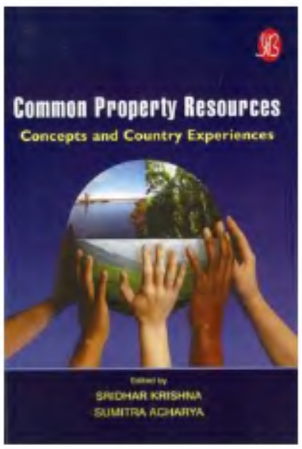

Common Property Resources: Concepts and Country Experiences. Sridhar Krishna and Sumitra Acharya (eds). The Icfai University Press, 52, Nagarjuna Hills, Punjagutta, Hyderabad 500 082. 2008. x + 247 pp. Price: US$ 17.

According to the National Sample Survey Organization (54th Round), the percentage of common property land resources in relation to the total geographical area in our country is 15%. Nearly 48% of rural households reported that they depend on Common Property Resources (CPR) for their needs of fuel, fodder, grazing land, etc. A study in West Bengal showed that CPR contributes 12% of household income in the case of the rural poor. Fuel accounted for 60 to 80% of the resources collected, and fodder between 5 and 20%. The CPR of India is now in great distress due to anthropogenic pressures as well as pressure from excess grazing by farm animals. Both the ocean and groundwater resources are also getting polluted. CPR has thus become an euphemism for degraded land and depleted and contaminated water resources.

Sridhar Krishna and Sumitra Acharya have rendered valuable service by compiling this book. The book has a comprehensive set of essays written by experts not only from India, but from other countries familiar with conditions in Bangladesh, Ethiopia, Brazil, Mexico, Zimbabwe, South Africa, Kenya, China and several South Asian countries. Examples of sustainable management of CPR, as for example CAMPFIRE (Communal Area Management Programme for Indigenous Resources) in Zimbabwe, which involves commercial partnership between safari operators and rural communities have been described. There are also many depressing examples relating to the tragedy of the commons.

In a comprehensive overview of the papers included in the publication, Sridhar Krishna has summarized the various dimensions of CPR management in India and outside. He has highlighted the danger of privatization of national parks and other public lands. The loss of CPR leads to the further deprivation of marginal communities, particularly of women. Methods of achieving harmony between forest dwellers and the authorities in charge of forest management are cited. Emphasis is placed on groundwater ethics, citing the example of Delhi. A recent article in *Science* (vol. 325, 14 August 2009) has drawn attention to the alarming state of aquifer exploitation in the heartland of the green revolution. There is a detailed paper in this book on marine resource management in the complex world. Seawater constitutes 97% of global water resources and is one of the most important social resources to humankind. This is why Mahatma Gandhi started the Salt Satyagraha to emphasize that sea water is a social resource and that its use should not be subjected to tax. Recent research work has shown that sea water farming involving the cultivation of halophytes together with marine aquaculture (agri–aqua farms) will open up sustainable livelihood opportunities to coastal communities. It is important that such scientific methods of sea water use are popularized to relieve the demographic pressure on coastal resources.

In the early 1970s the practice of Joint Forest Management (JFM) involving the forest dwellers and foresters was started in West Bengal. JFM is now the official policy of forest departments throughout the country. It has to some extent reduced the pressure on wood based forest products. Access is being promoted to non-wood forest products including gums and medicinal plants. The Government of India has also enacted a law conferring land and other rights to forest dwellers and scheduled tribes. Such measures have helped to halt the further degradation of prime forest land. Scientists of the M. S. Swaminathan Research Foundation have also developed detailed guidelines for Joint Mangrove Forest Management involving concurrent attention to the land and the ocean. The tsunami of 26 December 2004 as well as the super cyclones in Orissa and Sunderbans have highlighted the importance of mangrove bioshields in coastal areas to serve as speed breakers during heavy storms and seawater penetration to the inland. There are several issues relating to CPR Management which have been highlighted in the paper of Sumitra Acharya. She has referred to people's movement like the Chipko in Garhwal.

All in all, this book is a timely contribution worthy of being read both by policy makers and professionals involved in safeguarding the remaining CPR for the benefit of present and future generations. CPR management involves concurrent attention to intra- and inter-generational equity. It needs for its success integrated action in the areas of conservation, sustainable use and equitable sharing of benefits. We owe a deep debt of gratitude to Sridhar Krishna and Sumitra Acharya for this timely contribution. The book has been published in a reader-friendly manner.

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Karanakutuhalam of Bhaskaracharya II with Notes. S. Balachandra Rao and S. K. Uma (eds). Indian National Science Academy, Bahadur Shah Zafar Marg, New Delhi 110 002. 2008. xv + 220 pp. Price: Rs 400/US$ 150.

Eclipses have remained awe-inspiring events from the remote past. As a first step in understanding the phenomena, our ancestors studied the movements of sun and moon meticulously. They arrived at the exact calculations that are responsible for the celestial dramas. Their studies were based on strong mathematical foundations which were again based on rational thoughts and logic. When it comes to understanding the techniques they used, especially in the Indian context, we face major difficulties like (i) non-availability of texts, (ii) the available texts are beyond the comprehension of lay persons and even postgraduates in mathematics or physics.

These difficulties are fortunately being overcome by the efforts of a small group of schools who are well-versed in mathematics, astronomy and Sanskrit. The book under review is one such grand addition to a small list.

Bhaskara II or Bhaskaracharya is well known to all Indian scholars and those from outside because of his monumental work in mathematics – *Lilavathi*. This text enlightens us on the depth of knowledge in arithmetic, algebra, geometry and mensuration as was known in the 12th century. He wrote several other important works, some of which are available to us with English translations. There is a need for all of them to be made available to the current Indian students. One of the texts which was not available so far was *Karana Kutuhalam* which was written in 1184 A.D. This appears to be a later version of *Grahalaghava*, since many of the chapters repeat in the same order as brief summaries. The text is an exact translation with the original Sanskrit made available at the end in the form of an appendix.

The calculation of the exact timings of the eclipse, either lunar or solar, requires the knowledge of the following parameters:

1. The exact diameters (angular) of the two bodies in question – the body causing the eclipse is called *chadya*; the body being eclipsed is called *chadaka*.
2. The precise rate of motion of the bodies.
3. The projection on to the earth, as seen by observers at different locations on the earth.

In case of a solar eclipse, *chadya* is the sun and the *chadaka* is the moon. In case of the lunar eclipse, *chadya* is the moon and *chadaka* is the shadow of the earth. To get the dimensions of these bodies it is essential that we understand the basic concepts of positional astronomy. The techniques of describing the location of an object in the sky are quite complicated owing to the three types of motion – the diurnal motion, annual motion and the precessional motion. The first two are obtained from observations. The small shift of about 50″/year in the point of intersection of ecliptic and the celestial equator has been arrived at after compiling observations over thousands of years. The Indians adopted the same technique of counting the number of days from a fixed epoch. As is well known, this is a date corresponding to 3101 BC, identified as the beginning of *Kaliyuga*. This method ensured the correction to be applied based on the precession of equinoxes for the position of planets. This constitutes the very first chapter – *Madhyamadhikarah*. Further, the positional information as measured by an observer is necessarily a function of his latitude and longitude. There is a detailed explanation of the correction that needs to be applied for a change of longitude in terms of the distance and direction of a new location. In present day textbooks of spherical astronomy, this is described in the very first chapter bringing in the concept of spherical earth. It is interesting to note that this was already incorporated into the calculations in this 11th century text, which means the spherical shape and the rotation of earth were well established.

The observations made from the earth giving the location of the sun, moon and planets will have to be converted to other coordinate systems which use the idea of their orbits. Depending on their position in these orbits, and whether the earth is overtaking them (opposition in case of outer planets) or whether the planet is overtaking the earth (inferior conjunction in case of inner planets) more corrections have to be applied. This gives the 'true positions' of the planets.

The speeds of the planets, sun and moon are not fixed quantities owing to their elliptical orbits. Thus, based on the mean 'motion', the true motion also needs to be precisely calculated.

The book also gives an idea of the standardization of the observational data. The meridian passing through Lanka, Sita Mountains and Ujjain is considered the standard meridian (just as we have Greenwich as the standard). Calculation of the time of the day, including the smaller fractions also thus gets standardized.

Now we are ready to compute the possibility of eclipses. If the preliminary condition is satisfied we continue with the calculation of the event itself.

The mathematical details are elaborately discussed in the text with some examples for every case. It is interesting to note that for lunar eclipse the *chadaka*, object getting eclipsed, is considered as a body extending to three times the size of the moon. This means that the diameter of the shadow of cone of the earth at the distance of moon was known. Indirectly it speaks of their knowledge of the relative sizes and distances. This idea of the width of the earth's shadow perhaps was so well known in those days that we do not find an explicit mention anywhere in the text. This particular aspect was beyond the comprehension of many European scholars who found it difficult to digest the method of computation (e.g. the comments of Le Gentil who visited India in 1761).

The details of computation of eclipses form two separate chapters, one for lunar and another for solar. The preliminary computation for the check on possibility of eclipses also is a chapter by itself. All these are described extensively with many numerical examples, aptly provided by the present authors, who have made use of commentary on the text by Sumatiharsha. Duration of eclipse and the exact timings of the points of contact are all calculated in these examples.

Kutuhala means curiosity. After the sun and moon, a curious mind would definitely want to extend the technique to other bodies as well. The planets are termed '*taragraha*', star-like planets (since moon and sun are also called planets). The possibility of mutual conjunctions, called *grahayuti*, is discussed in great detail. This is a very complicated calculation because it involves calculation of the location of the nodes of the orbits of these planets. In the context of moon, the nodes are named *Rahu* and *Ketu* (ascending and descending nodes). It is interesting to note that the word *Rahu* is hardly used in the text. Similar nodes of the other five planets also are computed for fixing the dates of conjunction of Jupiter and Venus on 14 April 1619. The duration of the conjunction is also calculated. Every detail of the calculations for direct and retrograde motions is also given.

A general discussion on the visibility of the cusps of the moon is found in all Indian astronomical textbooks, although the exact purpose of this is not clear. Similarly there is a discussion on 'parallel aspects'; again the purpose is not very clear. This gives the calculation of events when the declinations (north–south coordinates) of the sun and the moon are numerically equal. For example, on a specific day if the sun has a value of δ, there are two days in the same month when the moon also will have the same value of δ, on either side of the equator. This is termed as *Vyatipata* (same side of equator) and *Varidhrity pata* (opposite sides of equator). We come across many references to *Vyatipata* on stone inscriptions; such occasions were considered auspicious for making donations and releasing grants. It is likely that this is a

quick guide to fix the possibility of eclipses in the month.

The location of the sun in the sky is a direct indication of the time of the year. In most parts of Karnataka the agriculturists refer to the seasonal rains by the names of stars. These are the same 27 stars that are used to reckon the location of the moon in the sky. Thus the association of the same name to the rain implies the location of the sun in the sky. For example, the rains associated with *Mrigashira* and *Ardra* are generally the heaviest and occur in July/August. This corresponds to the position of sun near those stars. The tradition of associating the star name with rain (indirectly the sun) appears to have deep roots in the 27 star calendar system which was in circulation before the advent of the zodiacal constellations attributed to Greek invasion.

There is an additional chapter called *Niradarka Vicharah* by the commentator Sumatiharsha. This contains only six verses. The first three refer to the calculation to be done for fixing the 'star' for the sun. Perhaps this was needed for agricultural purposes, since many farmers decide the date of sowing the seeds after consultation with local pundits who give them the dates of 'rain stars'. The duration of a 'rain star' is about 13–15 days and from generations the information about right 'star' for sowing has been passed on. However, the other three verses appear to be purely of astrological interest and convey notings relevant to astronomers. They specify the planetary positions for good rains.

The authors have taken great pain in translation as well as in providing numerical examples. The book serves as a very useful tool for people who want to explore the depths of Indian astronomy. However, this text is no exception to the general observation that Indian authors shy away from providing diagrams explaining the concepts, which is vital in understanding the 3-D celestial sphere. Bhaskaracharya has provided hints on drawings for understanding – these are termed *parilekhana*. Corresponding drawings would have added to the clarity in reading. Otherwise as one reads through, a mental picture of the associated drawing will have to be created. This may not be possible for many readers. It would be nice if diagrams as per *parilekhana* are incorporated in future editions, which can also have an index at the end, of subjects and *shlokas*. It may be better to have the verses printed in Devanagari script. A glossary and a cross-reference of technical terms like *deshantara*, *sara*, *chapa* and so on may be incorporated. A preliminary table on the representation of numbers, for e.g. 7^{R}, *kala*, *vikala* also would be very handy for people from different backgrounds.

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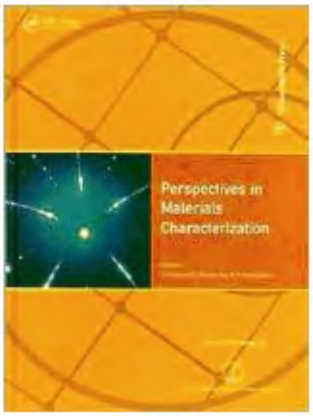

Perspectives in Materials Characterization. G. Amarendra, Baldev Raj and M. H. Manghnani (eds). University Press, 2009. 183 pp. Price not mentioned.

The importance of materials in the evolution of mankind has long been recognized by historians when they categorized the periods of human civilizations (Bronze Age, Iron Age) in terms of the type of materials invented during that period. In the antiquity, the ability to manipulate materials for useful purposes was more of an art than science. Perhaps, the alchemists were among the people who could create new types of materials through secret 'tricks'. The systematic discovery of elements and their consolidation in the form of a periodic table two centuries ago by Mendelev heralded a new beginning in the very thinking process of dealing with matter as a whole. The subsequent developments in physics and chemistry offered a variety of theoretical and experimental tools for quantitative characterization of matter in terms of the constituents, their arrangements in space, internal dynamics, and their relationships with the different physical properties. Armed with such an extensive range of characterization tools and the pace at which various disciplines (biology, chemistry, physics, metallurgy and other engineering disciplines) have come closer in the past two to three decades, it may not be so outrageous to speculate that in the years to come the materials scientists may as well be known as new-age-alchemists. The very interdisciplinary character of Materials Science offers exciting opportunities for doing new things. Many of the technological solutions to some of the pressing issues of the contemporary world such as energy, health and environment, will significantly depend upon the development of novel materials and processes. Regular updates of the new developments are therefore essential on various aspects of materials research from time to time.

The characterization tools in Materials Science are very diverse in nature and no single book can discuss exhaustively all topics of interest without comprising on its size and weight. One may cite two books: (i) *ASM Handbook*, Volume 10, *Materials Characterization* (ASM International, 1998) and (ii) *Characterization of Materials*, Volume 1 and 2 edited by Elton N. Kaufmann (Wiley-Interscience, 2003) in this context. Also, often such 'bulky' volumes focus on the traditional areas of characterization, sometime highlighting some of the new developments in that field. For readers interested only in some specific topics, along with the most recent updates, he/she would prefer a friendly-sized book. This aspect is taken care of in the book *Perspectives in Materials Characterization* under review. This new book, of about 200 pages, is published by the University Press as a part of the series in Metallurgy and Materials Science and is a sequel to a previous volume *Advances in Materials Characterization* published two years ago (in 2007) in which a broad overview of the developments in scanning tunneling microscopy, transmission electron microscopy, confocal microscopy, defect characterization using positron annihilation spectroscopy and Brillouin scattering has been presented. The new book, with glossy pages, contains five chapters on different themes (Raman, Micro-Laue diffraction, Ion beams, piezospectroscopy and X-ray spectroscopy). Each chapter gives the essential concepts of the technique, followed by examples from published literature. It may be