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The Giant Planet Jupiter

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# The Giant Planet Jupiter

JOHN H. ROGERS  
*British Astronomical Association*



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# Preface

As this book was being written, in 1990–1993, the British Astronomical Association (BAA) was celebrating 100 years of systematic visual observations of the planets, and the Galileo spacecraft was wending its way out to Jupiter. So this was an opportune time to summarise our knowledge of the planet to date, integrating the wealth of Earth-based records with the fascinating data from the Pioneer and Voyager spacecraft. If the Galileo mission is successful, we will soon know much more about many aspects of the jovian system, but we can expect that the largescale properties and long-term patterns described in the present account will remain valid.

A reader unfamiliar with the planet will find the overall properties of the atmosphere described in Parts II and IV. More detailed support for the generalisations therein is given in Part III, which is a complete review of the observations up to 1990 or 1991.

However, I hope that even the expert reader will find something new in this book. The author’s duty of tabulating all the historical records has sometimes been unexpectedly rewarding, and I was particularly pleased to discover or rediscover the following:

- long-term trends in the size and speed of the Great Red Spot, paralleling those of the South Tropical Disturbance and South Temperate white ovals, which strongly suggest that the Great Red Spot originated as recently as 1700;
- the detailed Voyager record of the origin of a South Tropical Disturbance;
- changes in the speed and latitude of the major retrograde jetstream, possibly related to South Tropical Disturbances;
- confirmation that reddish colour is a usual sequel of intense disturbances in many latitudes;
- reproducible cycles of activity in the North Equatorial Belt, involving broadening, reddening, and the formation of ovals;
- a change in speed and style of outbreaks in the fastest jetstream in the 1970s, soon after the onset of a new type of coloration event in the adjacent North Temperate Belt;
- confirmation of the 10-year periodicity in North Temperate Belt latitude, and explanation of it in terms of selective fading.

## Conventions and abbreviations

The names and abbreviations of the belts, zones, jetstreams, and currents are given in Fig. 1.3 and Figs. 3.1&2. Other abbreviations include GRS (Great Red Spot), STropD (South Tropical Disturbance) and FFR (folded filamentary region).

A standard system of terms and units has long been used in visual reports on Jupiter. Recently, completely different terms and units have been used by space scientists. The two systems are described in Chapter 1.3 (Table 1.3). In this book, the visual conventions are used, both for historical continuity and for their intrinsic convenience. Thus all images of the planet are shown with south up. Planetary east is termed ‘preceding’ (p.), and planetary west is ‘following’ (f.). Longitudes are measured in System I (equatorial region and NTBs jetstream) and System II (all other latitudes). Speeds are given in degrees longitude per 30 days ( $\Delta\lambda_1$  or  $\Delta\lambda_2$ ). Latitudes are zenographic.

In the chapters on the satellites, as most of the data are from spacecraft, images are presented with north up unless otherwise stated.

## References

Anyone of my generation learning about Jupiter must be indebted to the book by B.M. Peek (1958), *The Planet Jupiter*. Peek was one of the most famous Directors of the BAA Jupiter Section, and his book summarised the observations and understanding of the planet at that time. References to ‘Peek’ in the present text are to that book unless otherwise stated.

Sources for observations of the planet are the apparition reports by various organisations, listed in Appendix 3. For specific details, if no other organisation is specified, the information is from the BAA reports. Other organisations are abbreviated as follows: ALPO (Association of Lunar and Planetary Observers), LPL (Lunar and Planetary Laboratory of the University of Arizona), NMSUO (New Mexico State University Observatory), RAS (Royal Astronomical Society), SAF (Société Astronomique de France), SAI (Società Astronomica Italiana), SAS (Société Astronomique de Suisse).

References which are not in these series are cited in the text or in footnotes by name and date of publication (the date being in



italics where necessary to avoid confusion with dates of observations). The full references are given in Appendix 4 (for Parts I–IV, the planet) and Appendix 5 (for Parts V and VI, the magnetosphere and satellites).

**Acknowledgements**

First, this work has depended on the many observers, of the BAA and other organisations, who have studied the planet over the years. It is their assiduous work which has made possible our present knowledge of the planet. I thank the BAA Council for permission to use BAA materials freely in this book. I am also grateful to the Royal Astronomical Society for access to their archives and for permission to reproduce illustrations from them. For my own observations, I would like to acknowledge the use of telescopes of the University of Cambridge and of the University of California at Los Angeles.

Equally, all of us interested in planets have a historic debt to the National Aeronautics and Space Administration (NASA), to the researchers responsible for the experiments on NASA spacecraft, and to the United States taxpayers who have supported the whole enterprise of space exploration. In addition to sending out the space missions themselves, NASA have (until very recently) provided spacecraft data and images either free of charge or at minimal cost, to interested researchers such as myself. Without this enlightened policy, much of this book could not have been produced. I am also grateful to the Department of Physics, Imperial College, London, for access to the NASA archive of Voyager images and maps. I have measured some of these, including strip-maps produced by the Voyager Imaging Team, to establish the drift rates of features shown in Fig. 6.4, Fig. 8.10, Fig. 10.28, and Table 12.2B.

The Voyager images were produced by the Voyager Imaging Team (leader Dr. Bradford A. Smith), and were obtained for this book as follows.

- (1) Public release images from NASA.
- (2) Other images of the planet were kindly provided as prints by the National Space Science Data Center, Greenbelt, Maryland, through the World Data Center A for Rockets and Satellites. (These are cited by numbers in the format ‘12345.12’; many are previously unpublished.)
- (3) Other images of the satellites were obtained from CD-ROM discs purchased from the same source. Processing of these images, using the programs Procyon Common Lisp (Scientia Ltd.) and PhotoFinish (ZSoft Corp.), was expertly and generously done by Simon Mentha.

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John H. Rogers  
1993 August 5