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MADAGASCAR WINGS
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fig. a Chrysiridia rhipheus, photographed by Didier Descouens

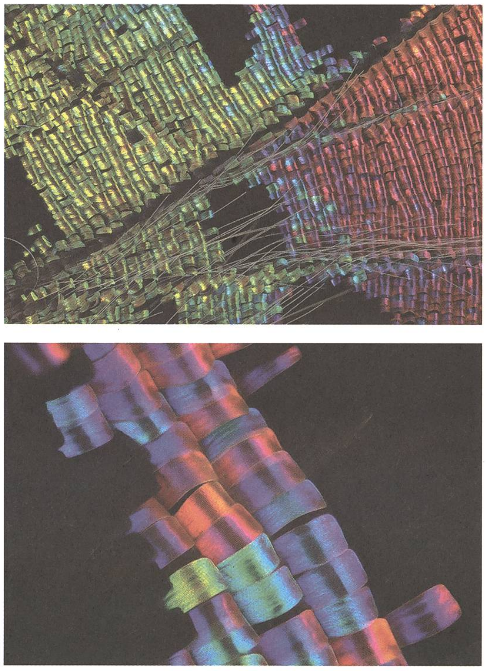

fig. b,c Sunset moth wing, photographed by Linden Gledhill

fig. d the Orion constellation, photographed by Mouser

During the last centuries philosophers of science explored the question of colour realism and searched whether colour is subjective, objective, physical, physiological or psychological. Even though colours could be perceived at a first naive glance as a physical property of the objects or as a creation somewhere in the brain, I would rather state that colours are showing us that one thing is different from another. Colours help us to differentiate, leading to an observed diversified world. They tell us about the seasons and the cycles of life. They show us the laws governing the reality we inhabit and finally they let us survive.

According to physicalism, colour is the product of a *light source* (e.g. the sunlight), a *matter surface* (with fixed reflecting characteristics) to produce reflected light and a kind of *photoreceptor* (e.g. human eyes). All of those parameters are changing all the time.

Starlight, the moon, and the sun provide us with white light. Isaac Newton constructed a triangular prism and in 1704 he presented his theory of refraction and colour. In his experiment he showed a sunbeam going through a prism, refracting its light. Passing through the prism, the sunlight manifests its substructure projecting the colours of the rainbow. Newton called the range of colours that occurred ‹a spectrum›. He concluded that colours are components of white light.

Contemporary physics tell us that the light presents a wave-like behaviour. Therefore it can propagate through space and time. It can be reflected, absorbed and interfered[1]. White light can be thought as the sum of the waveforms of the colours appearing in the rainbow—with each colour corresponding to a specific waveform. The reflectances of the light provided by the three-dimensional nanostructures of the Madagascar butterfly wings are responsible for the bright blue or the dark areas that are visible on its surface. The size between the atoms in the molecules that constitute the butterfly's wings is exactly the right size to create these vibrant blue reflections (fig. a,b,c). In other words, these elementary structures of nature generate colour through manipulating light, hence through controlling its potential reflectances, absorptions and interferences.

Human eyes have developed under adaptation to evolutionary pressures and this links colour perception with history. The observer's position (viewing angle) and its sensor capacities lead to a perception of colours which is dependent on space and time. In fact, nature equipped us with photoreceptors. Those three types of cones in our eyes' cells are sensitive to red, green and blue. Taking a look at the night sky is a good proof. Stars appear to be exclusively white at a first glance. But if we look carefully, we can notice a range of colours[2]: blue, white, red, and even gold. Looking at the constellation of Orion in the winter, a beautiful contrast is seen between the red Betelgeuse at Orion's armpit and the more recently formed vibrant blue Bellatrix at the shoulder (fig.d).

No matter how far it is produced and how close it can be reproduced, colour is not only a question of the nature of the light itself. The retina, where our photoreceptors live, is provoking the messages transmitted through the light, making comparisons of what it sees in one region with what it sees in another. Colour is a matter of perception and the perception of different colours varies according to different circumstances.

Isaac Newton, ‹Opticks: or, a treatise of the reflexions, refractions, inflexions and colours of light. Also two treatises of the species and magnitude of curvilinear figures›, Commentary by Nicholas Humez , Octavo (Ed.), Palo Alto 1998, (‹Opticks› was originally published in 1704).
Paul A. Boghossian, J. David Velleman, ‹Colour as a secondary quality›,in: ‹Mind 98›, Oxford 1989, pp.81–103.
Alex Byrne, David R. Hilbert, ‹Colours and reflectances›, in: ‹Readings on colour›, vol. 1: The philosophy of colour, MIT Press 1997.
Stephen E. Palmer, ‹Colour, consciousness, and the isomorphism constraint›, Berkeley 1999.
F. Jackson, R. Pargetter, ‹An objectivist's guide to subjectivism about colour›, Revue Internationale de Philosophie, 1987.

1 Two light waves of the same wavelength can interact to reinforce each other if they are in phase, or cancel each other out if they are out of phase. Hence, bright colours and dark areas may appear due to interference of light.

2 The colour variation of stars is a direct consequence of their surface temperatures. Cool stars radiate most of their energy in the red and infrared region of the electromagnetic spectrum and thus appear red, while hot stars emit mostly blue and ultraviolet wavelengths, making them appear blue or white. On the other hand, the surface temperature is directly connected to the evolution path of a star and therefore to its age.

Eleftherios Panagiotou, born 1988, studied physics with a focus on particle physics at the Aristotle University of Thessaloniki. Based in Athens since 2016, he is collaborating with the documenta 14 organization team, the Hellenic Broadcasting Corporation and Urban Dig Project, applying his interests, amongst others, in the performing arts and documentary filming.