PHOTONIC VALVE ARCHITECTURE OF *COSCINODISCUS WAILESII*: A NOVEL APPROACH BASED ON DIGITAL HOLOGRAPHY

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One of the most versatile photonic architecture present in nature is definitely given by diatom frustules. Valves are characterized by hierarchical, complex and quasi-ordered patterns of pores (areolae and poroids) whose dimensions can range from nanometer to micrometer scale. Several studies suggest that these patterns are able to play an active role in light manipulation and exploitation, possibly affecting the photosynthetic process. The impressive similarity of diatom areolae with the pores of artificial photonic crystals enforces these hypotheses. Among radial centric diatoms, *Coscinodiscus wailesii* Gran & Angst 1931 has been the object of recent studies which have demonstrated the ability of its valves to confine coherent radiation coming from a laser in a spot a few microns and that this confinement effect takes place also for non-coherent radiation, most likely due to in-phase superposition of the diffracted waves arising from the pores of the frustule itself.

In this work we report the use of Digital Holography (DH) as a novel approach to the characterization of coherent light transmitted by a single valve of *C. wailesii.* This technique is not only able to three-dimensionally define the valve microstructures but also allows us to better reconstruct the light propagation through the valve depth and cytoplasmatic volume giving precise information about its intensity and phase variations during the interaction with sub-micrometric valve pores. Furthermore, compared with other photonic techniques, DH enables to separate and discriminate the diffraction contribution due to the valve edges from that coming from the pores patterns. Our results on light manipulation ability of *C. wailesii* valves, correlated with ongoing *in vivo* studies on monochromatic light mediated plastid response in cell culture, could be useful to determine the effect of frustule architecture on diatom photobiology.