Ancient roots

Desmond King-Hele

The Great Copernicus Chase and Other Adventures in Astronomical History. By Owen Gingerich. *Cambridge University Press: 1992. Pp. 304. $19.95, $29.95.*

SCIENCE began with astronomy (or so it can be argued), when humankind first tried to codify the operations of the external world of nature. Repeatable observations may have sparked the idea of repeatable experiments; and the obvious start, the reliable recurrence of sunrise and sunset, could have led to awareness that the sunset direction changed from day to day, but then became near-constant at midsummer or midwinter. Why not plant two standing stones to mark this special sunset point? Would the setting Sun manage to creep to the same point next year? Yes, it did, and some bold theorist may have made the (scientific?) prediction that it would get there every year. Perhaps things did not happen like that, but much tangible evidence in durable stone may be trying to tell us that they did.

With the mystique of these ancient roots to help, the history of astronomy has an inherent fascination, which no one in recent years has communicated more effectively than Owen Gingerich. Now, between the covers of this book, 36 of his fluent and expert essays on astronomical history are reprinted: 26 were published in *Sky and Telescope* in the 1970s and 1980s, and ten elsewhere. The order is chronological, from the sky magic of the ancient Egyptians to the comet of 1965; the recipe is a clear, urbane and judicious style; and the result is a feast for astrophiles.

One nourishing item on the menu is the astronomy of Stonehenge. For Gingerich, Stonehenge is "not so much an ancient megalithic observatory as the *monument to an earlier observatory*". The first Stonehenge was an earthwork circle about 100 metres in diameter and 2 metres high, broken (about 2400 BC) by a single gap through which passes the line from the centre to the heel stone marking midsummer sunrise. After 300 years the smaller circle of heavy stones (Stonehenge 3) was set up to "fossilize" this successful observatory. The first Stonehenge was more accurate, as it had longer sightlines and smaller stones, though Gingerich is sceptical of the idea that it was used for calculating eclipses. He takes great care to explain the astronomical alignments, and produces paper cutouts to be stuck on a cola tin to help in visualizing the gyrations of the Earth and the apparent motion of the Sun.

The Great Copernicus Chase in the title refers to Gingerich's obsessive pursuit of first (and second) editions of Copernicus's epoch-making *De Revolutionibus Orbium Coelestium*, first published in 1543. The chase has taken him all over Europe (and elsewhere), and some good stories are woven into the tapestry of finicky scholarship. So far he has found 245 copies of the first edition. They differ, if at all, in their handwritten notes, and the identification of the hands keeps his ingenuity at full stretch.

Ingenuity is the watchword too in several other essays. When Gingerich tells us about the discovery of the two small satellites of Mars in 1877, he also faces the question, "How did Jonathan Swift manage to specify their orbits so well in 1726, in *Gulliver's Travels*?" Ingeniously, Gingerich notes that Swift predicted the radii of the satellites' circular orbits as three and five times the planet's diameter: this is the same as for Io and Europa, satellites of Jupiter. Whether Swift knew this is questionable, but if he did his clairvoyance fades into opportunistic unoriginality.

Maybe there was "nothing new under the Sun", or at most not much, in the era of Islamic dominance; but at least astronomy remained alive and well between the eighth and fourteenth centuries. Gingerich's long essay on Islam is notable for his careful explanation of the astrolabe and its functions. Two other essays are on astrolabes: one describes a particular specimen, the other is a cautionary guide to fake astrolabes.

A fake of wider interest is the "great comet that never was" of 1857. In Paris particularly, this mythical monster was widely expected to collide with the Earth on 13 June. Apparently this idea originated in an astrologer's forecast, which was based on a wrong interpretation of a genuine prediction that a previous comet would reappear in 1848, though this prediction itself proved to be wrong. The non-appearance of the non-comet only heightened the tension, and comet-proof clothing was designed, rather as in 1979, when anti-Skylab steel helmets were put on sale.

The essays are beguiling and well-written. Reading them *en masse* does, however, expose some weaknesses. Often the narrative flows along with panache but then seems to peter out in a lame and tentative conclusion. Possibly this has happened because *Sky and Telescope*, like all successful journals, must take care not to offend too many of its readers. With this proviso, the essays are well worth reading (or re-reading), and the book will bring them the wider audience they deserve. □

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Light exercise

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Advanced Materials for Sports Equipment. By K. E. Easterling. *Chapman and Hall: 1992. Pp. 127. £17.50 (pbk).*

MANY people are prepared to spend a lot of money on equipment for sport, even if they play only for recreation and at a modest level. There are plenty of manufacturers competing to satisfy the demand for equipment that may boost our egos by enabling us to perform just a little better, even if it has to be expensive. Much of the equipment they produce is built to elaborate design, from unconventional materials. Some running-shoe soles have pockets of gas encapsulated in polyurethane foam to make them springy; and some bicycle frames are made of silicon carbide fibres embedded in an alloy of copper and aluminium. What good does all this sophistication do? Why should we pay the extra price?

In a few cases, the benefits are clear. The world record for the pole vault increased dramatically from around 4.75 metres to more than 6 m as bamboo poles were replaced by aluminium ones and then by poles made of carbon fibre-reinforced epoxy resin. Conventional steel bicycle frames weigh 2 to 3 kilograms but carbon fibre frames can weigh as little as 1.2 kg. In many other cases the benefits of the new materials are less evident and may even be imaginary.

Easterling, an engineer, sets out to explain the new materials. His book is designed for intelligent sports enthusiasts with little, if any, scientific knowledge; but unfortunately he seems to feel unable to explain basic science to them.

He tells us that cracks spread less easily through composite materials such as fibreglass than through conventional materials, but explains why in only a superficial way. He tells us that panels of sandwich construction (for example, a metal honeycomb between solid plates) combine stiffness with lightness, but omits the rudiments of bending theory that explain why. He tells us how a racket responds when a ball strikes the sweet spot but does not explain the underlying principle. Nonscientists who want real understanding will be disappointed, and scientists will be annoyed by some sloppy use of technical terms. The book will nevertheless be welcomed by everyone who wants to know about the materials hidden below the glossy finish of modern equipment. □

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