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Organized light scattering: origin of the blue coloration in the feather of common kingfisher

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It is well known that some species of birds utilize microstructures inside their feather to produce the brilliant color. These colors are called structural color and various optical phenomena such as optical interference, diffraction and scattering have been suggested to work as the origin of such coloration. The common king fisher is one of those of which color is structurally produced. The barb of the blue feather consists of a spongy-like network structure having a comparable size with the wavelength of light. Although interaction between such network structures and light has not been rigorously described yet, Fourier transformation technique has been applied to analyze the optical properties of the structure. This analysis is essentially based on the single scattering approximation. However, our recent measurements on polarization properties of the reflection suggest that the single scattering approximation does not hold well, but the multiple scattering process is also effective to produce the blue color. Namely, the reflected light is rather depolarized even under polarized light illumination and the intensity of the depolarized component is stronger in shorter wavelength region. Here we report the structural and optical investigation of the common kingfisher's blue feather and suggest that the origin is the *organized light scattering*, which is a combined effect of light scattering including multiple process and optical interference realized by precisely adjusted network size.