

species level. To the extent that systematics is funded at all, the bulk of investment is in phylogenetic, molecular and DNA studies, which, although important in themselves, are of little practical use to the field ecologist, who wants to identify his material at the species level.

The problem is particularly acute for bees: pollination biologists and ecologists are ill-served by the current state of bee taxonomy, and we are in the bizarre situation whereby our understanding of pollination biology is growing faster than our ability to identify bee species.

This is a serious matter, because bees are not just another bullet point in the biodiversity crisis: as the principal pollinators of both natural vegetation and food crops, they occupy a key ecological position and, as such, are themselves vital natural resources. If we are to conserve and manage them sustainably and understand the network of bee–plant relationships on which life on Earth depends, we must be able to identify them.

Michener's magnificent book will do much to ameliorate this situation by raising the profile of bee taxonomy, and will, I am sure, stimulate more research. The book should appeal not only to entomologists interested in bees, but also to ecologists looking for an overview of bee biology. Moreover, it will be invaluable to pollination biologists who need some kind of fix on which bees are doing which things to their plants. And as far as bees are concerned, an identification to the level of genus unlocks much information on behaviour and nesting biology. ■

Christopher O'Toole is at the Bee Systematics and Biology Unit, Hope Entomological Collections, Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW, UK.

Science in culture

Suggestive signatures

Ken McMullen at the "Signatures of the Invisible" exhibition.

Martin Kemp

"I do not know if we are able to convey the beauty of this world and its extreme strangeness in order to start a fruitful dialogue between artists and scientists. Is it possible to bring this strange world back to earth through pictures or films or ...?"

This question was put to me by Hans Drevermann, virtuoso of visualization and representation of nuclear events at CERN, the European Laboratory for Particle Physics, in Geneva (see *Nature* 405, 886; 2000). Its immediate context is the "Signatures of the Invisible" exhibition, which has resulted from the collaboration of CERN scientists and 11 international artists under the aegis of the London Institute. Drevermann's "strange world" is populated by electrons, protons, neutrons, muons, quarks and suchlike, which are inaccessible to our normal powers of spatial and temporal modelling. How can this Schrödingerian world of paradox, indeterminacy, probabilities, logical contradictions and oscillating transformations be captured by the sensate media to which the artist is ineluctably wedded?

Perhaps we may take comfort from the paradoxical nature of art itself — how, for example, patches of pigment on a flat surface are transformed into a speaking likeness of Rembrandt or a landscape by Constable. Perhaps the artist's tools of illusion, allusion, evocation, imaginative inference and metaphor might serve to construct worlds that do not aspire to direct representation of weird happenings in particle physics, but rather stand as suggestive analogues to the mental pictures formed by physicists.

One strategy, among many in this stimulating show, is that adopted by its ringmaster, Ken McMullen, in his video-work, *Lumen de Lumine*. The idea sounds simple, even banal. In a black space, a red-dressed woman, swaying with hands high above her head, whirls a bright light on a chord in a wide arc around the fulcrum of her body. The maximum outer circumference of the light's orbit corresponds to a shallow circle of metal on the ground. The resulting video image is paired, mirror-wise. The idea begins to assume

resonance when we realize that the dark chamber belongs to the old nuclear reactor and the metallic ring is a cross-section of the abandoned accelerator. But the physical simplicity of the set-up still seems too earth-bound in the face of the awesome complexity of particle physics.

However, clustered around this apparent simplicity are a series of rich metaphorical and perceptual dimensions. The reversed images consciously evoke the notion of matter and anti-matter, and perpetually threaten collisions that only materialize in occasional close-ups. The swishing light, whirled by its human agent, pursues almost identical yet unpredictable paths, progressively decaying as fatigue sets in. 'Fatigue' and 'decay', we may note, are just two of the human and organic metaphors that permeate the language of engineering and physics.

As observer, we can discern five different traces of the rushing light in each scene. The first, of course, are the primary paths, witnessed through persistence of vision. But we can also focus on the elliptical glares from the moderately shiny floor, on the racing gleams on the metal rings, on the fragmentary flickers from some remaining equipment at the back of the rooms, and, most surprisingly, on four, paired secondary bright-spots that oscillate back and forth over short tracks on either side of the vertical divide. If we saw only one of these traces, how well would we reconstruct the physical set-up?

By analogy, the physicist detecting the behaviour of the most elusive particles is in the position of an observer who can only see the oscillating bright-spots, which do not in themselves obviously declare the orbiting circularity of the original source. At best, the physicist might have access to two of the secondary phenomena, say the oscillating tracks and the flickering fragments at the rear. Perhaps a brilliant visualizer could hypothesize the implicate order behind the observed phenomena and the nature of the physical set-up.

I am not imputing to McMullen the direct and conscious intention of spelling out these perceptual–cognitive dimensions. Rather, they are what arise when an artist creates something that induces complexity from simplicity, presenting the work as a field for imaginative observation. In a context such as CERN, the field could hardly be richer for any artist concerned with the business of seeing and knowing. ■

Martin Kemp is in the Department of the History of Art, University of Oxford, 59 George Street, Oxford OX1 2BE, UK.

"Signatures of the Invisible" is at the Atlantis Gallery, 91 Brick Lane, London E1, until 29 March. It will also be at the Centre d'Art Contemporain in Geneva (January–March 2002) and the Gulbenkian Modern Art Centre in Lisbon (October 2002 – January 2003). Further showings are planned in Rome, Paris and Stockholm.

