# A different view of the universe

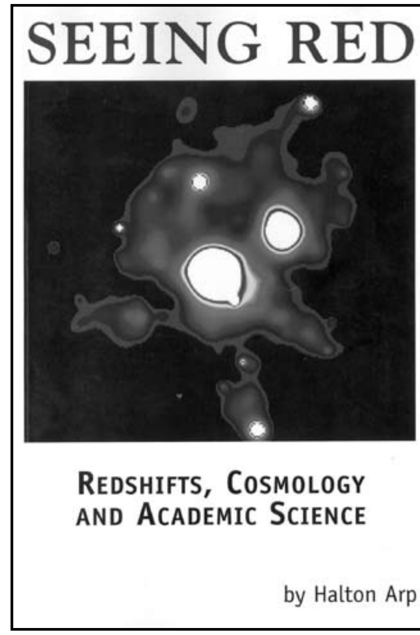
A review of
*Quasars, Redshifts and Controversies*
by Halton Arp
Interstellar Media, Cambridge University Press, 1987
and
*Seeing Red: Redshifts, Cosmology and Academic Science*
by Halton Arp
Apeiron, Montreal, 1999

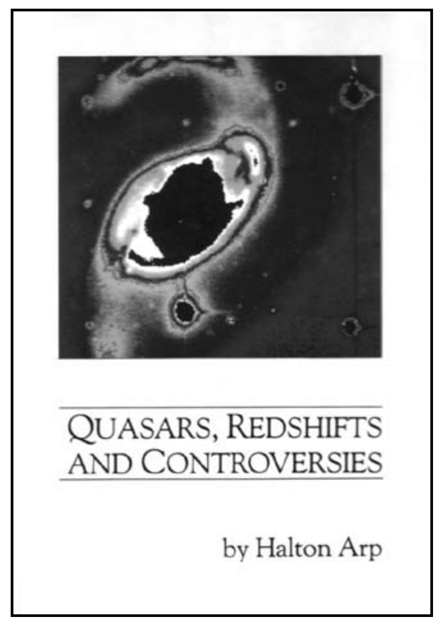
Bill J. Worraker &
Andrew C. McIntosh

In these two books, Halton Arp elaborates his contention that since 1966, observations have been accumulating which contradict the generally accepted ‘big bang’ cosmology. The key issue is the interpretation of redshift, the fractional increase in the wavelengths of lines in an astronomical spectrum when compared with laboratory wavelengths. Arp puts together a substantial body of observations to produce a very different picture of the universe from that envisaged in ‘big bang’ cosmology. Since the ‘big bang’ is the current astronomical orthodoxy, it is no surprise that Arp and others with similar views have encountered unrelenting, often unreasonable, opposition in publishing their findings. Arp graduated from Harvard in 1949 and obtained his Ph.D. from Caltech in 1953. His thesis work on colour-magnitude diagrams for stars in globular clusters boosted the development of stellar evolution theory and helped establish the currently-accepted age for the Milky Way galaxy of around 15 billion years.[1] In the mid-1960s, he produced the *Atlas of Peculiar Galaxies*, which involved photographing (often using the largest instruments available) and carefully scrutinising hundreds of galaxies. He is evidently well acquainted with the detailed structure and relationships of numerous galaxies. Arp is certainly no creationist (*Seeing Red*, p. 270).

Our main purpose in reviewing Arp’s books is to draw the attention of *CEN Tech. J.* readers to vitally important astronomical observations whose implications need to be addressed in any creationist cosmology, but which might otherwise go unnoticed. Arp’s books illustrate how a scientific establishment, wedded to a particular paradigm, reacts to discordant results. Anyone who has contended for biblical creation against the evolutionary story of origins will find numerous echoes of their own experience here!

Although Arp introduces the conventional interpretation of redshift through the Doppler effect, strictly speaking this does not apply to redshifts in an expanding universe. As various authors have pointed out,[2–5] a cosmological redshift measures the expansion of space between light source and observer while the light is in transit; fundamentally it has nothing to do with velocity. If the expansion is smooth in time, such a redshift is proportional to velocity; individual galaxy motions (e.g. due to orbiting in the gravitational field of a group of galaxies) will add a positive or negative Doppler shift. Arp uses either measured redshift values (pure numbers, represented by the symbol ‘z’)[6] or velocities given by ‘cz’, where ‘c’ is the speed of light. This practice does not affect the force of his arguments.




## *Quasars, Redshifts and Controversies*

This book is foundational to the whole controversy over redshift interpretation, and most of the criticism of Arp’s work, that we have seen relates to evidence presented here.

As the title suggests, quasars figure prominently in this book. These were first encountered in radio surveys in the early 1960s. Optically they looked just like stars, but their spectra were unrecognisable until the Caltech astronomer Maarten Schmidt found that they possessed enormous redshifts. Why did quasar redshifts considerably exceed any known galaxy redshift? Non-cosmological causes were dismissed and it was soon decided, despite unresolved difficulties, that quasars were the most distant and most luminous objects in the universe.

Arp notes that there is considerable evidence that not only quasars, but galaxies too, can violate the accepted redshift-distance relation. This strengthens the case that the redshift-distance law can be broken. But it also raises the stakes in the theoretical quest for a cause of intrinsic (non-velocity) redshifts, since any candidate mechanism must operate on entire galaxy-scale assemblages of stars, gas and dust.

### Excess redshifts in quasars

In the first five chapters Arp deals with the anomalous evidence on quasars. Most of this evidence is of two kinds, *viz.* (i) one or more quasars fall closer to a galaxy than expected by chance; (ii) quasars visibly connected to a galaxy. In both cases the galaxy is at a much lower redshift than the associated quasars, and is often disturbed in form or unusually active in showing starburst activity or in producing considerable radio emission. Several deep, well-reproduced photographs are shown to illustrate these associations. For example, the disturbed galaxy NGC 4319 and the nearby quasar Markarian 205 have very different redshifts (cz = 1,700 km/s and 21,000 km/s respectively), yet anyone can see from the photographs that they are connected.[7] Thus the quasar is close to the galaxy in space, not at its redshift distance according to the Hubble law. Despite much criticism, this result, which plainly contradicts conventional assumptions, has been confirmed by several independent lines of evidence.

Some galaxies (e.g. NGC 1097) are accompanied by lines of quasars pointing outwards from their nuclei. Furthermore, Arp shows (chapter 5) that the distribution of a large number of bright quasars in space is very different from that expected on conventional assumptions, and that many are associated with nearby galaxies.

### Excess redshifts in galaxies

Arp also shows plenty of examples of galaxies visibly connected to smaller companion galaxies with redshifts up to 36,000 km/s higher. He notes peculiarities in these systems which mean that they cannot be dismissed as accidents. There are also several cases of interacting galaxy groups involving discordant redshifts, most notably 'Stephan's Quintet'.

Members of the M31 (Local Group) and M81 galaxy groups are systematically redshifted with respect to the dominant galaxies in a way that cannot be explained in terms of orbital velocities within the groups. Not only this, but the redshift intervals are quantized in multiples of 72 km/s. Despite much ridicule, this result has been confirmed in other galaxy groups but has been ignored by conventional astronomers because it cannot be explained in terms of 'big bang' cosmology.

### Ejection phenomena

The large radio galaxies, Virgo A (M87) and Centaurus A (NGC 5128), have long been known to possess pairs of radio jets emerging from their nuclei. Arp shows that they also sport lumpy inner jets seen at visible and ultraviolet wavelengths. These are aligned with the radio jets, and there are galaxies and quasars, some of them strong radio and/or X-ray sources, scattered close to the jet directions. All of this points to an ejection origin for the objects associated with these large galaxies. Arp also notes (p. 146) that:

> *'It is a curious and exciting property of the universe that a great deal of extragalactic matter appears to be arranged in linear formations.'*

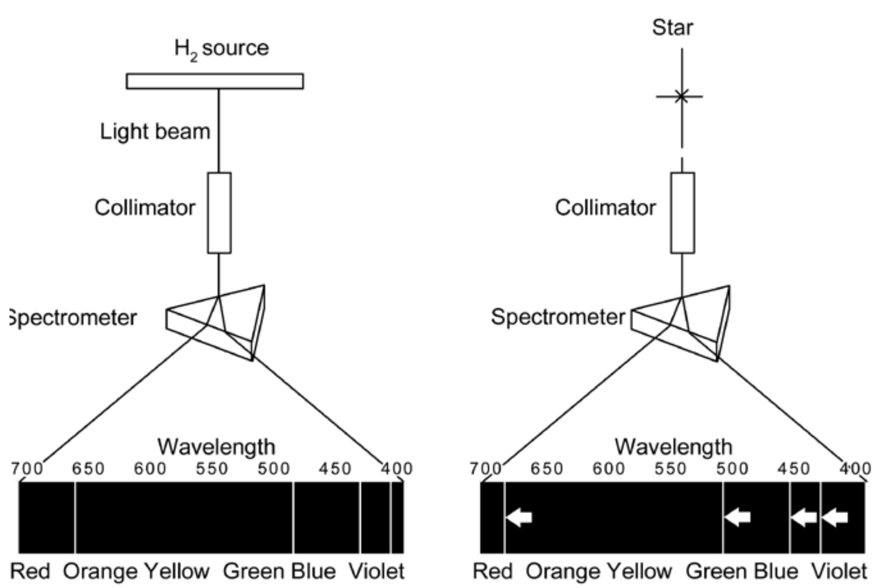
Since so many galaxies are arranged in chains (which frequently contain members with discordant redshifts), Arp suggests (p. 147) that:

> *'…perhaps all the extragalactic matter in the universe unfolded first from a few active centres and then further from secondary and perhaps even tertiary centres. This concept would be worth investigating with an open mind.'*

Arp further suggests that a general cause of the beautiful spiral arms seen in so many galaxies could be paired ejections in the plane of rotation.

### Cosmology

Arp suggests that the Hoyle-Narlikar theory of conformal gravity can be used to synthesise the observations he has presented. He explains that this is




*The distinct emission spectrum for hydrogen can be measured in the laboratory. When the emission spectrum for hydrogen is measured from distant stars, the lines are often shifted toward the red end (shift not necessarily to scale). This effect is known as the red shift.*

more general than the 'normally used' theory in that particle masses can vary in space and time. Applied to quasars ejected by galaxies, the idea is that new matter emerges into our universe in active galactic nuclei, where Arp suggests there may be white holes rather than black holes. This does not appear to be *creatio ex nihilo* in the biblical sense, but rather the transformation of energy into matter.[8] The postulated new matter has zero mass and very high redshift. It is then ejected, and increases in mass and decreases in redshift. Arp suggests that redshift quantization might have a natural explanation in terms of this approach.

No mathematical detail is given, and important aspects of the theory as described by Arp remain unclear. His theoretical ideas are more fully developed in *Seeing Red*.

Arp summarises the problem of following up research of the kind he has described thus (p. 162):

> *'Since the people who make these kinds of observations have now been excluded from regular observations on the [Palomar 200-inch] telescope ... how can one measure the magnitudes and redshifts [of new quasars] and obtain complete area surveys which are so useful and necessary? ... It is clear there is a vested political interest in suppressing these kinds of observing projects.'*

## Seeing Red

This book extends the scope of *Quasars, Redshifts and Controversies* very considerably. The sheer weight of evidence presented here gives the lie to comments such as *'... we judge that the case for anomalous redshifts has not gained strength over the years, and has even weakened ...'*.[9] We note some of the key themes below.

### X-ray observations

Chapter 1 discusses galaxy-quasar associations discovered or confirmed by recent X-ray observations. In several cases, there are quasars obviously paired across a galaxy, and some of these can be identified with radio sources whose ejection origin had been identified by Arp in the 1960s. Chapter 2 shows from X-ray observations how Seyfert galaxies,[10] as a class, act as quasar factories. In some cases, BL Lac objects[11] are also found close to the Seyferts. The quasars considered in these chapters have much higher redshifts than the galaxies that ejected them.

### Excess redshifts from galaxy groups to stars

Chapter 3 describes excess redshifts in galaxy groups, notably in the Virgo Cluster. These excess redshifts depend systematically on galaxy size and type. Thus, for example, Arp shows vividly that ScI galaxies (high-luminosity 'open' spirals) have considerable excess redshifts. Quasars and companion galaxies lie preferentially along the projected minor axes of spiral galaxies, a strong hint that not only are these objects ejected, but also that there is a post-ejection evolution from quasars to companion galaxies. It also turns out (chapter 4) that bright blue stars[12] in the Milky Way, Magellanic Clouds and other nearby galaxies are systematically redshifted. Arp explains this in terms of the age of the stellar material since 'creation' (energy-mass conversion) in a galactic nucleus using arguments based on the Narlikar variable-mass theory which he describes more fully in chapter 9.

### The Local Supercluster

In chapter 5 Arp considers the detailed structure of the Local Supercluster, that great chain of galaxies encircling the entire sky and dominated by the Virgo Cluster. He shows from X-ray and gamma ray observations that the bright quasar 3C273, the highly variable quasar 3C279 and others all belong to the cluster despite being at much higher redshifts. Ultra high-energy cosmic rays come mainly from the supergalactic plane, with a peak towards the centre of the Virgo Cluster; there is no recognised mechanism for producing them within 'big bang' cosmology.

### Redshift quantization in various types of objects

In chapters 6 and 7, Arp shows that supposedly distant galaxy clusters[13] have, from the conventional viewpoint, many unexplained characteristics. For example, they tend to concentrate near an active galaxy or within large nearby galaxy groups, notably the Virgo and Fornax Clusters. By superposing the X-ray outline of the Virgo Cluster on a plot of the Fornax Cluster (Fig. 6–13, p. 153) he shows the uncanny similarity between these two clusters. The Abell clusters within them are arranged almost identically, which doubly emphasises that they are members of the two large clusters, not remote background objects.

In chapter 8 Arp notes, in addition to the 72 km/s redshift periodicity found previously, an even more striking one of 37.5 km/s for galaxies in the Virgo Cluster. Furthermore the redshifts of quasars, BL Lac objects, galaxies within a cluster and 'distant' clusters are all quantized with peaks at $z = 0.06$, 0.30, 0.60, 0.96 (and beyond) following a common simple formula (the $z = 0.06$ peak is especially prominent for galaxy clusters). This not only implies physical continuity but also an evolutionary sequence. Examples of groups consisting of a bright galaxy plus Seyfert galaxies and quasars in lines suggest a hierarchy of paired ejections; some of these are particularly impressive and are analysed to yield ejection velocities.

### Cosmology revisited

In chapter 9 Arp presents his alternative to 'big bang' cosmology. He uses the Narlikar version of general relativity (GR). This retains the possibility that particle masses can vary in space, and not (as is usually done) be eliminated at an early stage. Arp explains that this formulation implies that curved space-time is not needed, i.e. space is Euclidean. The Narlikar field

Photo by NASA

*Galaxy NGC 5194 is one of Halton Arp's peculiar galaxies. There is a distinct bridge between this galaxy and its neighbour NGC5195 which is difficult to explain within the 'big bang' model because the redshifts differ quite considerably.*

equations are given in an appendix.

Arp shows that a Hubble plot for galaxies of the same age as the Milky Way can be simply deduced from the Narlikar theory without any expansion of the universe taking place. This model requires only one input parameter, the age of nearby galaxies, whereas the 'big bang' model needs several adjustable parameters. Arp says that we can only be sure of seeing objects within our Local Superclusters (Virgo and Fornax). He postulates that the nuclei of active galaxies eject, initially at the speed of light, low-mass, high-redshift quasars, generally in pairs. These decelerate and evolve to higher masses and lower redshifts. They then become BL Lac objects, which may break up into galaxy clusters or evolve further into Seyfert galaxies, active galaxies and finally into more relaxed 'normal' galaxies. Subsequent ejections may give rise to a cascade-like process of galaxy production.

### Discussion and implications

The main significance of these two books is that Arp presents a wealth of direct observational evidence that contradicts the foundational assumption of 'big bang' cosmology, *viz.* that extragalactic redshifts are due mainly to an expanding universe. The evidence can often be appreciated by the lay reader just by looking at the photographs or distribution maps of associated objects.[14] Nor can establishment astronomers legitimately escape the implications of this data by dismissing it as 'a few isolated cases'. Arp's coverage of the large-scale distributions of galaxies and bright quasars, as well as the numerous associations between objects of different redshifts, rule out this approach. Furthermore Arp has shown many examples pointing to the origin of galaxies as evolved quasars which were initially ejected from galactic nuclei.

How does Arp's picture of the universe compare with the 'big bang' picture? He says (*Seeing Red*, p. 251):

> *'The universe is not expanding, can be indefinitely large … .'*

However, Arp has noted that most observed galaxies are associated with either the Virgo or Fornax Superclusters, and that quasar redshifts are largely intrinsic. Hence the observed universe is smaller than hitherto supposed by a factor of up to 100. Inferred masses and luminosities are reduced by the square of this factor, i.e. 10,000. Arp finds little or no evidence for the existence of the 'dark matter' which is supposed to dominate the mass content of the universe.[5] He views the cosmic background radiation as thermalised galaxy light.[15]

Many will welcome Arp's Euclidean view of space after trying to understand 'curved space-time'. However, it is not clear how his cosmology meets the demands of Olbers' paradox.[16] This problem does not arise if the universe is finite in age and is bounded. Neither Arp nor his 'big bang' opponents even consider the possibility that the universe could be bounded, yet an unbounded universe has never been required by the observations.

How valid is Arp's view of the universe? He calls his cosmology 'Quasi Steady State' (*Seeing Red*, p. 238), and does not recognise a beginning in time. We reject this 'timeless' aspect, which does not derive from observation, and which conflicts with Scripture (Gen.1:1). Although Arp's explanation of the general redshift-magnitude correlation for galaxies in terms of the Narlikar theory gives a 'good' value for the Hubble constant, we regard this theory as *sub judice* pending investigation of the primary literature. However, his picture of a universe populated by galaxies born in a cascade of ejections of high-redshift quasars from active galaxies seems empirically well-founded. It raises numerous questions worthy of further investigation, both observational and theoretical. To ignore the observations he has put together would seem indefensible.

What can creationists learn from Arp's work? Arp writes of cosmic time scales measured in billions of years. Humphreys does too,[4,17] but also suggests how, by means of a bounded-universe and white hole cosmology with the Earth at the centre, this could be consistent with a young Earth. Humphreys' idea of the universe emerging from a white hole bears similarities to Arp's deduction that galaxies evolve from quasars, which were initially ejected as highly redshifted material from white holes in galactic nuclei. Redshifting here means that clock rates for the ejected material would initially be very slow, as in the centre of Humphreys' universe. Redshift quantization will doubtless be an important feature of any successful cosmological model. We suggest that there are many possibilities worth exploring, starting perhaps with the observations which Arp has courageously set before us. All of Arp's findings could be accommodated into a 6,000-year framework, with the stars made on the fourth 24-hour day of Creation week. One would have to argue for a much faster cascade of the development from quasars to galaxies (using possibly Humphreys' ideas from GR concerning differential clocks between the location of Earth near the massive centre, and locations of quasars/galaxies at a great distance away).

The value of these books lies in their detailed observations, which question the assumption that redshift is necessarily due to Hubble expansion, and lay an excellent alternative basis for considering the origin of heavenly bodies, quasars in particular. He has made accessible to the layman the significance of key observations which, within a creationist framework, have profound implications, and are relevant to the creationist cosmology being developed by Russell Humphreys and others.

We must recognise that any scientific description of origins is at best incomplete. It is wise to recall God's salutary words to Job: *'Who is this that darkens my counsel with words without knowledge? ... Where were you when I laid the earth's foundation?'* (Job 38:2–4, NIV).

## References


1. In quoting astronomical ages measured in billions of years we are not implying that we accept them as real. However, Humphreys (Ref. 4 & 17) has suggested how such apparent time scales could be consistent with an age for the earth of only a few thousand years and, in particular, with creation of the stars on the fourth day of Creation week.
2. Odenwald, S. and Fienberg, R.T., Galaxy redshifts reconsidered, *Sky and Telescope* **85**(2):31–35, 1993.
3. Clark, S., *Redshift,* Hertfordshire University Press, 1997.
4. Humphreys, D.R., *Starlight and Time,* Master Books, 1994.
5. Gribbin, J. and Rees, M., *Cosmic Coincidences: Dark Matter, Mankind and Anthropic Cosmology,* Black Swan, 1992. Originally published as *The Stuff of the Universe,* Heinemann, 1990.
6. The redshift variable z, which measures the fractional change in wavelength ($z=\Delta\lambda/\lambda$), may take values between –1 and +infinity. Thus if z = 1.0, for example, observed wavelengths are double their corresponding laboratory values, while if z = –0.5, wavelengths are half their laboratory values (and the light source is blueshifted), and so on. If redshifts are interpreted in velocity terms, the corresponding velocities must in general be derived using the equations of special relativity as described by Clark (Ref. 3).
7. See Snelling, A.A., Galaxy-quasar connection defies explanation, *CEN Tech. J.* **11**(3):254–255, 1997, and the cover picture for *Quasars, Redshifts and Controversies* reproduced with this review.
8. The transformation of energy into matter is commonly observed in particle physics laboratories, e.g. gamma-ray photons of sufficient energy (at least 1.02 million electron volts) passing close to atomic nuclei can be transformed into electron-positron pairs. In the case of particle production by a mechanism of this general kind in a galaxy nucleus, the ultimate energy source must be the gravitational field.
9. Gribbin and Rees, Ref. 5, p. 40.
10. Seyfert galaxies were discovered by the American astronomer, Karl Seyfert, in the 1950s. They are essentially spirals with particularly bright, sharp nuclei with emission line spectra indicating a very high rate of energy release. They are strong X-ray sources.
11. BL Lac objects are named after a starlike object (BL Lacertae) that bears a variable star designation because it was once thought to belong to the Milky Way. They are very similar in appearance to quasars but have much weaker spectral lines. They are generally strong radio and X-ray emitters and vary considerably in brightness.
12. According to standard stellar evolution theory, bright blue stars are relatively young. A simple introduction to the subject of stellar evolution may be found in Meadows, A.J., *Stellar Evolution,* 2nd ed., Pergamon, 1978.
13. The galaxy clusters considered by Arp are listed in the *Abell* catalogue and are hence often referred to as 'Abell clusters'.
14. On being shown Fig. 1-1 of *Seeing Red* and asked to suggest what might have happened, the 11-year old daughter of one of us (WJW) said of the quasars paired across the galaxy centre, *'They were shot out'*. She knew what quasars were in observational terms, but otherwise knew nothing of what the book was about.
15. We have some difficulty with this view since thermalisation implies photon scattering, yet the clarity with which distant extragalactic objects can be seen across much of the electromagnetic spectrum implies that the required scattering must be extremely limited.
16. Olbers' paradox is the principle that the universe cannot both be indefinitely old and indefinitely large while containing light sources at a uniform density throughout. In such conditions any line of sight would inevitably end on the surface of a star, and the sky would be ablaze with light rather than dark as observed. A helpful discussion from a 'big bang' perspective is given in: Wesson, P.S., The real reason the night sky is dark: correcting a myth in astronomy teaching, *J. British Astronomical Association* **99**:(1):10–13, 1989.
17. Humphreys, D.R., New vistas of space-time rebut the critics, *CEN Tech. J.* **12**(2):195–212, 1998.