

# Light focusing via concave corrugated surface of photonic crystal

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In the recent years, it have been demonstrated that light spreading can be minimized by applying photonic crystal (PC) surface physics through the enhance transmission and directional emission of light from a sub-wavelength aperture<sup>1</sup>. In most literature, light beaming occurs on the flat plane of PC surface by selective termination or structure geometry variation. In this paper, we control light diffraction by means of using a concave curvature<sup>2</sup>. From Rowland's theory, it is shown that light can be focus or disperse with a spherical concave substrate. This concept is implemented on PC structure by introducing periodic modulation with concave curvature. Fig. 1 shows the schematic layout of the concave PC structure with surface corrugation. Fig. 2 shows the field pattern of light emerging from the subwavelength aperture. It can be seen that the field converges and focus at a distance from the aperture, which is called the focal length. Fig. 3 shows beam width at various positions. The spot size of the focus field is  $\sim 2.4a$ , which is limited by diffraction in free space.  $a$  is the lattice constant of the PC. Fig. 4 shows the focal lengths for different concave curvatures. The graph proves Rowland theory that image is form on the circumference of rowland circle, whose diameter is the radius of the concave curvature.

[1] E. Moreno et al, "Enhanced transmission and beaming of light via photonic crystal surface modes," *PRB*, **69**, 121402 (2004).

[2] M. C. Hutley, "Diffraction Gratings," Academic Pres (1982)

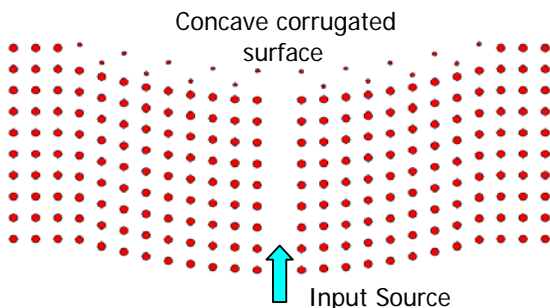


Fig. 1: Schematic layout of the concave PC surface corrugation

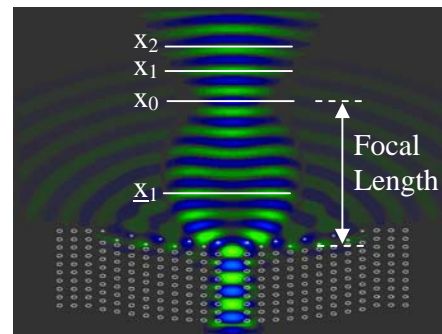


Fig. 2: Field showing the focusing phenomenon of concave surface

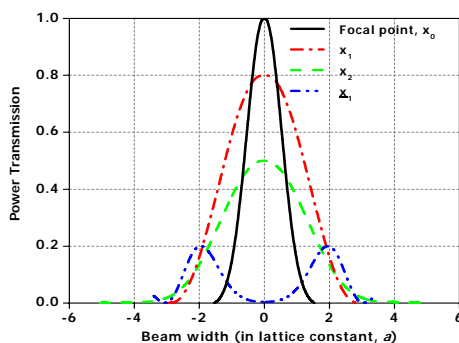


Fig. 3: Beam width at different positions

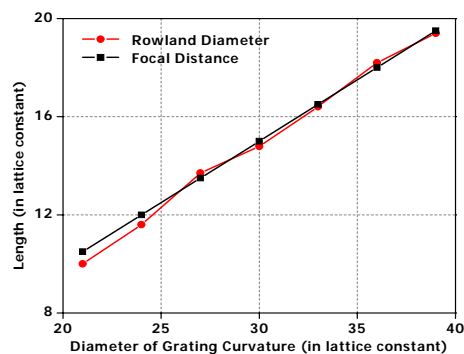


Fig. 4: Measured focal distance vs Rowland distance