Abstract

Present work mainly focus on two lithographic techniques viz; selective laser ablation lithography and atom lithography using dipole force.

The work on atom lithography using dipole is on simulation of atomic trajectories under dipole force using semi-classical technique for various configuration of atomic beams and light fields to focus down the atomic beam at sub-micron level. Through these studies new configuration of light fields and atomic beams were proposed for their applications in the field of microlithography and nanolithography. We proposed the use of square arrays of multiple atomic lens produced by interference of four nearly collinear optical beams in atom lithography using dipole force. This configuration is useful in writing large number of micro-periodic structures in square arrays in a single step via atom lithography. A novel configuration of microscopic square arrays of atomic beams (matrix of micro-ovens) in presence of TEM_{00} mode laser, acting as a atomic lens, is proposed for atom lithography via dipole force for obtaining sub $\lambda/2$ periodic structures.

Application of dipole force in the isotopic separation was also proposed. As an example, a scheme for the enrichment of U^{235} using dipole force generated by a red detuned TEM_{00} mode of laser with respect to U^{235} transition is discussed

Atom lithography technique needs fairly collimated atomic beam. Therefore we have developed a new technique of generation of cold atomic beam having low divergence using

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laser ablation without using any collimation optics. The axial velocities and divergence of atomic beam was studied as a function of laser energy.

Selective laser ablation technique is demonstrated for obtaining one and two dimensional periodic structures ranging from micron to sub-micron level using high power multiple laser beam interferometry in a single shot. The advantage of this technique over other technique is also discussed.

The proposed configuration of matrix of micro-ovens for obtaining large number of periodic atomic beams is experimentally realized via selective laser ablation lithography in one as well as two dimension for the first time.