

# Preface

The space between stars is not empty, but filled with interstellar matter, mostly composed of atomic, ionized or molecular hydrogen, depending on the temperature and density of the various phases of this medium. About 1% of the total mass of interstellar matter in our galaxy is contained in small solid particles, ranging in size from a few nanometers to many microns and even millimeters in planet-forming disks around young stars. This cosmic dust undergoes a complicated lifecycle, with fresh material produced in the outflows of evolved stars and supernovae, modified by shocks and cosmic rays in the diffuse interstellar medium and providing the surface for the formation of molecular ices in cold and relatively dense molecular clouds.

Although elemental abundances, formation routes, extinction curves, and early infrared and ultraviolet spectroscopy pointed to the presence of silicates, carbides, and graphitic material in space, it was only recently determined that a new field – astromineralogy – emerged from astronomical observations. The unprecedented spectral resolution and wavelength coverage provided by the *Infrared Space Observatory*, together with dedicated experimental work in the field of laboratory astrophysics, provided the unambiguous identification of minerals in space, ranging from olivines and pyroxenes to various carbides.

Cosmic mineralogy already provided earlier results on minerals in space by the in situ study of minerals in our solar system. Meanwhile, we see a bridge between astronomically-identified minerals and stardust minerals found by their isotopic signatures in meteorites and interplanetary dust. This may lead to a wider definition of astromineralogy that includes these investigations.

Early seminars on astromineralogy were held at the Universities of Amsterdam and Heidelberg. They showed the large interest of astronomers, physicists, chemists, and mineralogists in this new field and encouraged the publication of this book. New infrared missions such as SIRTf and NGST will provide more empirical material in this fascinating field.

I thank the authors for their contributions to this book and their willingness to follow my recommendations. In addition, I thank my former colleagues Drs. J. Dorschner, J. Gürtler, C. Jäger, and H. Mutschke for many years of fruit-

ful collaboration in the experimental characterization of cosmic dust analogues, which paved the way for the identification of minerals in space.

Finally, I would like to thank J. Weiprecht. Without his technical help, the production of this book would not have been possible.

Heidelberg and Jena  
December 2002

Thomas Henning

# List of Contributors

## **John Bradley**

Institute for Geophysics and Planetary  
Physics,  
Lawrence Livermore National  
Laboratory,  
Livermore, CA 94551, USA  
jbradley@igpp.ucllnl.org

## **Johann Dorschner**

University of Jena  
Astrophysical Institute and University  
Observatory  
Schillergässchen 2-3  
07745 Jena, Germany  
dorsch@astro.uni-jena.de

## **Hans-Peter Gail**

University of Heidelberg  
Institute for Theoretical Astrophysics  
Tiergartenstr. 15  
69121 Heidelberg, Germany  
gail@ita.uni-heidelberg.de

## **Martha S. Hanner**

Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, CA 91109, USA  
msh@galah.jpl.nasa.gov

## **Thomas Henning**

Max Planck Institute for Astronomy  
Königsstuhl 17  
69117 Heidelberg, Germany  
henning@mpia-hd.mpg.de

## **Elmar K. Jessberger**

University of Münster  
Institute for Planetology  
Wilhelm-Klemm-Str. 10  
48149 Münster, Germany  
ekj@nwz.uni-münster.de

## **Ingrid Mann**

University of Münster  
Institute for Planetology  
Wilhelm-Klemm-Str. 10  
48149 Münster, Germany  
imann@uni-münster.de

## **Frank Molster**

ESTEC  
Solar System Division  
Keplerlaan 1  
2201 AZ Noordwijk, Netherlands  
fmolster@so.estec.esa.nl

## **Ulrich Ott**

Max Planck Institute for Chemistry  
Postfach 3060  
55020 Mainz, Germany  
ott@mpch-mainz.mpg.de

## **L.B.F.M. Waters**

University of Amsterdam  
Astronomical Institute Anton  
Pannekoek  
Kruislaan 403  
1098 SJ Amsterdam, Netherlands  
rensw@astro.uva.nl



<http://www.springer.com/978-3-540-44323-0>

Astromineralogy

Henning, Th. (Ed.)

2003, IX, 281 p., Hardcover

ISBN: 978-3-540-44323-0