Leibniz paved the way for mathematical advances on the Continent, while British researchers doggedly hung on to the cumbersome Newtonian notation for decades. Gomez offers extensive geometrical proofs, complete with coloured diagrams, but he also gives the modern reader the trigonometric approach for ease of understanding. On the content of the two books, anyone looking for the original Greek and modern English translation must turn to the Carman and Buzón book, as Gomez just gives excerpts in English to advance his analysis. Thus, they are complimentary. There is a typo in the Gomez book: “proof” should be “prove” on page 45.

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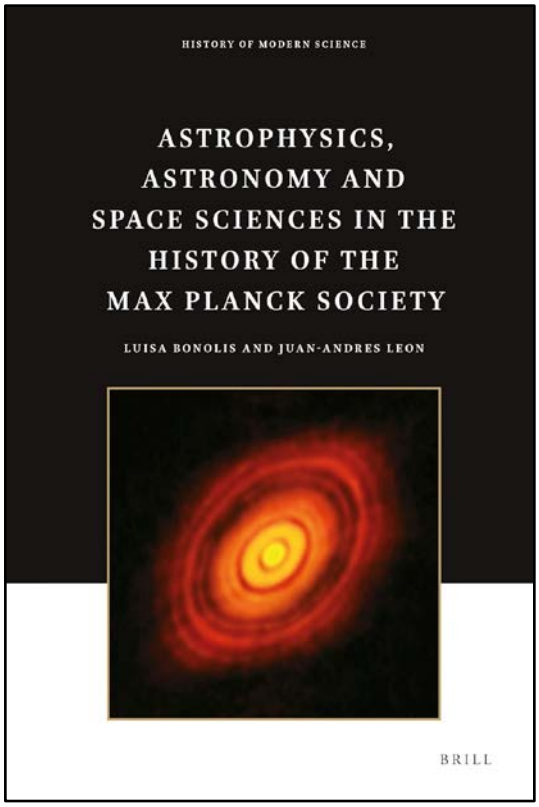
***Astrophysics, Astronomy and Space Sciences in the History of the Max Planck Society*, by Luisa Bonolis and Juan-Andres Leon (London, Brill, 2023). Pp. xxx + 714. ISBN 978-90-04-44975-6 (hardback), 240 × 160 mm, Euro173.34.**

What it says on the cover: the history of astronomy and related fields within the Max Planck Society (MPS), covering mainly the time from 1946 through 2000. If necessary, some background material from earlier times is included, and some projects begun before 2000 are followed for a somewhat longer time. Data-privacy restrictions, however, allow access to archival material only to 2004; the last couple of decades are thus missing. On the other hand, the book is long enough as it is, and perhaps in the future someone will write another one covering the more recent history, aided by access to the archives and perhaps allowing for a more candid discussion if some of the people mentioned are dead or at least retired.

This volume is part of a project on the history of the MPS as a whole, concentrating on the period from 1948, when the MPS was founded from the post-war ashes of the Kaiser Wilhelm Society, through 2002. Both of the authors are professional historians of science, associated with the Max Planck Institute (MPI) for the History of Science for this and other research. In addition to the archives of the MPS and of course normal publications, sources were fifty-four oral-history interviews with forty-four people (conducted over several decades, some by the authors), both with members of the MPS and with others. Such personal recollections complement the drier facts and together make up an interesting narrative. It is not a survey of all research done on those topics within the MPS; rather, it puts scientific developments into their socio-political contexts, follows how the MPS adapted to the changing research landscape, and shows the influence of the people involved, particular the Directors of the various MPIs.

The 33-page introduction gives an overview of the book, the sixteen main chapters of which are divided into five main parts: The Nuclear Age, The Space Age, Growth and



Reorganization of the Society, Internationalization, and Global Leadership in Emerging Fields. While roughly chronological, there is some overlap between the parts, as they are based on topics rather than time periods (though of course certain topics dominated certain times). Similarly, the chapters within each part are not arranged chronologically, but tell more or less concurrent stories.

The Kaiser Wilhelm Society had been founded in 1910 at the suggestion of Adolf Harnack, a professor of theology. His name lives on today in the `Harnack Principle', which refers to the idea, embraced by the MPS, of building an institute around an outstanding person (later extended to a few

people) as much as around a topic. Germany was divided after World War II and Robert Havemann and Max Planck disagreed on whether Goettingen or Berlin should be responsible for the Kaiser Wilhelm Society. The MPS was founded at the beginning of 1948 and gradually absorbed the West German Kaiser Wilhelm Institutes, while those in East Germany met a similar fate with the German Academy of Sciences at Berlin (later the Academy of Sciences of the GDR). It was only in 1960 that the Kaiser Wilhelm Society was formally disbanded. The MPS can be seen as the successor to the Kaiser Wilhelm Society.

World War II played a major role in the early years of the MPS since research which could have military applications was forbidden in occupied West Germany. In general, there was the post-war optimism of the nuclear age and technology, partly developed during the War, which had a big impact on astronomy, particularly radio astronomy. At the time, 'nuclear physics' could cover everything from peaceful nuclear (fission) energy and nuclear weapons to cosmic rays, particle physics, nuclear fusion, plasma physics, and so on. Considerable research was possible despite the Allied restrictions, and cosmic rays in particular were a 'hot topic'.

Competition between the three occupied regions of Germany (by France, the UK, and the USA) led to regional competition which primed the MPS for a role in the space age. In this first phase, the MPI for Physics and Astrophysics was in Goettingen (Lower Saxony), which, though Munich (Bavaria) had also been important, had been the main German university with regard to the development of quantum theory in the decades prior to WWII; Werner Heisenberg, the most prominent German physicist still in Germany, played a large role in the founding of the new society, and Ludwig Biermann and his group also played a key role.

At the same time, there was also a research community in southwest Germany, based on experimental physics. The key figure here was Wolfgang Gentner, carrying on the tradition established by Walther Bothe, with research concentrated at the MPI for Nuclear Physics in Heidelberg and the MPI for chemistry in Mainz. Another branch was balloon-based cosmic-ray research, eventually leading to the MPI for Aeronomy in Lindau (Lower Saxony). For various reasons, this institute, now the MPI for Solar System Research and relocated to Goettingen, had a difficult history.

The book covers not just the successes but also the less fortunate episodes in the history of the MPS. Basic research was eclipsed for a while when the emphasis shifted to nuclear power, particle accelerators, and so on. That period, after the Allied restrictions had been lifted in 1955, was characterized by power struggles between the different traditions, amplified by competition between the various federal states, with Heisenberg (from Wuerzburg in northern Bavaria) and Gentner two of the key players.

The areas of research in the early MPS were well suited to bringing the Society to prominence in space sciences after the launch of Sputnik. This change in emphasis due to the onset of the space age led to both more international cooperation and to an emphasis on various aspects of astronomy and astrophysics. While Allied restrictions hindered Germany from having its own space program, that also led to an emphasis on other fields relevant to the space age, now receiving national support due to the Cold War. Theoretical physicists, experimental particle physicists, balloon researchers, and chemists all refocussed their efforts and that of their institutes on space research. Reimar Luest (1923–2020), originally a plasma astrophysicist, emerged as a key figure in Munich and competitor to the MPI for Aeronomy, the previous research of which had been closest to that of the new Space Age.

Astronomy did not become a topic of the MPS until the 1960s. In contrast to modern developments involving bigger optical telescopes in the USA, astronomy in Germany at the time was still dominated by observatories from previous centuries, their now small telescopes also hampered by being at low elevation and subject to light pollution. In addition, such observatories were still the purview of the various states; Germany had been unified under Bismark less than a century before. (Many of those observatories still exist, usually associated with universities (also the purview of the individual states) and often MPIs as well, with little reliance on historical equipment.)

Radio astronomy had received a major boost from wartime work on radar. The biggest expansion of the MPS was the absorption of radio astronomy projects and their transformation into national infrastructures. That was repeated for optical astronomy and

also for wavelengths accessible only from space, leading to a shift away from theoretical plasma physics (in Munich) and experimental particle physics (in Heidelberg).

During that time, the MPS attracted external experts, a younger generation rose to power, and the rivalry between Heidelberg and Garching faded as Reimar Luest, elected President of the MPS in 1973, moved towards reconciliation. The Institute for Plasma Physics (which later spawned the MPI for Quantum Optics in Garching, just north of Munich) was re-admitted to the MPS and the basic structure with the MPIs for Radio Astronomy in Bonn (MPIfR), Astrophysics (theoretical, in Munich, originally a department of the MPI for Physics and Astrophysics), Astronomy (MPIA, observational, in Heidelberg), and Extraterrestrial Physics (originally a department of the MPI for Physics and Astrophysics) was in place. (A later development was the split of the MPI for Physics and Astrophysics into the MPI for Physics (Munich), MPI for Extraterrestrial Physics (MPE, in Garching), and the MPI for (theoretical) Astrophysics (MPA, in Garching).

Still later, the MPI for Gravitational Physics was spun off, with institutes in Golm (near Potsdam, in former East Germany, to some extent absorbing previous astrophysical institutes of the now defunct GDR, here concentrating on theory) and Hanover (concentrating on experiments, mainly gravitational waves; the Hanover site had originally been spun off the MPI for Quantum Optics), and the MPI for Solar System Research also still exists. The MPI for Plasma Physics is now also located in Garching (and Greifswald), as are the headquarters of the European Southern Observatory (ESO) and, to some extent, the Technical University of Munich and the Ludwig Maximilian University of Munich—the main university in Munich, going back to 1472—thus making the Garching campus one of the largest for astronomy and related fields in the world.

After the Cold War, internationalization became even more important, and the emphasis shifted from operating observatories to participating in large collaborations, with the instrumental expertise of the MPIs playing a major role. In contrast to the 1960s, when many large telescopes and satellites were national projects, later on, international organizations such as ESO and the French–German–Spanish Institute for Millimeter Astronomy (IRAM) led the way to a new mode of doing science. The observatory at Calar Alto, in Spain, run by the MPIA in Heidelberg, did not really live up to expectations, in part because by the time it was finished the technology was almost obsolete. The MPIA nevertheless managed to survive. Interestingly, the MPIA, MPE, and MPIfR all had projects in the infrared, approaching it from different angles, so to speak; that led not to competition but to intense collaboration, to some extent obscuring the differentiation based on wavelength of earlier times. Most surprising is that, during the restructuring in the 1990s (tied up with German reunification), the MPA was in real danger of being closed completely. Today, it is arguably the leading institute for theoretical astrophysics in the world.

The final regular chapter leaves the bird's-eye view to illustrate the interrelationship of long-standing traditions in the MPS and their involvement in international collaborations via three examples: the solar-neutrino puzzle, the search for gravitational waves, and high-energy astrophysics, the latter covering the history from early cosmic-ray research to ground-based gamma-ray astronomy. In the first two cases, Nobel Prizes were awarded to non-German astronomers (not counting Rai(ner) Weiss, who was originally from Germany but immigrated via Prague to the USA with his family as a young child). A huge amount of development in gravitational-wave detection had been done within the MPS, but budgetary constraints, mainly due to German reunification, caused plans to be downscaled to a pilot detector (GEO600 near Hanover). A full-scale detector was never built, and to this day GEO600 has not actually detected any gravitational waves, although it continues to play a role as a technology test-bed. Cosmic rays were a major topic in the early years of the MPS, but later became eclipsed by other subjects, though some research continued at universities. A renaissance in high-energy astrophysics occurred when the MPI for Physics and the MPI for Nuclear Physics, initially in collaboration with Armenian scientists, constructed the successful H.E.S.S. and MAGIC telescopes and are now major players in the Cerenkov Telescope Array Observatory.

The appendix is rather different from the other chapters, illustrating the history of the MPS through its finances. Especially for experimental work, financing is very important,

and financial decisions both reflect and influence what happens in research. Rather than cluttering the other chapters with such details (even though they are important), the reader is referred to the Appendix when finances play a role in the narrative. The book ends with a bit more than 95 pages of bibliography and a small-print index of somewhat more than 13 pages.

Despite the scholarly nature of the book, it is an interesting and exciting read. Even those familiar with the big picture will learn new details, especially *via* the personal angle, in large part due to the input from many interviews. Probably more than any other research institute, the MPIs are built around people, and the book makes it clear that it is people who do science. That usually does more harm than good, as personality clashes can get in the way. The first chapter contains many black-and-white photographs, mostly of people; it is not clear why later chapters do not—I think that they would have added some value. The price is certainly justified for such a long, well-produced book. However, the pdf file is also publicly available for free (at the website given below). Anyone interested in the history of astronomy and/or the relationship between research and politics will probably enjoy this volume.

https://www.mpiwg-berlin.mpg.de/resources/publications/books/astrophysics-astronomy-and-space-sciences-history-max-planck-society

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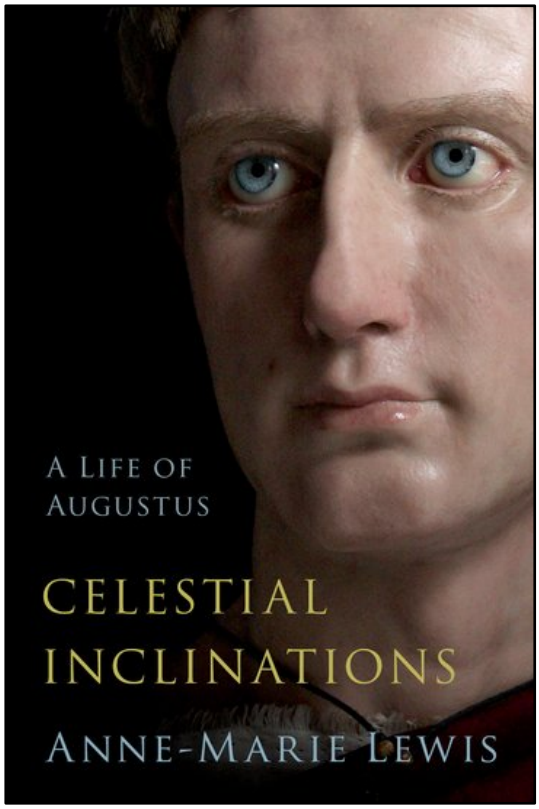
Celestial Inclinations: A Life of Augustus, by Anne-Marie Lewis. (Oxford, Oxford University Press, 2023). Pp. xvi + 538. ISBN 978-0-197-59964-8 (hardback), 160 × 240 mm, US$125.

As is well known, Augustus was the most adept of all Roman politicians. How he rose from a young and rather insecure young man (known as Octavius) at the death of his uncle Julius Caesar to become the first Emperor of Rome is a study in statecraft like no other. In this book, Anne-Marie Lewis (Associate Professor of Ancient Greek and Latin at York University in Toronto, Canada) shows that Augustus used and manipulated the celestial realm to further his manipulation of the terrestrial. Indeed, they were inextricably intertwined:

> Augustus used both astrology and observational astronomy to access and exploit the celestial sphere throughout his life … political activities were his astronomical observations of the sky where the celestial manifestations of his mythological Julian kin could be found. (page 2).

To accomplish this, accurate dating was required, which leads Lewis to the conclusion that both Augustus and the statesman Cicero abandoned the quasi-lunar Roman calendar for an astronomical calendar based on the movement of the Sun. This allowed Augustus to set the date for a new event based on the



stars visible on that original date and future anniversaries. Both men, whose output of letters was voluminous, were also attentive to exact time. Augustus "… added to all his letters the exact moments of the hours of both the day and night." (page 14). For a historian, dating an event is of great importance. In the life of Augustus

> There are forty-six datable events occurring in all twelve months of the year for which the sky can be seen to have provided a meaningful backdrop that reflected the support of the celestial sphere for Augustus. (page 17).

Examining these events forms the backbone