A World without Time: The Forgotten Legacy of Gödel and Einstein. Palle Yourgrau. 2005. Basic Books. Price: €19,70/ US $24.00/Can $ 33.95/Rs 1100.

This book presents a lay account of Kurt Gödel's excursion into (general) relativity, which came about due to his decade-long close personal association with Albert Einstein at the Institute for Advanced Study, Princeton, USA, until Einstein's death in 1955. More technical accounts were published in a 1991 book[1], and later its revised edition[2] in 1999 by the same author. Palle Yourgrau has fluently written an engaging story woven around nine themes, which are roughly chronological from the beginning of the book to its end, although thematic integrity has given way to strict chronology, as and when appropriate.

Before taking up the title theme, seventh in the book, the author builds the background, interweaving historical, personal and philosophical threads, sometimes personifying even contemporary or modern contributions to philosophical discourse by their proponents, just like the usual style of doing so for ancients like Euclid, Parmenides, Aristotle, Plato, and even Kant, leading to economy of expression. In the seventh theme, 'The scandal of Big "*T*" and little "*t*"', *T* denotes cosmic time of the big bang theory (while *t* is the coordinate time of a local observer), although *T* is also briefly used for truth, to make connection with Gödel's distinction between truth and provability, as in his incompleteness theorems in logic of mathematics.

A lay account is given of the foundations of modern mathematics and logic, especially as they impact on philosophy, including Bertrand Russell's exposé of the inconsistency of self-reference in naive set theory and its subsequent repair by others via formalizing set theory, before explaining how Gödel confounded even this formalization, by showing that consistency and completeness are mutually exclusive, thus dashing to the ground David Hilbert's hopes of constructing a complete and consistent account of each branch of mathematics. This is the fourth theme, 'A spy in the house of logic'.

Kurt Gödel's propensity to go to the logical limit, be it in logic of mathematics or in relativity, is brought out well, without going into technical details, nevertheless presenting the full logic of the argument. This is a readable book, which can be followed fruitfully by anyone who has some acquaintance with foundations of mathematics and with relativity theories of Einstein. Such familiarity is, in fact, assumed of the reader.

Gödel discovered a spinning universe as the solution to Einstein's equations of general relativity. This universe (i.e. space–time) admits what looks like a closed time-like geodesic, confounding the intuitive notion of time as a progression from (absolute) past to (absolute) future (in the language of null geodesics or light-cones), and in fact, seemingly erasing the distinction between time-like and space-like (invariant) intervals (of special relativity), so that intuitive time cannot be represented (or approximated) by the *t* coordinate in Gödel's spinning universe. And since this is (mathematically logically) possible for one (class of) solution(s) of Einstein's equations, all other solutions are also suspect, since the same physical laws underpin the equations (and hence all their solutions).

(Astro)physicists' first response[3] was to suspect Gödel of making a mistake in his calculations (without consulting Gödel), although it turned out *they* had made a mistake, probably due to their haste in catering to their own prejudice (as shown by Howard Stein, although he found it possible to publish[4] this only when Gödel himself intervened) (reminiscent of Eddington's prejudiced reaction to Chandrasekhar's application of quantum mechanics to stars). Gödel the astrophysicist, was however so sure of his calculations, that he tried to find out the spin of the universe, using the then best available observations, viz. orientations of images in *Hubble Atlas of Galaxies*, which also happened to be the dissertation topic of Dan Hawley, student of physical cosmologist James Peebles at the Institute for Advanced Study, Princeton, although Gödel, and Peebles and Hawley were ignorant of each other's interest in the matter, until prompted by John Wheeler of the same institute. (Later, whenever there accrued a large enough cosmological dataset, astrophysicists have used it to put a limit on the spin of our universe.)

From the modern standpoint today, when the big bang theory is embellished by inflation and considerations of dark matter and dark energy, and when the formalism of general relativity itself has seen much recent development, e.g. the distinction between coordinate singularities and essential singularities between local and global geometries of a space-time manifold, use of Ashtekar variables, and attempts at a quantum theory of gravity, it becomes necessary to reassess Gödel's result about the ideality of relativistic time from many other angles as well.

All in all, *A World without Time* is a well-written, thought-provoking book for well-informed lay readers as well as for students of mathematics, physics, philosophy and logic, whetting the appetite to delve into earlier writings on this topic, as well as Gödel's original paper(s). Detailed Notes, Works Cited and Index at the end of the book enhance its authenticity and utility to scholars.

1. Yourgrau, P., *The Disappearance of Time: Kurt Gödel and the Idealistic Tradition in Philosophy*, Cambridge University Press, Cambridge, 1991.
2. Yourgrau, P., *Gödel meets Einstein: Time Travel in the Gödel Universe*, Open Court, 1999.
3. Chandrasekhar, S. and Wright, J. P., *Proc. Natl. Acad. Sci. USA*, 1961, **47**, 341–347.
4. Stein, H., *Philos. Sci.*, 1970, **37**, 589–601.

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Handbook of Indian Wetland Birds and their Conservation. Arun Kumar *et al.* Zoological Survey of India, 234/4, AJC Bose Road, 13th Floor, Nizam Palace, Kolkata 700 020. 2005. 468 pp. Price: Rs 1500/US $ 80/£ 60 (Rs 975 special discount price for students, birdwatchers and scholars).

A brilliant *Handbook on the Indian Wetland Birds and their Conservation*, which was long overdue, has finally arrived. This handbook includes groups popularly known as the waterfowl, waders, shorebirds and seabirds. In addition, a number of birds such as kingfishers, raptors and some passerines, which are also ecologically dependent on wetlands have all been included here. These birds are one of the best indicators of the health of a given wetland habitat.

The handbook provides extensive information on 310 wetland bird species, including 243 waterbirds and 67 wetland-dependent and associated birds from India. Of these, 51 species are globally threatened.

Taej Mundkur and M. J. Crosby have taken up proper editing, recasting and rewriting tasks to weed-out imperfections. Their persistent efforts have brought about the cogency of flow and the soundness of factual information into this reliable document.

It is indeed edifying to compare the handbook with *A Field Guide to the Waterbirds of Asia* (Kodansha, Tokyo) brought out a decade ago. The pioneering effort by Bharat Bhushan *et al.* is bettered by the authors of this handbook, who have gone one stage further to include the conservation aspects of wetland birds. The authors have provided ample species facts, included hundreds of useful pictures and packed the book with countless distribution maps, graphs and colourful diagrams.

In the preliminary section of the book, the authors have given notes on 'How to use the book'. The information is presented with coloured distribution maps for each species and symbols to indicate the spatial distribution of population. A list of terms and abbreviations used is also provided.

The introductory chapter discusses the geology and climate of the region. Additionally, topics such as wetlands and their values, heronries and migratory routes have also been covered. Banard Lau of Malaysia has written a noteworthy communication on digital photography. The following chapter, which deals with the wetland and wetland-dependent birds is the focus of the book. Here an impressive checklist of wetland birds has been provided along with their distribution maps for India, conservation and residential status, abundance, population trends and estimates.

However, the authors have excluded Eurasian thick-knee and coursers, probably on account of their preference for arid regions. These species could have been included under a separate category titled 'Birds from wetland-dependent families'.

The authors discuss the status of wetland birds in yet another comprehensive chapter. Here tables of IUCN red-list categories and conservation status of the 51 globally threatened species occurring in India, are provided with photographic plates.

The socio-economic issues pertaining to wetlands have been dealt with in a separate chapter. This section provides insights into direct and indirect usage as well as classification of wetlands. Information provided here will prove exceptionally useful in creating awareness about the multiple roles of wetlands. The sub-chapter on biodiversity in Indian wetlands deals with the vegetation and faunal diversity. The common types of aquatic plants and some cultivable species of fish are illustrated along with photographs of some 16 wetland habitats. Wetland losses, threats to waterbirds, information needs, and effects of climate change are also dealt with.

Wetland sanctuaries, national parks, Ramsar and world heritage sites have been listed with detailed descriptions on each site. This section provides three useful tables, including a list of wetlands identified under the national conservation programme, statewise distribution of wetland-protected areas, and important bird-area sites in India. This being a government document, the tables and figures can be quoted in all conservation-related issues pertaining to these wetlands.

The book concludes with detailed information on national policies and laws, and international conventions and agreements pertaining to wetland conservation. A section on coordination of action in the Asian region and another on the strategy for threatened wetland birds in India deal with the complex issues relating to international cooperation. Additionally, various conservation programmes carried out by government and non-government organizations such as Wetlands International's Asian waterfowl census, have also been discussed.

A cursory glance at the presentation did not reveal any contradictions of body or text. The accentuation on titles and strong construction, which are seldom repeated, can be described as a merit of this work. The design and symmetry of the illustrations are comparable to any international publication. This handbook will be a useful tool for birders, species specialist groups as well as conservationists undertaking programmes to conserve and study our wetlands.

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Glaciers – The Rivers of Ice. V. K. Raina. Geological Society of India, PB 1922, Gavipuram PO, Bangalore 560 017. 2006. 40 pp.

A glacier horn in the Himalayas. These are carved by the headward erosion of two or more glaciers.

This slim, well-illustrated book, second in the 'Popularization of Science Series', is a readable and informative account on the glaciers of India. Glaciers form the most important storehouses of freshwater made available to the vast plains of India lying in front of the Himalayan mountain range. They are large masses of ice formed through the accumulation of snow in the icy cold mountainous regions representing the northern border of India. On solidification, the accumulated snow moves down hill slopes in the form of rivers of ice. Unlike waters in the rivers, glaciers move slowly. Their melt waters feed the great rivers of India like Ganga, Sindhu and Yamuna, which keep flowing even during dry weather and are our greatest natural asset. Chapters are devoted to the scientific study of glaciers, use of satellites in glaciology, glaciers as indicators of past climate, dangers posed to human habitation, etc. Valleys covered by glaciers are some of the most picturesque and scenically beautiful parts of our country.