

recent one published in this journal (Cunningham, 2020).

An image on page 91 gives us a "... family photograph of eight of the inner moons ..." of Uranus, but only seven are identified: the eighth has been cut off the lower edge of the image! In a look at the moons of Neptune, Kennett mentions the Roche limit (which sadly is not included in the Index), describing it as a

... minimum distance a satellite can approach a planet without being pulled apart by the planet's gravity and even go on to form a planetary ring. (p. 164).

That has certainly been the view for many years, but a recently-discovered violation of the outer Roche limit in the formation of rings at least suggests this inner Roche limit is not as ironclad as scientists have believed (Morgado, 2023).

Those looking for a discussion of the atmosphere of Uranus find this as the opener on the Voyager flyby. "An alarm sounded just four days before the encounter, and one of the onboard computers flagged up a memory error." (p. 45). Does anyone need to know this, especially as it has nothing to do with the atmosphere? After a second sentence on this engineering glitch from 39 years ago, Kennett writes: "In these early images Uranus did not appear to have any markings on its surface." (p. 46). For someone just learning about the planet, it would certainly be confusing to talk about the upper atmosphere of Uranus as if it were the planet's surface; the actual planet of Uranus to its core *is* discussed on pages 48 and 49, with our best guess as to its internal structure nicely shown in a cutaway diagram.

Throughout, the author quotes temperatures only in Kelvin, which will mean nothing to most readers. On page 66, without any prior explanation, the reader will encounter this opening sentence on the tilt of Uranus: "In 2006 the Canup-Ward model was able to demonstrate the position and density of the satellites found around Uranus ..." We are not told what this now-obsolete model is, although there is a reference given to the 2006 paper.

Finally, Kennett offers a problematic analogy about Triton's atmosphere, stating the

... photochemical haze forms when hydrocarbons and methane react with sunlight, much in the way that

smog is formed in Los Angeles. (p. 156).

One difference is that probably a major component of the haze particles on Triton is hydrocarbon and nitrile ices, such as ethylene and ethane. LA's haze is composed of much heavier tholin-like macromolecules (which gives it that characteristic orange-brownish colour), more like the haze on Titan than the haze on Triton.

For those who do not look too closely at the technical details, this is a fine primer on the planets Uranus and Neptune. The Reaction series (which began in 2017) is nearing its end, as a separate volume on Pluto will not be included. The final book in the series, which is a general survey of the entire Solar System, is currently in preparation.

References

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***The Growth and Development of Astronomy and Astrophysics in India and the Asia-Pacific Region*, edited by Wayne Orchiston, Aniket Sule and Mayank Vahia. (Cham, Springer, 2019). Pp. lx + 527. ISBN 978-981-13-3645-4 (eBook), 216 × 279 mm.**

These are the proceedings of a conference held at the Indian Institute of Scientific Education and Research (IISER) in Pune. (They constitute Volume 54 of the Astrophysics and Space Science Proceedings.) The subtitle of these transactions reads, "ICOA-9, Pune, India, 15-18 November 2016". The ICOA (International Conference on Oriental Astronomy) is a series of meetings held at intervals

of about three years between the triennial General Assemblies of the IAU (International Astronomical Union). This was, then, the ninth meeting in the series, which was initiated back in 1993, when the first ICOA took place in South Korea.

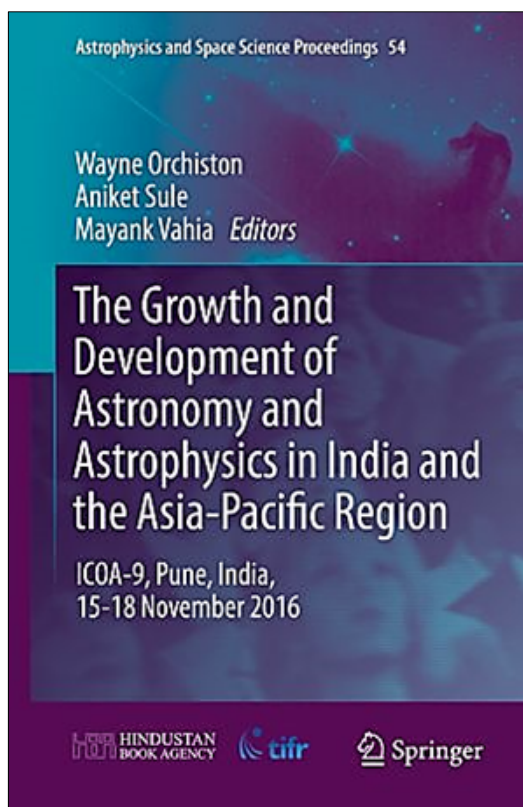
The topics included in ICOA-9 come from many parts of the region, but are dominated by research themes from the Indian sub-continent as might be expected given the conference venue. (In fact, 70% of the papers are concerned with specifically Indian-related topics, so there is some imbalance; one might even wonder whether the title isn't slightly misleading.) The book is structured on the basis of seven headings; some are quite logical (eclipses, transits and occultations are clearly related phenomena), while others seem to have been cobbled together to encompass several miscellaneous (in terms of research topic) presentations. The number of talks in each category ranges from two to seven. This is not an important point of debate, but one might just as well have labelled the topics with numbers or letters.

Conference proceedings, if composed well, provide a reader with the latest information on the topic in question. Of necessity it is that the work be published swiftly. In the present case, the time for publication ranged from 2 years (production in India) to 3 years (Singapore), an acceptable but not exceptional publishing speed (it is about average for ICOA proceedings publications). Speed may be important, but quality of the content is essential. A danger of conference proceedings is that they may include talks that have either already been published elsewhere (perhaps in a different conference), or are being presented while not yet ripe for public airing (of course this is something which the conference organizers can, to a certain extent, guard against). One would like to identify papers which occupy the middle ground between these extremes. I can think of several cases of conference papers of high quality that at the same time were in a publishable state.

Let us consider for a moment the work of H.C. van de Hulst (at the time a student) who presented his ideas on the then unobserved 21 cm wavelength HI line at a research meeting in 1944. In Leiden during the war (and under occupation) no more than a handful of interested listeners could attend. The talk was presented in Dutch (as were the subsequent proceedings); the papers were printed

within a year(!). H.I. Ewen and E.M. Purcell, who first detected the interstellar HI line, happened to hear about Van de Hulst's work during a meeting one of them attended. So, despite the war and a language barrier, the proceedings eventually reached their intended audience. (I will discuss a similar treasure from ICOA-9 below.)

Resuming our perusal of ICOA-9, I note that some of the material in: "Part V. The Emergence of Astrophysics and Radio Astronomy in Asia", has already seen the light of day. The chapter is a kind of outline sketch of, mainly, radio astronomy and its development in India and Australia, in particular. The section, written jointly by Govind Swarup and Wayne Orchiston (the former responsible for India, the latter probably for Australia), offers an interesting contrast in how history of science can be presented.



The section on Australia gives a chronological summary of radio astronomy progress post-WWII; it is a fairly standard treatment and adequately covers the topic. Sources used are referenced, many coming from standard astronomical research journals. Swarup's account of how the Ooty and GMRT (Giant Metre Radio Telescope) instruments came to fruition, on the other hand, is a more personal account. It explains how the Ooty concept came about while Govind was

reading two papers about lunar occultation observations of the quasar 3C 273. The reader is really taken to the moment when the penny dropped, and the research goal, and path to it, became clear. For me, this is a highlight of the proceedings (but such moments are rare, and cannot be preprogrammed, only anticipated at best).

Apart from my minor criticisms concerning the structure and balance of ICOA-9, the contents have been assembled with care and attention to detail. The text is generally clearly written with a relatively small number

of errors (mostly typos, a few of language). The editors are to be congratulated on a job well done (I know how much effort can go into text editing and proof-reading). My overall evaluation is that this collection of articles will be of interest to a modest group of researchers interested in very specific research topics in the history of Indian astronomy.

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