FIG. 1

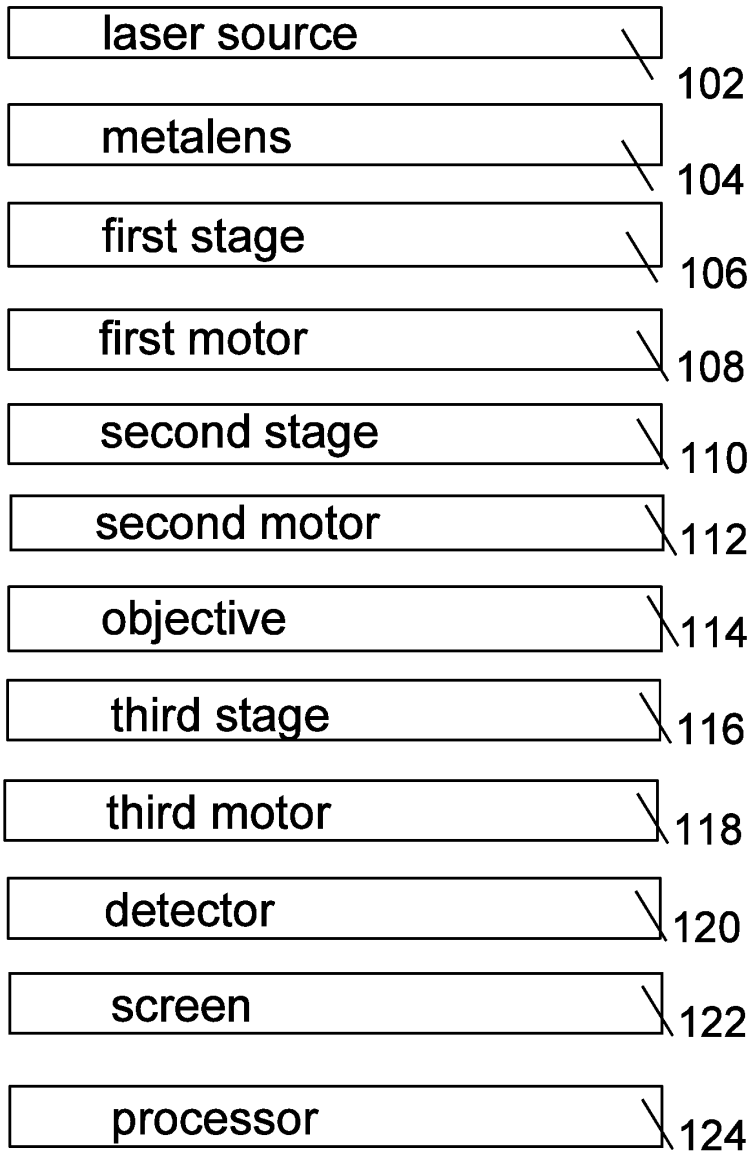
laser source
102
metalens
104
first stage
106
first motor
108
second stage
110
second motor
112
objective
114
third stage
116
third motor
118
detector
120
screen
122
processor
124

FIG. 2

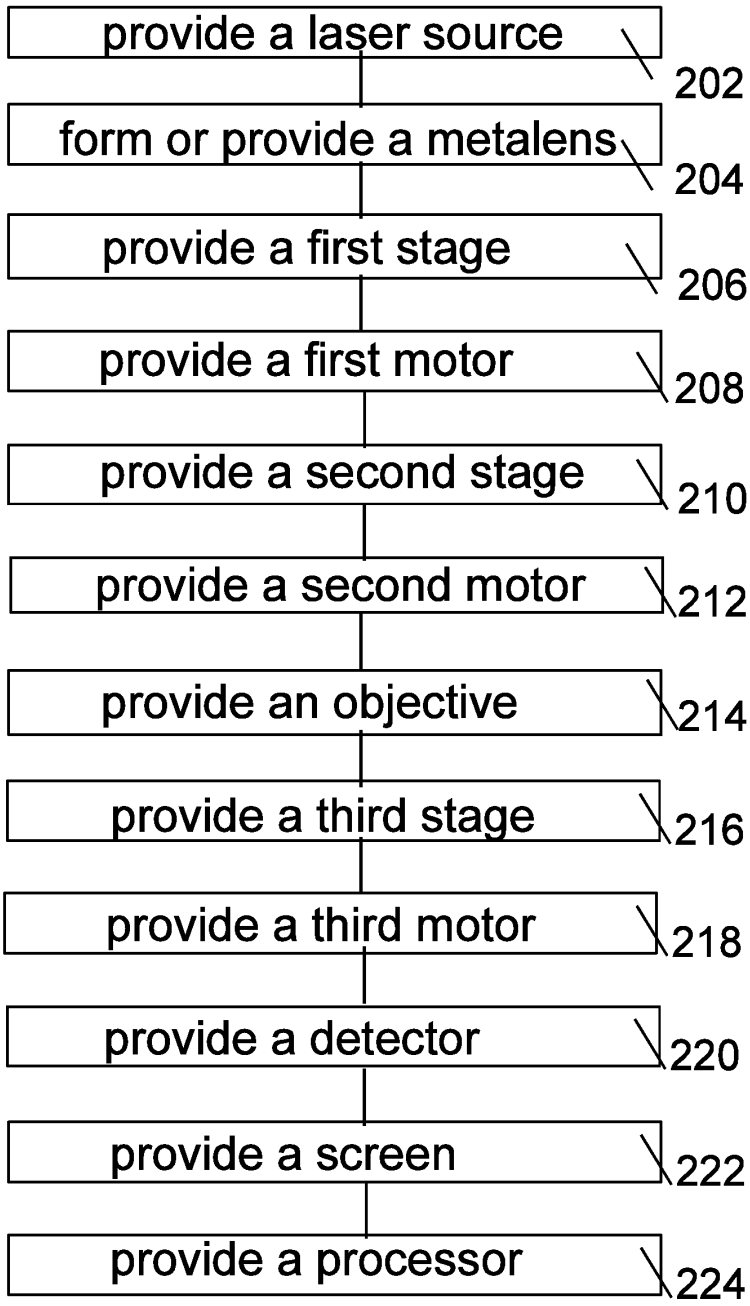
provide a laser source
202
form or provide a metalens
204
provide a first stage
206
provide a first motor
208
provide a second stage
210
provide a second motor
212
provide an objective
214
provide a third stage
216
provide a third motor
218
provide a detector
220
provide a screen
222
provide a processor
224

FIG. 3

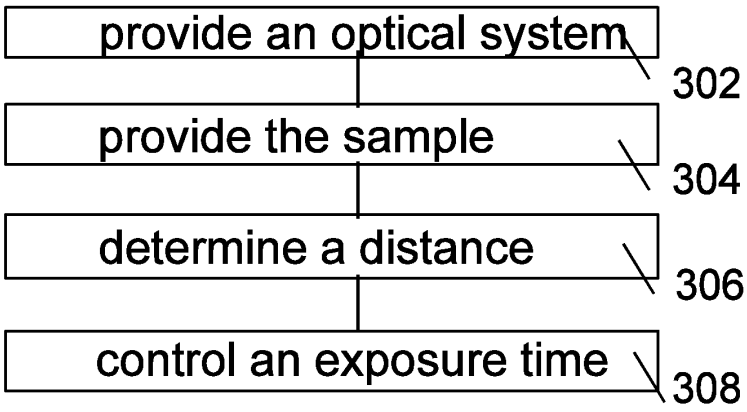
provide an optical system
302
provide the sample
304
determine a distance
306
control an exposure time
308

FIG. 4

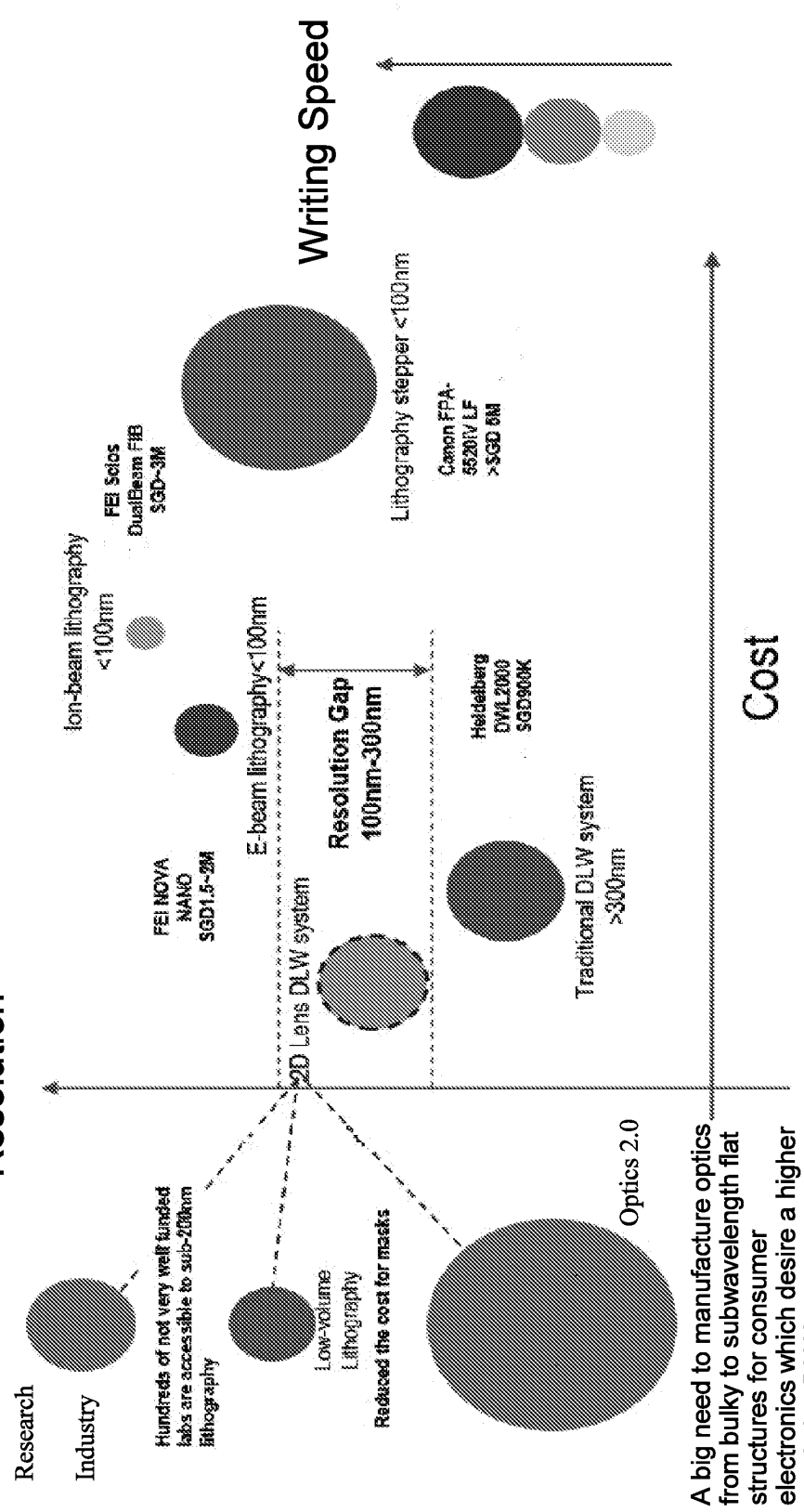
Resolution
Writing Speed
Cost
Research
Industry
Hundreds of not very well funded labs are accessible to sub-200nm lithography
Low-volume Lithography
Reduced the cost for masks
Optics 2.0
Ion-beam lithography <100nm
FEI Sclos DualBeam FIB SGD~3M
FEI NOVA NANO SGD1.5~2M
E-beam lithography<100nm
2D Lens DLW system
Resolution Gap 100nm~300nm
Heidelberg DWL2000 SGD90K
Traditional DLW system >300nm
Lithography stepper <100nm
Canon FPA-5520iV LF >SGD 6M
A big need to manufacture optics from bulky to subwavelength flat structures for consumer electronics which desire a higher resolution DLW system

FIG. 5

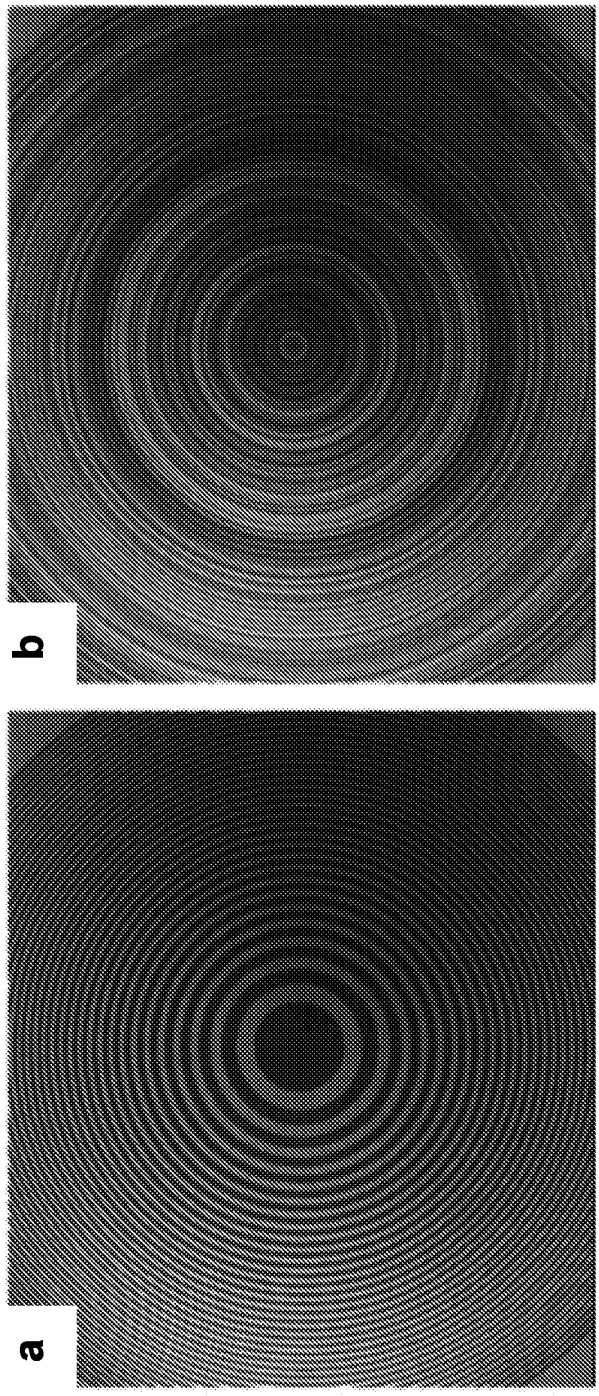

FIG. 6

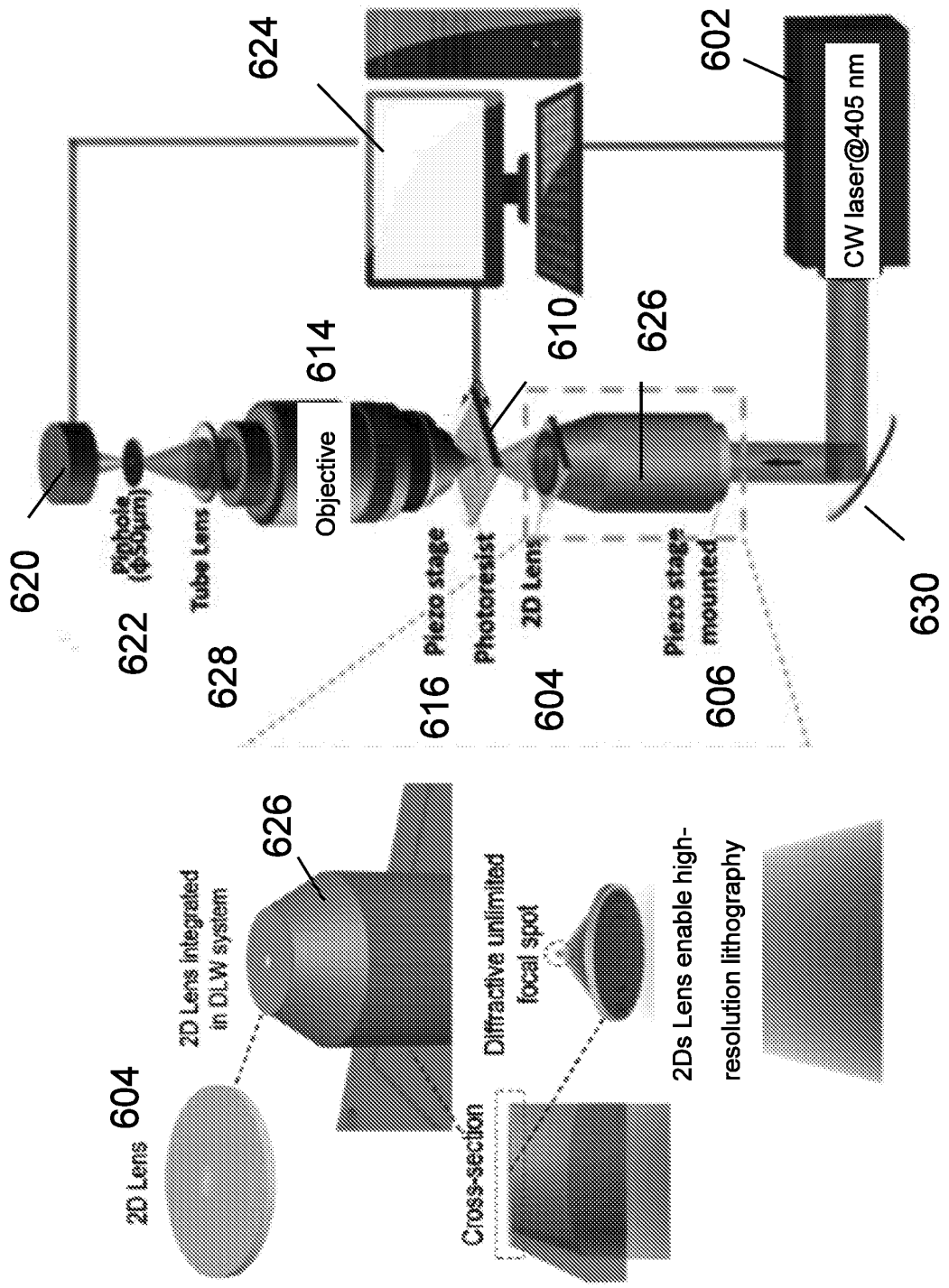
620
622
628
616
604
606
630
624
602
614
610
626
Objective
Tube Lens
Piezo stage
Photoresist
2D Lens
Piezo stage mounted
CW laser@405 nm
2D Lens
604
2D Lens integrated in DLW system
626
Cross-section
Diffractive unlimited focal spot
2Ds Lens enable high-resolution lithography

FIG. 7

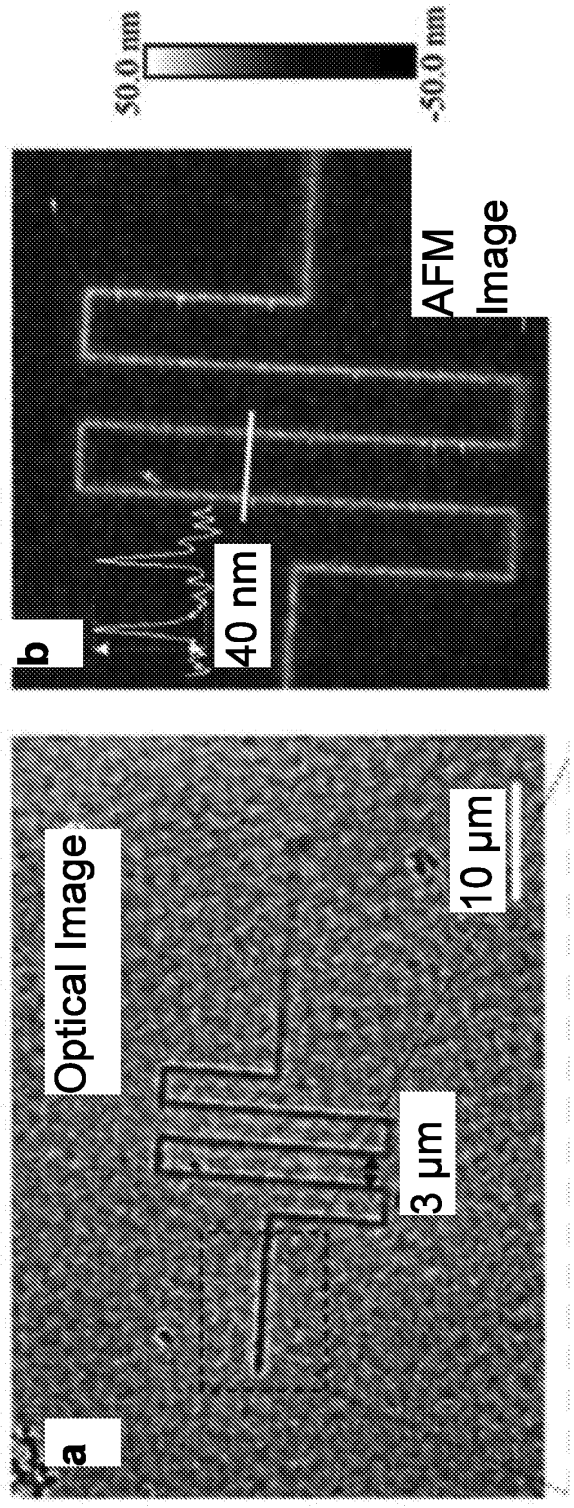

FIG. 8

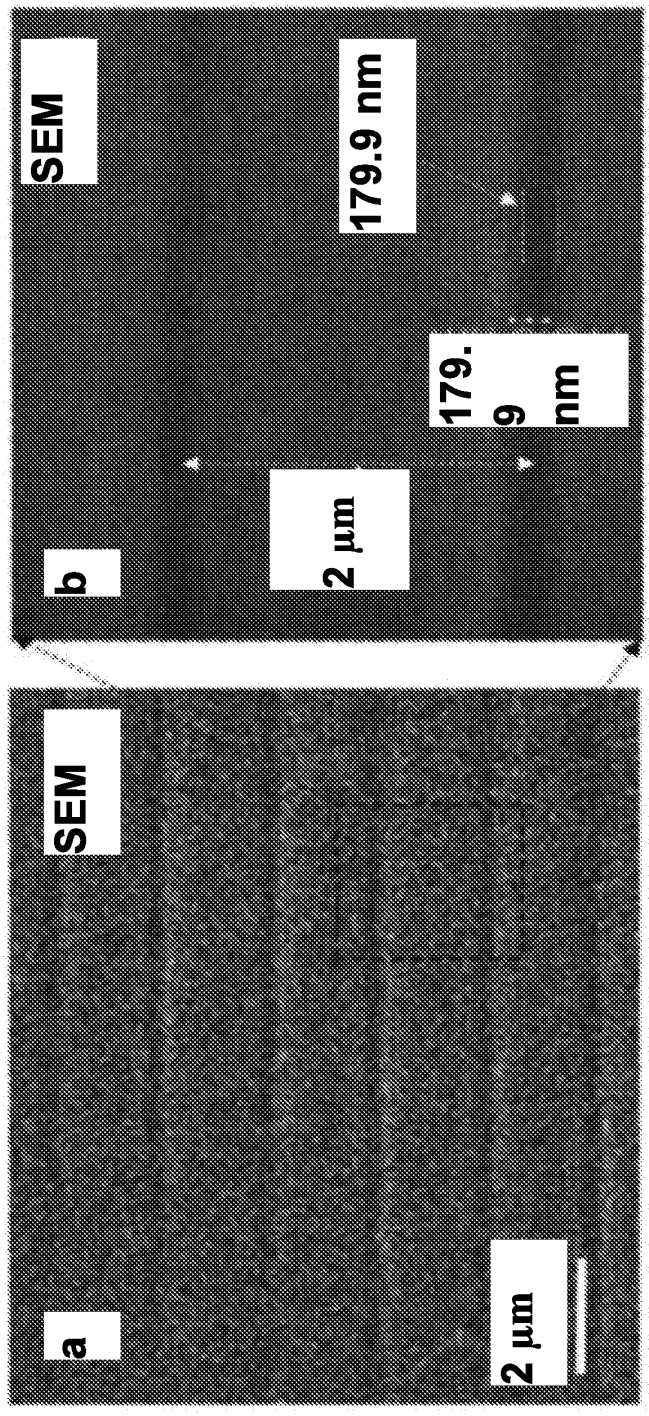

FIG. 9

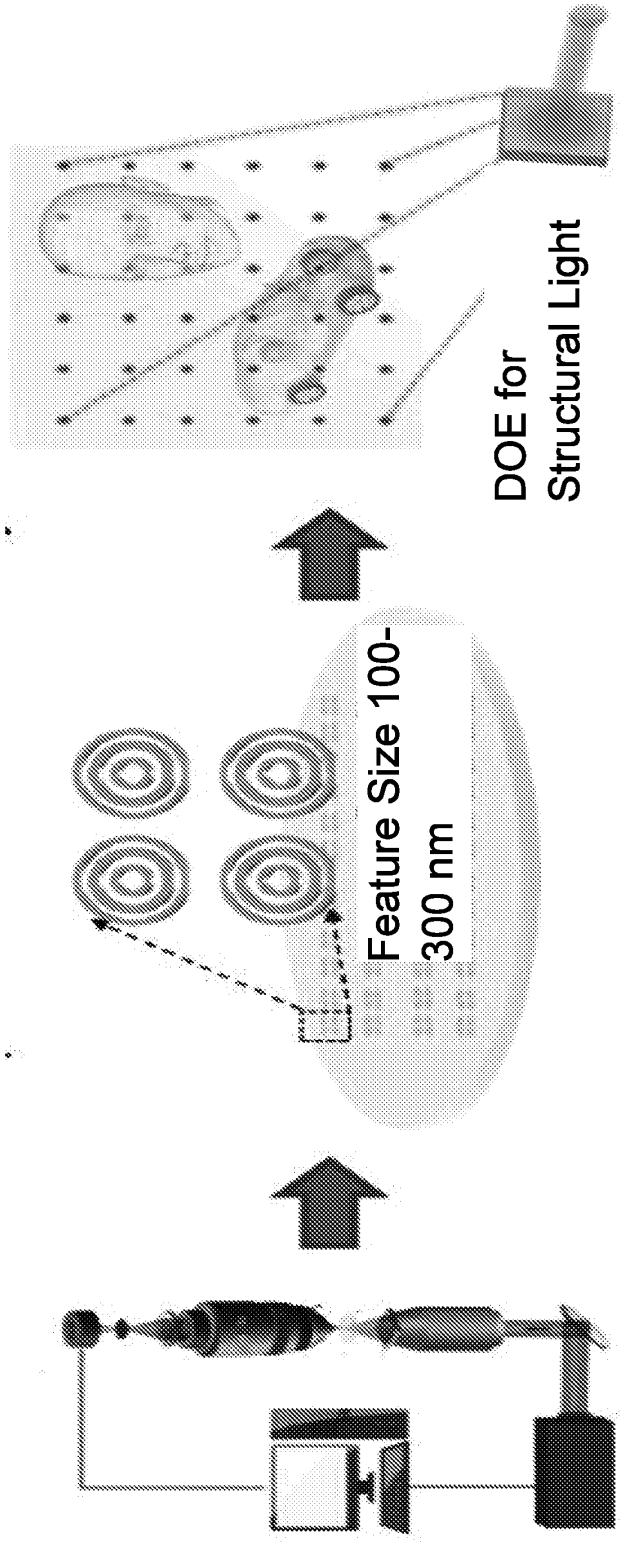

FIG. 10

	Embodiment	Heidelberg DWL 66+ DLW System	Nano System Solution DL 1000 DLW System
Focusing resolution	Sub diffraction limit Super Oscillation lens could leads to the resolution as high as 180nm	Diffraction limited conventional lens leads to low resolution (~ 3 00 nm in this system)	1um resolution (0.5um or 2um resolution are the option)
Shape of the focal spot	Can be needle shape with microns depth of focus, good for lithography	Round focusing spot with certain focusing depth	Round focusing spot with certain focusing depth
Ease of fabrication	Fabricated using semiconductor processing, which is potentially fast and for large volume production	The conventional lens needs careful polishing and alignment, are very time consuming	The conventional lens needs careful polishing and alignment, are very time consuming
Cost of technology adoption	The total estimated cost of our DLW system is around 300k	The sale price of Heidelberg DWL 66+ is around 800k	The sale price of DL 1000 is from 500k to 700k
Exposure efficiency	Multi Super Oscillation lens can be integrated in one writing head for multi focus spot	Only 1 focus spot for exposure	Only 1 focus spot for exposure