping condition and a non-overlapping condition at the moveable substrate support.

11. The apparatus of claim 8, wherein each stimulated emission depleted beam generator further comprises a beam splitter and a micromirror array.

12. The apparatus of claim 11, wherein at least one beam splitter comprises a Fourier grating.

13. The apparatus of claim 12, wherein the Fourier grating is a two dimensional Fourier grating.

14. The apparatus of claim 12, wherein the Fourier grating splits a beam from the respective stimulated emission depleted beam generator into a plurality of beamlets.

15. The apparatus of claim 14, wherein the optics further include a beam combiner positioned in the beampath between the micromirror arrays of the first and the second stimulated emission depleted beam generators, such that beamlets from the first stimulated emission depleted beam generator pass through the combiner, and beamlets from the second stimulated emission depleted beam generators are reflected at the combiner.

16. The apparatus of claim 15, further including a controller capable of independently moving each mirror of at least one of the micromirror arrays.

17. A method of causing a reaction at a sub-micron region of a substrate, comprising:

providing a first beam having an a first excitation portion of a first energy level surrounded by a first depleted region;

providing a second beam having an a second excitation portion of a second energy level surrounded by a second depleted region;

providing a third beam having a third excitation portion of the first energy level surrounded by a third depleted region;

providing a fourth beam having a fourth excitation portion of the second energy level surrounded by a fourth depleted region;

selectively partially overlapping the first excitation portion and the second excitation portion at a surface of the substrate to form a first reaction region having an area smaller than the projected area of either the first or the second excitation portion on the substrate;

selectively partially overlapping the third excitation portion and the fourth excitation portion at the surface of the substrate to form a second reaction region;

providing at least one reactant species at the first reaction region; and

performing a reaction involving the reactant species in the first reaction region but not in substrate regions adjacent to the first reaction region.

18. The method of claim 21, further including:

interrupting the passage of the first and third beams such that the first and third beams do not reach the substrate;

moving the substrate; and

causing only the first beam to again reach the substrate.

19. The method of claim 18, wherein moving the substrate occurs before the first beam again reaches the substrate.

20. The method of claim 17, wherein the reactant species is a deposition or etching reactant.

21. The method of claim 17, wherein the first reaction region at least partially overlays the second reaction region, forming an overlay reaction region.

22. The method of claim 18, further comprising, after moving the substrate, selectively partially overlapping the first excitation portion and at least one of the second excitation portion and the fourth excitation portion in the presence of the reactant to cause the reaction in the overlay reaction region.