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Light manipulation with Bacteriorhodopsin membrane self-assembled on high-Q photonic structures[1]

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Resonant photonic structures such as ring resonators and photonic crystal nanocavities interact evanescently with biological material assembled on a reflecting interface. Quality (Q-) factors $\sim 10^6$ and sub-wavelength modal (V-) volumes significantly enhance the interaction so that tuning of microcavity resonances by only few molecules is feasible. Since only few constituents are required, the molecular-photonic interface can be fashioned from self-organizing principles that govern interaction of organic and biological polymers. We demonstrate this bottom-up approach with photochromic Bacteriorhodopsin membrane which we self-assemble on various microcavities. The hybrid molecular-photonic architectures exhibit high Q/V-values and are sensitive to photoinduced molecular transitions and other non-linearities which we utilize for demonstrations of all-optical switching, routing and molecular analysis.

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