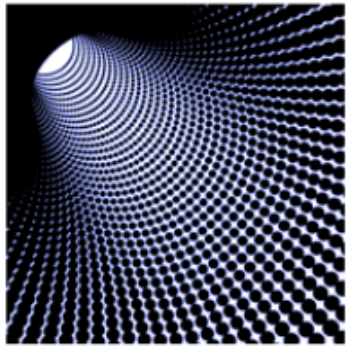

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Spotlight on Optics

Highlighted Articles from OSA Journals

January 2018

Spotlight Summary by Michael Berry

Geometric optics of a refringent sphere illuminated by a point source: caustics, wavefronts, and zero phase-fronts for every rainbow “k” order

Completing Descartes’ Rainbow

In the Middle Ages, it was known that the rainbow originates in "sunshine on a dripping cloud." Descartes’ achievement, in 1637, was the definitive understanding of the ray optics (using what we now call a numerical simulation based on Snel’s law): light rays refracted twice and reflected once by a raindrop get focused and emerge concentrated onto a conical far-field caustic surface. What we see as the rainbow are all those brightly lit drops on whose caustics our eyes lie. This paper by Paul-Étienne Ouellette completes what Descartes pioneered. In the full geometrical optics of refracting spheres, there are intricate caustics inside the drop as well as outside, and these proliferate as more reflections give rise to higher-order rainbows. All this is compactly explained, as well as the forms of the wavefronts perpendicular to the rays. Complementary to these ray caustics are the elaborate electromagnetic wave patterns inside and outside transparent spheres, explored by Moyses Nussenzveig in the 1960s, starting from Maxwell’s equations, in a tour de force of analysis.

Article Reference

Geometric optics of a refringent sphere illuminated by a point source: caustics, wavefronts, and zero phase-fronts for every rainbow “k” order

Paul-Étienne Ouellette

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