# Electronic Supplementary Information for

## Light-directed on-chip shape transformation of a single gold nanoparticle

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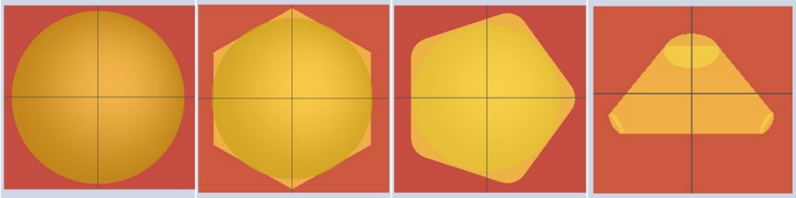
**Table S1** Geometry setting of different shaped Au NPs (simplified from the SEM images in Figure 1c) for FDTD simulations

| Time (s) | 0 | 4 | 6 | 10 |
|---|---|---|---|---|
| FDTD Geometry |  | | | |
| | Sphere | Hexagon | Pentagon | Prism |
| Size (nm) | Φ85 | Φ80, 45*20[a] | Φ76, 46*20[a] | 90*60 |
| Volume($nm^3$) | $3.2*10^5$ | $3.4*10^5$ | $2.9*10^5$ | $3.1*10^5$ |

a) Size of the facet in a format of $l*h$. Here $l$ is the length of the facet while $h$ is the height of the facet.

**Table S2** Laser-induced growth, etching and ripening of Au NPs under different irradiation conditions

| Power (mW) / Conc. (mM)[a] | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 5 | growth | growth | growth | ripening |
| 25 | growth | growth | ripening | ripening |
| 50 | dissolution | dissolution | dissolution | dissolution |

a) Concentration of $HAuCl_4$ in aqueous solution.

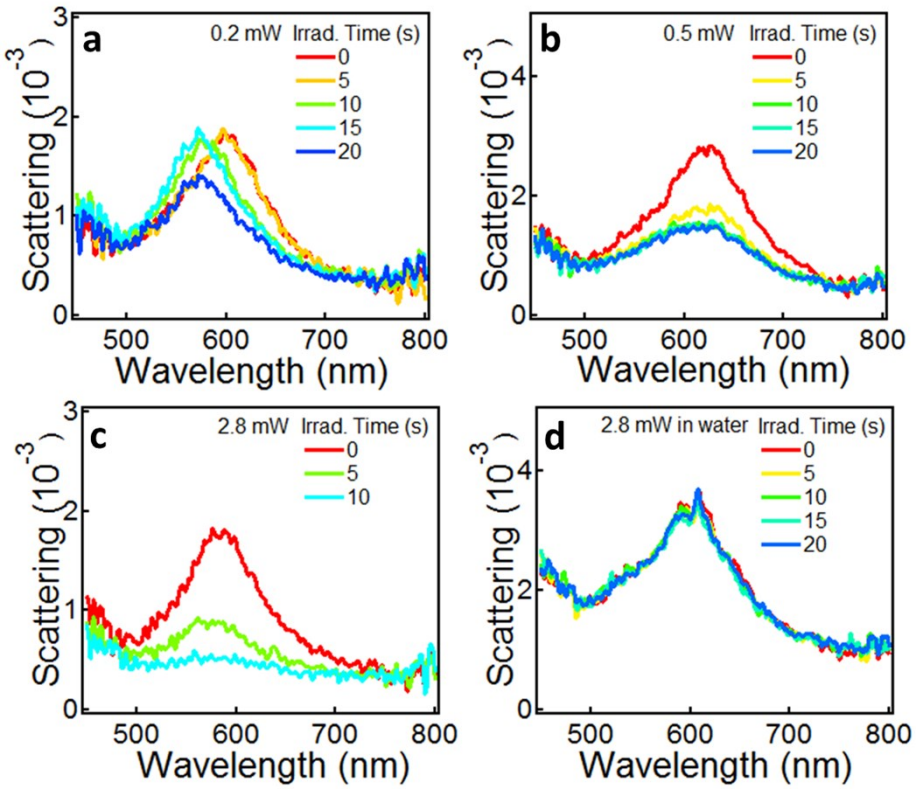



**Fig. S1** (a-c) Dark field scattering spectra showing kinetics of AuNPs in $HAuCl_4$ solution (25 mM) at different irradiation powers. (a) 0.2 mW, (b) 0.5 mW, (c) 2.8 mW. (d) Dark field scattering kinetics of AuNPs in water as a control at irradiation power of 2.8 mW.

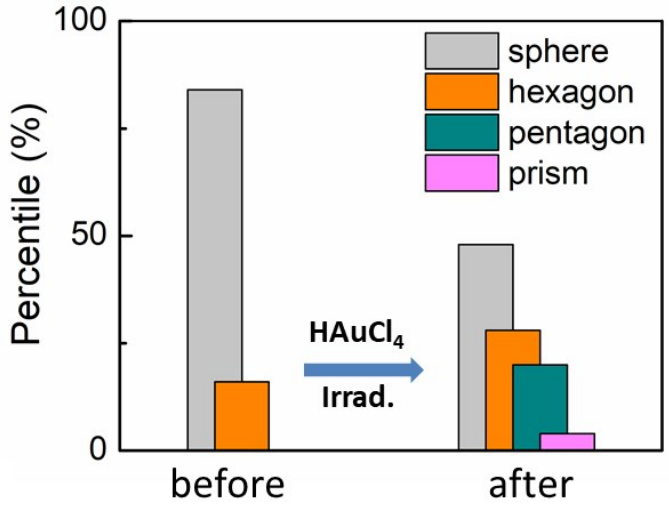



**Fig. S2** The statistic histogram of Au NPs shape before and after the irradiation. $HAuCl_4$. Concentration: 20 mM. Irradiation power: 4 mW.

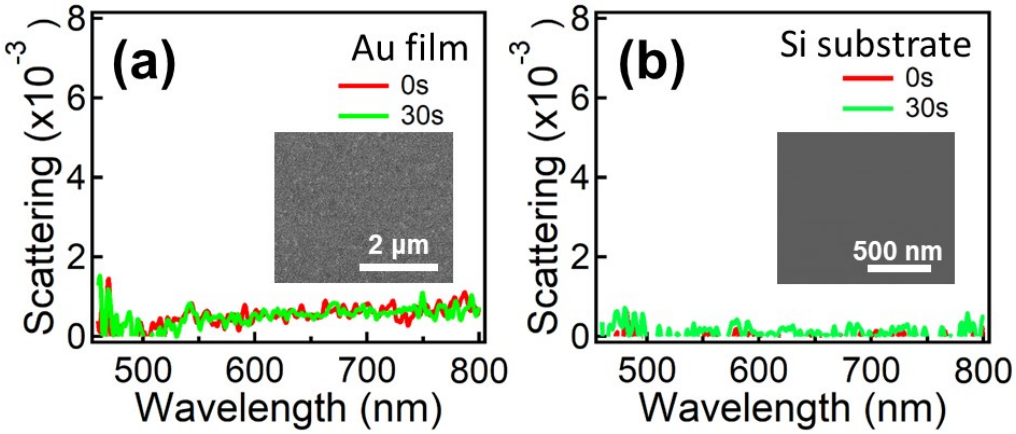



**Fig. S3** Scattering spectra before and after laser irradiation (a) on Au film. $HAuCl_4$. Concentration: 50 mM. Irradiation power: 8 mW. (b) on Si substrate. $HAuCl_4$. Concentration: 25 mM. Irradiation power: 8 mW.

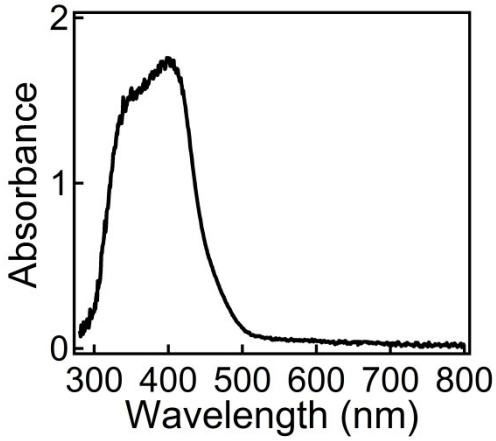



**Fig. S4** UV-Vis absorbance of $HAuCl_4$ aqueous solution (10 mM).

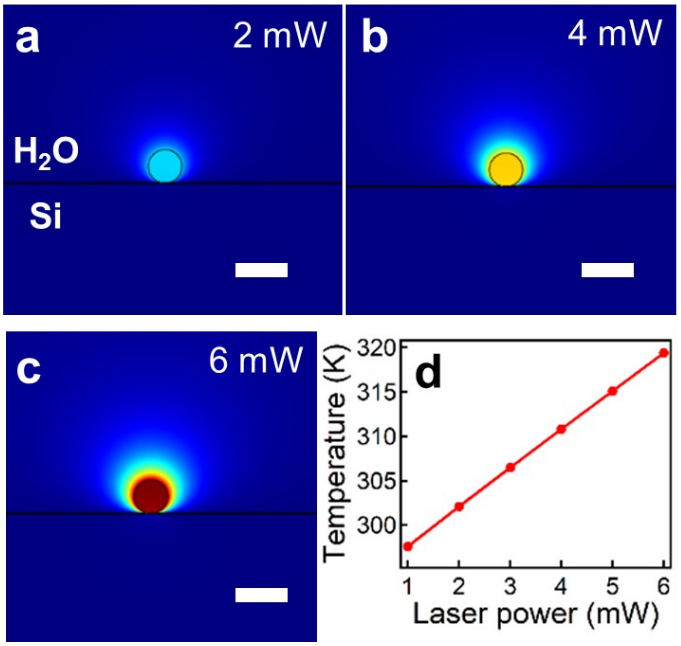



**Fig. S5** Temperature distribution around Au NPs on Si substrate with water medium. Irradiation power: (a)2 mW, (b) 4 mW, (c) 6 mW. Scale bars are 100 nm. (d) Change of Au surface temperature with irradiation power.

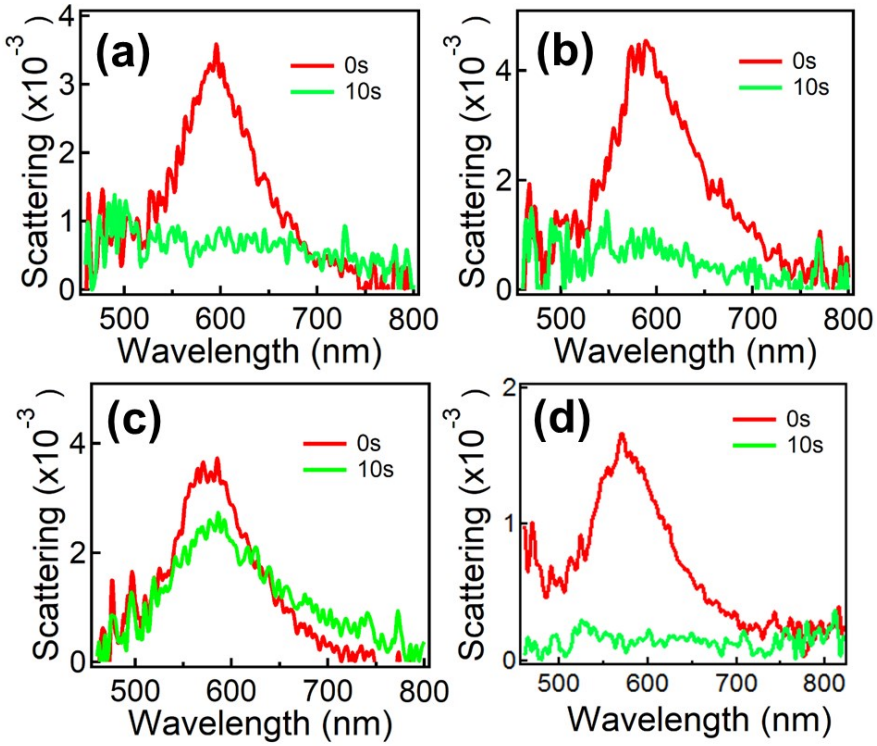



**Fig. S6** Scattering spectra of Au NPs before and after the irradiation under different conditions. (a) in 5 mM $HAuCl_4$ solution containing 50 mM HCl. (b) in 5 mM $HAuCl_4$ solution containing 50 mM NaCl. (c) in 50 mM $NaAuCl_4$ solution (pH=6). (d) in 50 mM $HAuCl_4$ solution.

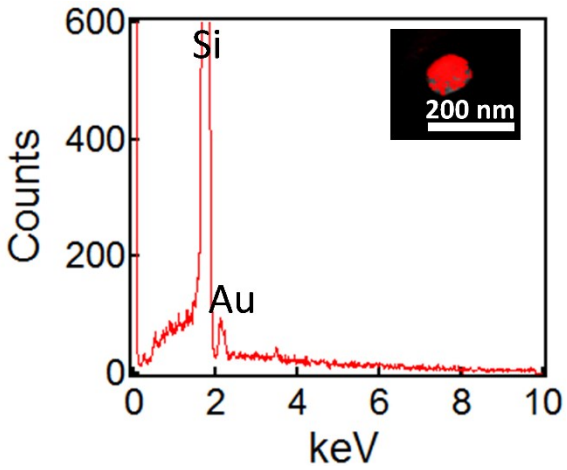



**Fig. S7** The EDX spectrum of the irradiated Au NP on Si substrate. Inset is the EDX mapping of Au element overlapping with the SEM image.

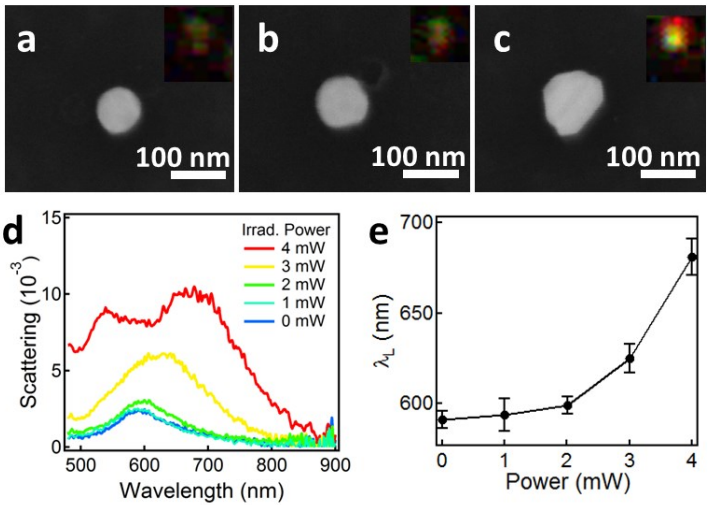



**Fig. S8** Power dependent growth of Au NPs in the presence of $HAuCl_4$ solution (5mM). (a-c) SEM images of Au NPs after the irradiation (30 s). irradiation power: a)2 mW, b) 3 mW, c) 4 mW. d) Change of scattering spectra with irradiation power. and e) the corresponding change of the plasmon peaks.

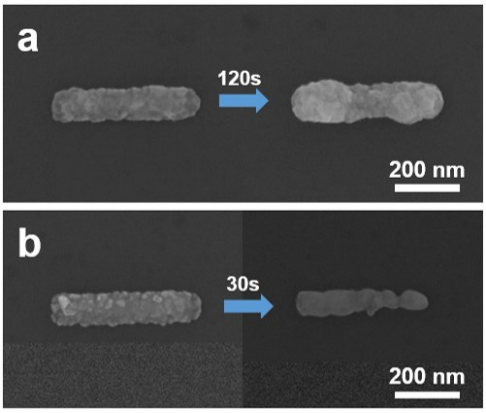



**Fig. S9** SEM images of Au nanorods (NRs) before and after the laser irradiation. Irradiation power: 1 mW. $HAuCl_4$. Concentration: (a): 10 mM. (b): 30 mM. The Au NRs were fabricated via e-beam lithography without any surface ligands. The irradiation results show similar trend as Au NPs: higher concentration of $HAuCl_4$ leads to etching of the Au NRs while lower concentration $HAuCl_4$ leads to growth at ends.

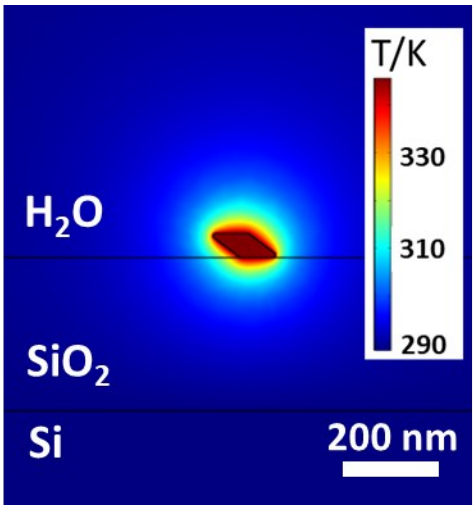



**Fig. S10** Temperature distribution around the Au BPN on $SiO_2$/Si substrate with water medium. Irradiation power: 1 mW.