phenomenon "perhaps have a cycle time of about 500 years"? We are not told.

Hoyle the scientist has become Hoyle the crystal-ball gazer but retaining a pseudo-scientific veneer of graphs, cycles and so on. And his draconian proposal that we should stop all this growth by heavily taxing three-children families just comes as a flashy bit of provocativeness which really advances serious thinking on problems in the real world very little.

In all, a strangely mixed book, at times charming, at times half-baked. □

David Davies is Editor of Nature.

Cosmic gushers

Roman Znajek

White Holes: The Beginning and End of Space. By John Gribbin. Pp. 200. (Paladin: London, 1977.) £1.50; $4.50.

A WHITE HOLE is like a black hole, but with time running backwards. Nothing can get out of a black hole, and nothing can get into a white hole. Whenever a black hole is formed, matter that is unable to withstand its own gravitational field collapses to form a point called a singularity. A white hole is *caused* by its singularity. The latter is best thought of as a remnant of the initial singularity from which the Universe began in the Big Bang. According to John Gribbin, if we are prepared to accept the existence of black holes then "the rest of the new astronomy inexorably follows", and that includes white holes. His book is intended to be a popular account of some of this new astronomy.

Now nobody knows for certain what a white hole singularity is going to do, and indeed nobody knows why it should be there at all. It is, however, not unreasonable to suppose that at some stage in its career it will start spewing things out and turn into a cosmic gusher, as Gribbins like to put it. Because the amount and nature of the gush is completely unknown, Gribbin has no difficulty in 'explaining' various highly energetic phenomena of extragalactic astronomy in terms of these cosmic gushers.

The conventional view is that quasars, radio-galaxies, and so on, derive their energy from matter in strong gravitational fields. For example, when gas spirals in towards a black hole very large quantities of heat are released through friction. There are reasons for expecting that kind of process to occur, even though there is much debate over the details. There are no reasons for expecting white holes to occur. Gribbin disagrees. According to him, the Big Bang is a white hole, and so there is every likelihood of there being others. But the universal Big Bang is a very different phenomenon from the local white holes he thinks are responsible for quasars. What Gribbin cannot explain is why the Universe's initial singularity should have been deformed in such a way as to give rise to white holes.

Even if white holes did exist in the early Universe, they would have been very rapidly destroyed. In 1974, Douglas Eardley showed that white holes are unstable. A white hole attracts radiation and matter. But this material cannot get into it. It piles up on the surface of the hole, getting continuously accelerated. An exponentially strengthening 'blue sheet' is formed, which twists round the gravitational field and turns the white hole into a black hole. The black hole remains, because black holes are stable. The process is very rapid, and only ridiculously large white holes would survive into the present epoch.

It is interesting to see how Gribbin tackles this problem. First of all, he refers to Eardley's work as a "suggestion". He then says that "better physics is needed to deal with the situation". This is correct in so far as we don't know why the white hole is there, but given its existence Eardley's argument is immediately applicable. Gribbin finishes by claiming that this difficulty "is more than compensated for by the amazing discovery in the mid-1970s that black holes can explode". This is the cue for five pages on the Hawking process, which is interesting in itself but completely irrelevant to Gribbin's cosmic gushers.

The possession of unconventional ideas does not disqualify a person from writing a popular book. But he should at least give a good account of the orthodox view. Gribbin doesn't. The saddest thing about his book is that his astronomy is old. It is five years or so out of date. In the sixties astronomers were ofted baffled by the objects they saw through their telescopes, and were prepared to believe in all kinds of curious explanations. It now seems that there is no need to invoke unlikely objects such as white holes in order to understand quasars. White holes are old-fashioned. □

Roman Znajek is an SRC Postdoctoral Fellow at the Institute of Astronomy, Cambridge, UK.