Light and color in the open air: introduction to the feature issue

Kenneth Sassen and W. Patrick Arnott

The topical meeting on light and color in the open air was held 9–12 February 1997 in Santa Fe, New Mexico. The series of papers that follows represents the fruition of this meeting, revealing the range of current scientific explorations into the play of light and color in nature. © 1998 Optical Society of America

OCIS code: 010.0010.

It is uncommon in most scientific disciplines that entirely new phenomena are discovered, or explanations for previously documented phenomena are shown to be entirely unsatisfactory. In the research field loosely referred to as atmospheric optics, however, this is often our goal.

Since 1978, a series of topical meetings addressing this endeavor has fostered an eclectic examination of the phenomenon that can be perceived around us.[1] As a matter of fact, the reliance on human perception as a starting point for scientifically characterizing all of nature's vague or vivid displays, has led to an acknowledgment of the philosophy expressed by M. Minnaert, who wrote in the preface to his book, *Light and Color in the Open Air*,[2]

> "It is indeed wrong to think that the poetry of Nature's moods in all their infinite variety is lost on one who observes them scientifically, for the habit of observation refines our sense of beauty and adds a brighter hue to the richly colored background against which each separate fact is outlined."

Hence the last three topical meetings have borne the name of his book, formulated during the Nazi imprisonment of this Dutch physicist during World War II.

This tribute, on the other hand, has its obligations. According to Minnaert's view, again from the Preface, there is a three-part test that must be applied;

> "We must systematically avoid: (i) Anything that can be found only with the help of instruments. (ii) Anything deduced from long series of statistical observations. (iii) Theoretical considerations not directly concerning what we see with our eyes."

These are stringent impositions that test our propensities for comprehending our environment with the aid of modern instrumentation, and frankly, not all the previous or current reports are in strict conformity. (For example, a description of a near-infrared rainbow, although based on the visible analog, clearly cannot be perceived visually.) Nonetheless, the eloquence of this philosophy is perhaps able to adjust to the subsequent rapid developments in optical physics measurement capabilities. So can we offer an amendment to Minnaert's postulates, "or phenomena that exist within the realm of human perception, but are observed by analogy through detectors more sensitive than the eye"?

Perhaps this study of light and color has unexpected consequences. The optical principles used to understand and quantify phenomena such as mirages, halos, and glistening icicles are potentially useful for designing graded-index fibers for imaging applications, for evaluating the quality of fibers once produced, and for photothermal deflection spectroscopy.[3] In another example, the appearance of optical displays such as halos or coronas in cirrus clouds is an immediate clue to the likely crystallography of the crystals in the cloud. Alternatively, the lack of optical displays when viewing conditions are optimal

K. Sassen is with the Department of Meteorology, University of Utah, Salt Lake City, Utah 84112. W. P. Arnott is with the Desert Research Institute, Atmospheric Sciences Center, Reno, Nevada 89506.

Received 21 November 1997.
0003-6935/98/091425-02$15.00/0
© 1998 Optical Society of America

helps determine that certain crystal habits are not present. The naked eye may be a poor person's remote sensing tool, but it is truly a rich person that can envision more from such a simple observation of a colorful phenomenon in the sky.

We express our thanks to the staff of the Optical Society of America, who guided us professionally through the mire from the meeting announcement to this last-minute gasp (thanks especially to Rosemary Dwyer, Barbara Williams, and Alexine Moore), to the Light and Color Technical Program Committee, and to all our colleagues for making the review process workable, including in particular M. Vollmer for helping to realize the incomplete paper left by E. Traenkle. In consideration of his untimely death, and as an expression of our sympathy to the friends and family of Eberhard Traenkle, we dedicate this feature issue of *Applied Optics* to him in recognition of his varied accomplishments to this field of scientific endeavor.

The 1997 Topical Meeting on Light and Color in the Open Air was sponsored in part by a grant from the U.S. Department of Energy as part of their Atmospheric Radiation Measurement program.

References and Notes

1. The history of our Topical Meetings is as follows: on meteorological optics, Keystone, Colo., August 1978; Incline Village, Nev., January 1983; and Honolulu, Hawaii, April 1986; followed by the current series of Light and Color in the Open Air, Washington, D.C., July 1990; University Park, Pa., June 1993; and, last, Santa Fe, N. Mex., February 1997. Those interested in previous features should consult J. Opt. Soc. Am. **69,** 1051–1198 (1979); J. Opt. Soc. Am. **73,** 1622–1664 (1983); J. Opt. Soc. Am. A **4,** 558–620 (1987); Appl. Opt. **30,** 3381–3552 (1991); and Appl. Opt. **33,** 4535–4760 (1994).
2. M. Minnaert, *Light and Color in the Open Air*, Dover (Dover, New York, 1954).
3. F. M. Sogandares and E. S. Fry, "Absorption spectrum (340–640 nm) of pure water. I. Photothermal measurements," Appl. Opt. **36,** 8699–8709 (1997).