Io After *Galileo*

A New View of Jupiter's Volcanic Moon

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To our late colleagues Damon Simmonelli and Bill Sinton,
who greatly contributed to our understanding of Io.
We miss their scientific insight, humor, and friendship.

Preface

This book is a community effort that grew largely out of the informal Io workshops that have happened since the early 1990s. In the first few years, the purpose of the workshops was to determine which *Galileo* observations would be key to further our understanding of this exotic moon. Since *Galileo*'s main antenna did not open, the number of observations taken by the spacecraft was exceedingly small compared with other missions; it was therefore imperative to decide which observations would be the highest priority. We can make an analogy between a tourist with a point and shoot camera, taking pictures at a high rate to decide later which are the best, and Ansel Adams, spending many hours or even days deciding how best to take a single shot.

The competition for resources on *Galileo* was fierce, but those of us in charge of Io observations for *Galileo*'s instruments decided at an early stage that much could be gained from collaboration. Thus, the workshops evolved into the planning of collaborative observations and dividing resources between us in a mostly peaceful manner. By the time we began acquiring *Galileo* Io data, in 1995 for fields and particles and 1996 for remote sensing, a *Galileo* Io working group was already well established, paving the way for collaborative research. As the years passed, the workshops became more aligned with data analysis and, finally, we started discussing key questions such as how hot Io's magma really is, and what key future observations we will need to answer the many unsolved mysteries that Io continuously threw our way. When the *Galileo* mission ended in 2003, we felt the time was right for a book reviewing the state of knowledge after *Galileo*. Hopefully, it will serve as a guide for future work, be it in the form of new space missions, telescopic observations, data analysis, or modeling.

We would like to thank all the people who participated in these workshops over the years and, in particular, all those who took on the task of organizing them. We thank Clive Horwood from Praxis for inviting us to take on this book project, Neil Shuttlewood and his team for editing and pre-press book production, and Jim Wilkie for the cover design.

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Figures

Tables

Abbreviations and acronyms

ADONIS	Adaptive Optics Near-Infrared System
AKR	Auroral Kilometric Radiation
AMU	Atomic Mass Unit
AO	Adaptive Optics
AU	Astronomical Unit
CAI	Calcium–Aluminium Inclusion
CFB	Continental Flood Basalt
CFD	Computational Fluid Dynamics
COS	Cosmic Originas Spectrograph
DDS	Dust Detector Subsystem
DSMC	Direct Simulation Monte Carlo
EPD	Energetic Particles Detector
ESO	European Southern Observatory
EUV	Extreme UltraViolet
FOS	Faint Object Spectrograph
FWHM	Full Width at Half-Maximum
GEM	*Galileo* Europa mission
GHRS	Goddard High-Resolution Spectrograph
GMM	*Galileo* Millennium Mission
GSMT	Giant Segmented Mirror Telescope
HIC	Heavy Ion Counter
HST	Hubble Space Telescope
IRIS	InfraRed Imaging Spectrograph
IRTF	InfraRed Telescope Facility
ISO	International Space Observatory
ISS	Imaging Science Subsystem
IUE	International Ultraviolet Explorer
JOI	Jupiter Orbit Insertion

JPL	Jet Propulsion Laboratory
JWST	James Webb Space Telescope
KH	Kelvin–Helmholtz
LBT	Large Binocular Telescope
LGA	Low-Gain Antenna
LTE	Local Thermodynamic Equilibrium
MAG	MAGnetometer
MMSN	Minimum-Mass Sub-Nebula
MMT	Multi-Mirror Telescope
NIMS	Near-Infrared Mapping Spectrometer
OSIRIS	OH-Suppressing InfraRed Imaging Spectrograph
OWL	OverWhelmingly Large Telescope
PLS	PLasma detector Subsystem
PPR	PhotoPolarimeter and Radiometer
PMS	Pre-Main-Sequence
PWS	Plasma Wave Subsystem
SB	Stochastic–Ballistic
SPIFFI	SPectrograph for Infrared Faint Field Imaging
SSI	Ssolid-State Imaging system
STIS	Space Telescope Imaging Spectrograph
SZA	Solar Zenith Angle
TEXES	Texas Echelon Cross Echelle Spectrograph
TMT	Thirty Meter Telescope
UVS	UltraViolet Spectrometer
VIMS	Visible–Infrared Mapping Spectrometer
VLT	Very Large Telescope

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