

IAU Symposium

343

20-23 August 2018

Vienna, Austria

Proceedings of the International Astronomical Union

Why Galaxies Care About AGB Stars: A Continuing Challenge through Cosmic Time

Edited by

Franz Kerschbaum

Martin Groenewegen

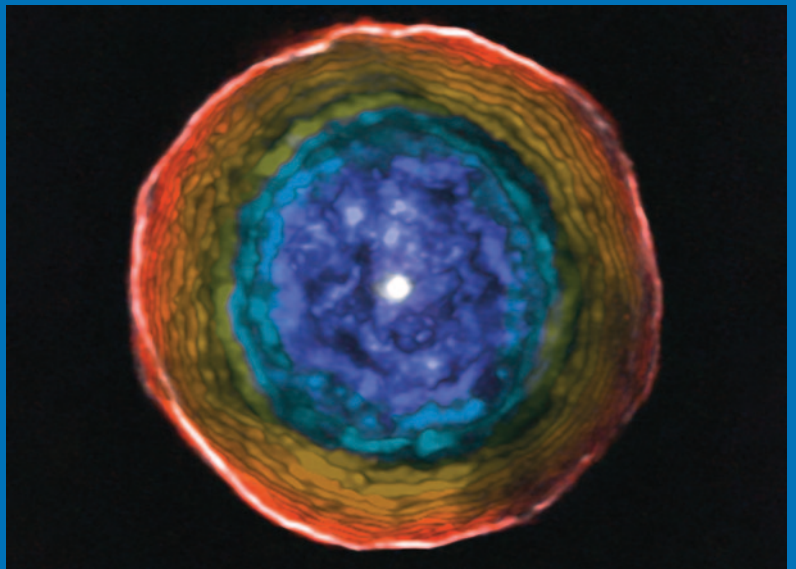
Hans Olofsson

ISSN 1743-9213

International Astronomical Union



CAMBRIDGE
UNIVERSITY PRESS



WHY GALAXIES CARE ABOUT AGB STARS:
A CONTINUING CHALLENGE THROUGH COSMIC TIME

IAU SYMPOSIUM 343

COVER ILLUSTRATION: THE DETACHED GAS SHELL OF U ANTLIAE

Mass loss during the AGB phase is critical for the evolution of the star itself as well as for the chemical evolution of the hosting galaxy. During the last years, observations have revealed that its temporal evolution, the structure and dynamics of its extended atmosphere, and the chemistry related to molecule and dust formation are more complex than originally thought. As an example, the detached shell surrounding the carbon star U Antliae as observed by ALMA is shown.

Credit: ALMA (ESO/NAOJ/NRAO/F. Kerschbaum)

IAU SYMPOSIUM PROCEEDINGS SERIES

Chief Editor

PIERO BENVENUTI, IAU General Secretary

IAU-UAI Secretariat

98-bis Blvd Arago

F-75014 Paris

France

[*iau-general.secretary@iap.fr*](mailto:iau-general.secretary@iap.fr)

Editor

MARIA TERESA LAGO, IAU Assistant General Secretary

Universidade do Porto

Centro de Astrofísica

Rua das Estrelas

4150-762 Porto

Portugal

[*mtlago@astro.up.pt*](mailto:mtlago@astro.up.pt)

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

International Astronomical Union



**WHY GALAXIES CARE ABOUT
AGB STARS: A CONTINUING
CHALLENGE THROUGH
COSMIC TIME**

**PROCEEDINGS OF THE 343rd SYMPOSIUM
OF THE INTERNATIONAL ASTRONOMICAL
UNION HELD IN VIENNA, AUSTRIA
20–23 AUGUST, 2018**

Edited by

FRANZ KERSCHBAUM
University of Vienna, Austria

MARTIN GROENEWEGEN
Royal Observatory of Belgium

and

HANS OLOFSSON
Chalmers University of Technology, Sweden

Editorial Assistant

Verena Baumgartner
University of Vienna, Austria

 **CAMBRIDGE**
UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom
1 Liberty Plaza, Floor 20, New York, NY 10006, USA
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

© International Astronomical Union 2019

This book is in copyright. Subject to statutory exception
and to the provisions of relevant collective licensing agreements,
no reproduction of any part may take place without
the written permission of the International Astronomical Union.

First published 2019

Printed in the UK by Bell & Bain, Glasgow, UK

Typeset in System L^AT_EX 2 ϵ

*A catalogue record for this book is available from the British Library Library of Congress
Cataloguing in Publication data*

This journal issue has been printed on FSCTM-certified paper and cover board. FSC is an
independent, non-governmental, not-for-profit organization established to promote the
responsible management of the world's forests. Please see www.fsc.org for information.

ISBN 9781108471527 hardback
ISSN 1743-9213

Table of Contents

Preface	xvi
Editors	xviii
Acknowledgements	xix
Conference Photograph	xx
Address by the Scientific Organizing Committee	xxi
In memoriam Thomas Posch (1974–2019)	xxiii

Stellar structure and evolution to, on and past the AGB

AGB Stars: Remaining Problems	3
<i>John Lattanzio</i>	
3D modelling of AGB stars with CO5BOLD	9
<i>Bernd Freytag, Susanne Höfner and Sofie Liljegren</i>	
Magnetic fields of AGB and post-AGB stars	19
<i>Wouter Vlemmings</i>	
Constraining convection across the AGB with high-angular-resolution observations	27
<i>Claudia Paladini, Fabien Baron, A. Jorissen, J.-B. Le Bouquin, B. Freytag, S. Van Eck, M. Wittkowski, J. Hron, A. Chiavassa, J.-P. Berger, C. Siopis, A. Mayer, G. Sadowski, K. Kravchenko, S. Shetye, F. Kerschbaum, J. Kluska and S. Ramstedt</i>	
Imaging the dust and the gas around Mira using ALMA and SPHERE/ZIMPOL	31
<i>Theo Khouri, Wouter H. T. Vlemmings, Hans Olofsson, Christian Ginski, Elvire De Beck, Matthias Maercker and Sofia Ramstedt</i>	
Evolutionary timescales from the AGB to the CSPNe phase	36
<i>Marcelo M. Miller Bertolami</i>	

New and future observational perspectives

Resolved stellar populations: the outlook for JWST and ELT	49
<i>Eline Tolstoy</i>	
LSST: making movies of AGB stars	59
<i>Željko Ivezić, Krzysztof Suberlak and Owen M. Boberg</i>	
Probing stellar evolution with S stars and Gaia	69
<i>S. Shetye, S. Van Eck, A. Jorissen, H. Van Winckel, L. Siess and S. Goriely</i>	
AGB stars in <i>Gaia</i> DR2	73
<i>Thomas Lebzelter, Nami Mowlavi, Paola Marigo, Isabelle Lecoœur-Taibi, Michele Trabucchi, Giada Pastorelli, Peter Wood and Gaia Collaboration</i>	

Nucleosynthesis, mixing, and rotation

- Nucleosynthesis in stars: The Origin of the Heaviest Elements 79
Amanda I. Karakas
- The composition of Barium stars and the s-process in AGB stars 89
*Borbála Cseh, Maria Lugaro, Valentina D'Orazi, Denise B. de Castro,
 Claudio B. Pereira, Amanda I. Karakas, László Molnár, Emese Plachy,
 Róbert Szabó, Marco Pignatari and Sergio Cristallo*
- Abundances of C, N, and O in AGB Giants and Model Atmospheres 93
B. Aringer, P. Marigo, W. Nowotny, L. Girardi, M. Mečina and A. Nanni

Pulsation, dynamical atmospheres, and dust formation

- The evolution of DARWIN: current status of wind models for AGB stars 99
Sara Bladh
- Molecular dust precursors in envelopes of oxygen-rich AGB stars
 and red supergiants 108
Tomasz Kamiński
- On the onset of dust formation in AGB stars 119
*David Gobrecht, Stefan T. Bromley, John M. C. Plane, Leen Decin and
 Sergio Cristallo*
- Dynamics, temperature, chemistry, and dust: Ingredients for a self-consistent
 AGB wind 129
J. Boulangier, D. Gobrecht and L. Decin
- Lumpy stars and bumpy winds 134
Sofie Liljegren, Susanne Höfner, Bernd Freytag and Sara Bladh

Circumstellar envelopes of AGB stars and their progeny, planetary nebulae

- High angular resolution observations of AGB stars 141
Eric Lagadec
- The mass-loss characteristics of AGB stars An observational view 150
Sofia Ramstedt
- Circumstellar dust, IR spectroscopy, and mineralogy 159
Kyung-Won Suh
- Planetary Nebulae, Morphology and Binarity, and the relevance to AGB Stars . . . 164
Raghvendra Sahai
- Planetary nebulae in the (extra)-galactic context: Probing chemical evolution
 in star-forming galaxies 174
Letizia Stanghellini
- Extended Dust Emission from Nearby Evolved stars 181
*Thavisha E. Dharmawardena, Francisca Kemper, Peter Scicluna,
 Jan G. A. Wouterloot, Alfonso Trejo, Sundar Srinivasan, Jan Cami,
 Albert Zijlstra, Jonathan P. Marshall and the NESS collaboration*

On the circumstellar envelopes of semi-regular long-period variables	186
<i>J. J. Díaz-Luis, J. Alcolea, V. Bujarrabal, M. Santander-García, M. Gómez-Garrido and J.-F. Desmurs</i>	
The Impact of UV Radiation on Circumstellar Chemistry	191
<i>Maryam Saberi, Wouter Vlemmings, Tom Millar and Elvire De Beck</i>	
A Tough Egg to Crack	196
<i>Jeremy Lim and Dinh-van-Trung</i>	
Newly discovered Planetary Nebulae population in Andromeda (M31): PN Luminosity function and implications for the late stages of stellar evolution	201
<i>Souradeep Bhattacharya, Magda Arnaboldi, Johanna Hartke, Ortwin Gerhard, Valentin Comte, Alan McConnachie and William E. Harris</i>	
Binarity, planets, and disks	
Post-RGB and Post-AGB stars as tracers of binary evolution	209
<i>Devika Kamath</i>	
AGB stars in binaries and the common envelope interaction	220
<i>Orsola De Marco</i>	
Orbital properties of binary post-AGB stars	230
<i>Glenn-Michael Oomen, Hans Van Winckel and Onno Pols</i>	
Accretion in common envelope evolution	235
<i>Luke Chamandy, Adam Frank, Eric G. Blackman, Jonathan Carroll-Nellenback, Baowei Liu, Yisheng Tu, Jason Nordhaus, Zhuo Chen and Bo Peng</i>	
The missing mass conundrum of post-common-envelope planetary nebulae	239
<i>Miguel Santander-García, David Jones, Javier Alcolea, Roger Wesson and Valentín Bujarrabal</i>	
AGB stars in the cosmic matter cycle	
The role of AGB stars in Galactic and cosmic chemical enrichment	247
<i>Chiaki Kobayashi, Christopher J. Haynes and Fiorenzo Vincenzo</i>	
AGB stars and the cosmic dust cycle	258
<i>Svitlana Zhukovska</i>	
Chemistry and binarity in the early Universe: what is the role of metal-poor AGB stars?	265
<i>Anke Arentsen, Else Starkenburg, Matthew D. Shetrone, Alan W. McConnachie, Kim A. Venn and Éric Depagne</i>	
Calibrating TP-AGB stellar models and chemical yields through resolved stellar populations in the Small Magellanic Cloud	269
<i>Giada Pastorelli, Paola Marigo, Léo Girardi and the STARKEY project team</i>	

Resolved and unresolved AGB populations

- Asymptotic Giant Branch Variables in Nearby Galaxies 275
Patricia A. Whitelock
- AGB population as probes of galaxy structure and evolution 283
Atefeh Javadi and Jacco Th. van Loon
- The role of AGB stars in the evolution of globular clusters 291
*Paolo Ventura, Franca D'Antona, Marcella Di Criscienzo,
 Flavia Dell'Agli and Marco Tailo*
- Characterisation of long-period variables in the Magellanic Clouds 301
*Michele Trabucchi, Peter R. Wood, Josefina Montalbán, Paola Marigo,
 Giada Pastorelli and Léo Girardi*
- The End: Witnessing the Death of Extreme Carbon Stars 305
G. C. Sloan, K. E. Kraemer, I. McDonald and A. A. Zijlstra
- Oxygen-rich Long Period Variables in the X-Shooter Spectral Library 309
*Ariane Lançon, Anaïs Gonneau, Scott C. Trager, Philippe Prugniel,
 Anke Arentsen, Yanping Chen, Matthijs Dries, Cécile Loup,
 Mariya Lyubenova, Reynier Peletier, Laure Telliez, Alexandre Vazdekis
 and the XSL Collaboration*
- What Young Massive Clusters in the Magellanic Clouds teach us about Old
 Galactic Globular Clusters? 314
*Francesca D'Antona, Paolo Ventura, Aaron Dotter, Sylvia Ekström and
 Marco Tailo*

Galaxy evolution, including the first AGB stars

- The Impact of AGB Stars on Galaxies 321
Martha L. Boyer
- On the origin of N in galaxies with galaxy evolution models 330
Fiorenzo Vincenzo and Chiaki Kobayashi
- A Masing BAaDE's Window 334
*Lorant O. Sjouwerman, Ylva M. Pihlström, Adam C. Trapp,
 Michael C. Stroh, Luis Henry Quiroga-Nuñez, Megan O. Lewis,
 R. Michael Rich, Mark R. Morris, Huib Jan van Langevelde,
 Mark J Claussen and the BAaDE collaboration*

Posters

- M1–92 revisited: the chemistry of a common envelope nebula? 343
*Javier Alcolea, Marcelino Agúndez, Valentín Bujarrabal, Arancha Castro
 Carrizo, Jean-François Desmurs, Carmen Sánchez-Contreras and
 Miguel Santander-García*
- The Evolutionary State of CEMP Stars 345
Johannes Andersen and Birgitta Nordström

RAMSES II Raman Search for Extragalactic Symbiotic Stars	347
<i>Rodolfo Angeloni, Denise R. Gonçalves, Ruben J. Diaz and the RAMSES II Team</i>	
Observational Properties of Miras in the KELT Survey	349
<i>R. A. Arnold, M. Virginia McSwain, Joshua Pepper, Keivan G. Stassun, and the KELT Collaboration</i>	
s-process abundances of Primary stars in the Sirius-like Systems: Constraints on pollution from AGB stars	351
<i>Y. Bharat Kumar, X-M. Kong, G. Zhao and J-K. Zhao</i>	
On the nature and mass loss of Bulge OH/IR stars	353
<i>Joris A.D.L. Blommaert, Martin A.T. Groenewegen, Kay Justtanont and L. Decin</i>	
Understanding jets in post-AGB close binaries	355
<i>Dylan Bollen, Devika Kamath, Hans Van Winckel and Orsola De Marco</i>	
To Be or Not to Be: EHB Stars and AGB Stars	357
<i>David A. Brown</i>	
The discovery of an asymmetric detached shell around the “fresh” carbon AGB star TX Psc	360
<i>M. Brunner, M. Mečina, M. Maercker, E. A. Dorfi, F. Kerschbaum, H. Olofsson and G. Rau</i>	
Imaging Red Supergiants with VLT/SPHERE/ZIMPOL	362
<i>E. Cannon, M. Montargès, L. Decin and A. de Koter</i>	
The Impact of Dust/Gas Ratios on Chromospheric Activity in Red Giant and Supergiant Stars	365
<i>Kenneth G. Carpenter and Gioia Rau</i>	
Metallic Line Doubling in the Spectra of the Variable Star R Scuti	368
<i>K. Chafouai, A. Benhida, F. Sefyani, A. Ghout, Z. Benkhaldoun, P. Mathias, D. Gillet and Y. El Jariri</i>	
Populations of accreting white dwarfs	371
<i>Hai-Liang Chen, Tyrone E. Woods, Lev Yungelson, Marat Gilfanov and Zhanwen Han</i>	
Using Gaia to measure the atmospheric dynamics in AGB stars	373
<i>Andrea Chiavassa, Bernd Freytag and Mathias Schultheis</i>	
A critical test to disentangle the role of overshooting and rotation in stars	375
<i>G. Costa, L. Girardi, A. Bressan, P. Marigo, Y. Chen, B. Kanniah, A. Lanza and T. S. Rodrigues</i>	
The role of shocks in the determination of empirical abundances for type-I PNe	377
<i>Roberto D. D. Costa and Paulo J. A. Lago</i>	
Unravelling the sulphur chemistry of AGB stars	379
<i>Taiïssa Danilovich</i>	

MAGRITTE: a new multidimensional accelerated general-purpose radiative transfer code	381
<i>Frederik De Ceuster, Jeremy Yates, Peter Boyle, Leen Decin and James Hetherington</i>	
Stacking analysis of HERITAGE data to statistically study far-IR dust emission from evolved stars	383
<i>Thavisha E. Dharmawardena, Francisca Kemper, Sundar Srinivasan, Sacha Hony, Olivia Jones and Peter Scicluna</i>	
Observations of the Ultraviolet-Bright Star Barnard 29 in the Globular Cluster M13 (NGC 6205)	385
<i>William V. Dixon, Pierre Chayer, I. N. Reid and Marcelo Miguel Miller Bertolami</i>	
A systematic survey of grain growth in discs around post-AGB binaries with PACS and SPIRE photometry	387
<i>K. Dsilva, H. Van Winckel and J. Kluska</i>	
The loss of large amplitude pulsations at the end of AGB evolution	389
<i>D. Engels, S. Etoka and E. Gérard</i>	
A DARWIN C-star model grid with new dust opacities	391
<i>Kjell Eriksson, Susanne Höfner and Bernhard Aringer</i>	
Binary interaction along the RGB: The Barium Star perspective	394
<i>A. Escorza, L. Siess, D. Karinkuzhi, H. M. J. Boffin, A. Jorissen and H. van Winckel</i>	
Ammonia in C-rich stars	396
<i>Bartosz Etmański, Mirosław R. Schmidt, Bosco H. K. Yung and Ryszard Szczerba</i>	
The Maser-emitting Structure and Time Variability of the SiS Lines $J = 14-13$ and $15-14$ in in IRC + 10216	398
<i>J. P. Fonfría, M. Fernández-López, J. R. Pardo, M. Agúndez, C. Sánchez Contreras, L. Vellilla-Prieto, J. Cernicharo, M. Santander-García, G. Quintana-Lacaci, A. Castro-Carrizo and S. Curiel</i>	
Central Stars of Planetary Nebulae in Galactic Open Clusters: Providing additional data for the White Dwarf Initial-to-Final-Mass Relation	400
<i>Vasiliki Fragkou, Quentin A. Parker, Albert Zijlstra, Richard Shaw and Foteini Lykou</i>	
On cylindrically symmetric solutions of polarized radiative transfer equation	402
<i>Juris Freimanis</i>	
GK Car and GZ Nor: Two low-luminous, depleted RV Tauri stars	404
<i>I. Gezer, H. Van Winckel, R. Manick and D. Kamath</i>	
Infrared light curves of dusty & metal-poor AGB stars	406
<i>Steven R. Goldman, Martha Boyer and the DUSTiNGS team</i>	
A step further on the physical, kinematic and excitation properties of PNe	409
<i>Denise Rocha Gonçalves and Stavros Akras</i>	

Mid-IR colors and surface brightness fluctuations as tracers of stellar mass-loss in the TP-AGB	411
<i>Rosa A. González-Lópezlira</i>	
<i>Kepler</i> K2: A Search for Very Red Stellar Objects	413
<i>E. Hartig, K. H. Hinkle and T. Lebzelter</i>	
MIKE High Resolution Spectroscopy of Raman-scattered O VI and C II Lines in the Symbiotic Nova RR Telescopii	416
<i>Jeong-Eun Heo, Hee-Won Lee, Rodolfo Angeloni, Tali Palma and Francesco Di Mille</i>	
The Structure of the Inner Circumstellar Shell in Miras	419
<i>Kenneth H. Hinkle and Thomas Lebzelter</i>	
Signs of rotating equatorial density enhancements around SRb pulsators	421
<i>W. Homan, L. Decin, A. Richards and P. Kervella</i>	
Variability in Post-AGB Stars: Pulsation in Proto-Planetary Nebulae	423
<i>Bruce Hrivnak, Gary Henson, Griet Van de Steene, Hans Van Winckel, Todd Hillwig and Matthew Bremer</i>	
Are the silicate crystallinities of oxygen-rich evolved stars related to their mass loss rates?	425
<i>Biwei Jiang, Jiaming Liu and Aigen Li</i>	
Binary evolution and double sequences of blue stragglers in globular clusters	427
<i>Dengkai Jiang, Xuefei Chen, Lifang Li and Zhanwen Han</i>	
Near-Infrared Stellar Populations in the metal-poor, Dwarf irregular Galaxies Sextans A and Leo A	429
<i>Olivia C. Jones, Matthew T. Maclay, Martha L. Boyer, Margaret Meixner and Iain McDonald</i>	
Spectroscopic binaries among AGB stars from HERMES/Mercator: the case of V Hya	431
<i>Alain Jorissen, Sophie Van Eck, Thibault Merle and Hans Van Winckel</i>	
KIC 5110739: A new Red Giant in NGC 6819	434
<i>Edward Jurua, Otto Trust and Felix Kampindi</i>	
ALMA spectrum of the extreme OH/IR star OH 26.5+0.6	436
<i>K. Justtanont, S. Muller, M. J. Barlow, D. Engels, D. A. García-Hernández, M. A. T. Groenewegen, M. Matsuura, H. Olofsson, D. Teyssier, I. Martí-Vidal, T. Khouri, M. Van de Sande, W. Homan, T. Danilovich, A. de Koter, L. Decin, L. B. F. M. Waters, R. Stancliffe, W. Vlemmings, P. Royer, F. Kerschbaum, C. Paladini, J. Blommaert and R. de Nutte</i>	
When binaries keep track of recent nucleosynthesis	438
<i>D. Karinkuzhi, S. Van Eck, A. Jorissen, S. Goriely, L. Siess, T. Merle, A. Escorza, M. Van der Swaelmen, H. M. J. Boffin, T. Masseron, S. Shetye and B. Plez</i>	
Tomography of the red supergiant star μ Cep	441
<i>K. Kravchenko, A. Chiavassa, S. Van Eck, A. Jorissen, T. Merle and B. Freytag</i>	

Chemical enrichment of galaxies as the result of organic synthesis in evolved stars	443
<i>Sun Kwok, SeyedAbdolreza Sadjadi and Yong Zhang</i>	
Late Thermal Pulse Models and the Rapid Evolution of V839 Ara	445
<i>Timothy M. Lawlor</i>	
Carbon and oxygen isotopes in AGB stars. From the cores of AGB stars to presolar dust	447
<i>Thomas Lebzelter, Kenneth Hinkle and Oscar Straniero</i>	
Stellar Wind Accretion and Raman O VI Spectroscopy of the Symbiotic Star AG Draconis	449
<i>Young-Min Lee, Jeong-Eun Heo, Hee-Won Lee, Ho-Gyu Lee, Rodolfo Angeloni, Francesco Di Mille and Tali Palma</i>	
S-process Elements in Binary Central Stars of Planetary Nebulae	452
<i>Lisa Löbbling and Henri Boffin</i>	
OH/IR stars versus YSOs in infrared photometric surveys	454
<i>Cécile Loup, Mark Allen, Ariane Lançon and Anaïs Oberto</i>	
Zooming into the complex dusty envelopes of C-rich AGB stars	456
<i>Foteini Lykou, Josef Hron and Daniela Klotz</i>	
Mass loss rates of Li-rich AGB/RGB stars	458
<i>Walter J. Maciel and Roberto D. D. Costa</i>	
Abundance Estimates in Carbon Star Envelopes	460
<i>S. Massalkhi, M. Agúndez and J. Cernicharo</i>	
Separation of gas and dust in the winds of AGB stars	462
<i>Lars Mattsson, Christer Sandin and Paolo Ventura</i>	
The onset of mass loss in AGB stars	464
<i>Iain McDonald</i>	
Dust properties in the circumstellar environment of carbon stars	466
<i>M. Mečina, B. Aringer, M. Brunner, F. Kerschbaum, M. A. T. Groenewegen and W. Nowotny</i>	
Rotating and magnetic stellar models of intermediate-mass stars up to the AGB	468
<i>Luiz T. S. Mendes, Natália R. Landin and Paolo Ventura</i>	
The common-envelope wind model for type Ia supernovae	470
<i>Xiangcun Meng and Philipp. Podsiadlowski</i>	
Long Period Variables in Local Group dwarf Irregular Galaxies	472
<i>John Menzies</i>	
Updates on the Ultraviolet Emission from Asymptotic Giant Branch Stars	474
<i>Rodolfo Montez Jr., Sofia Ramstedt, Joel H. Kastner and Wouter Vlemmings</i>	

Astrometric observation of the Galactic LPVs with VERA; Mira and OH/IR stars	476
<i>Akiharu Nakagawa, Tomoharu Kurayama, Gabor Orosz, Tomoaki Oyama, Takumi Nagayama and Toshihiro Omodaka</i>	
The dust production rate of carbon-rich stars in the Magellanic Clouds	478
<i>Ambra Nanni, Martin A. T. Groenewegen, Bernhard Aringer, Paola Marigo, Stefano Rubele and Alessandro Bressan</i>	
Near IR and visual polarimetry of the Planetary Nebula M2-9	480
<i>Silvana G. Navarro, Omar Serrano, Abraham Luna, Rangaswami Devaraj, Luis J. Corral, Julio Ramírez Vélez and David Hiriart</i>	
SMA Spectral Line Survey of the Proto-Planetary Nebula CRL 618	483
<i>Nimesh A. Patel, Carl Gottlieb, Ken Young, Tomasz Kaminski, Michael McCarthy, Karl Menten, Chin-Fei Lee and Harshal Gupta</i>	
SWAG: Distribution and Kinematics of an Obscured AGB Population toward the Galactic Center	485
<i>Jürgen Ott, David S. Meier, Adam Ginsburg, Farhad Yusef-Zadeh, Nico Krieger and Cornelia Jäschke</i>	
AGB stars of the Magellanic Clouds as seen within the $\Delta\alpha$ photometric system . . .	487
<i>Ernst Paunzen, Jan Janík, Petr Kurfürst, Jiří Liška, Martin Netopil, Marek Skarka and Miloslav Zejda</i>	
On the circumstellar effects on the Li and Ca abundances in massive Galactic O-rich AGB stars	489
<i>V. Pérez-Mesa, O. Zamora, D. A. García-Hernández, Y. Ossorio, T. Masseron, B. Plez, A. Manchado, A. I. Karakas and M. Lugaro</i>	
AGB star atmospheres modeling as feedback to stellar evolutionary and galaxy models	491
<i>Gioia Rau, M. Wittkowski, A. Chiavassa, K. Carpenter, K. Nielsen and V. S. Airapetian</i>	
Circumstellar molecular maser emission of AGB and post-AGB stars	493
<i>Georgij Rudnitskij, Nuriya Ashimbaeva, Pierre Colom, Evgeny Lekht, Mikhail Pashchenko and Alexander Tolmachev</i>	
High angular-resolution infrared imaging and spectra of the carbon-rich AGB star V Hya	495
<i>Raghvendra Sahai, Jayadev Rajagopal, Kenneth Hinkle, Richard Joyce and Mark Morris</i>	
Infrared Studies of the Variability and Mass Loss of Some of the Dustiest Asymptotic Giant Branch Stars in the Magellanic Clouds	498
<i>B. Sargent, S. Srinivasan, M. Boyer, M. Feast, P. Whitelock, M. Marengo, M. A. T. Groenewegen, M. Meixner, J. L. Hora and M. Otsuka</i>	
Observing the mass-loss of nearby red supergiants through high-contrast imaging	500
<i>Peter Scicluna, R. Siebenmorgen, J. A. D. L. Blommaert, F. Kemper, R. Wesson and S. Wolf</i>	

The Nearby Evolved Stars Survey: Project description and initial results	502
<i>Peter Scicluna, on behalf of the NESS team</i>	
Modelling gas and dust around carbon stars in the Large Magellanic Cloud	504
<i>Sundar Srinivasan, I.-K. Chen, P. Scicluna, J. Cami and F. Kemper</i>	
Modelling dust around Nearby Evolved Stars Survey (NESS) Targets	506
<i>Sundar Srinivasan, T. Dharmawardena, F. Kemper, P. Scicluna and The NESS Collaboration</i>	
Population of AGB stars in the outer Galaxy	508
<i>Ryszard Szczerba, Ilknur Gezer, Bosco H. K. Yung and Marta Sewiło</i>	
The role of asymptotic giant branch stars in the chemical evolution of the Galaxy	510
<i>G. Tautvaišienė, C. Viscasillas Vázquez, V. Bagdonas, R. Smiljanic, A. Drazdauskas, Š. Mikolaitis, R. Minkevičiūtė and E. Stonkutė</i>	
The star formation history of the M31 galaxy derived from Long-Period-Variable star counts	512
<i>Maryam Torki, Atefeh Javadi, Jacco Th. van Loon and Hossein Safari</i>	
Comprehensive Panchromatic Data Analyses and Photoionization Modeling of NGC 6781	514
<i>Toshiya Ueta, Masaaki Otsuka and the HerPlaNS consortium</i>	
Mass Loss History of Evolved Stars (MLHES) Excavated by AKARI	516
<i>Toshiya Ueta, Andrew J. Torres, Hideyuki Izumiura and Issei Yamamura</i>	
Herschel Planetary Nebula Survey Plus (HerPlaNS+)	518
<i>Toshiya Ueta, Isabel Aleman, Masaaki Otsuka, Katrina Exter and the HerPlaNS consortium</i>	
Morpho-Kinematics of the Circumstellar Environments around Post-AGB Stars	520
<i>Toshiya Ueta, Hideyuki Izumiura, Issei Yamamura and Masaaki Otsuka</i>	
Planetary Nebulae Detected in the AKARI Far-IR All-Sky Survey Maps	522
<i>Toshiya Ueta, Ryszard Szczerba, Andrew G. Fullard and Satoshi Takita</i>	
Dust Structure Around Asymptotic Giant Branch Stars	525
<i>Devendra Raj Upadhyay, Lochan Khanal, Priyanka Hamal and Binil Aryal</i>	
Looking for new water-fountain stars	527
<i>L. Uscanga, J. F. Gómez, B. H. K. Yung, H. Imai, J. R. Rizzo, O. Suárez, L. F. Miranda, M. A. Trinidad, G. Anglada and J. M. Torrelles</i>	
Does 3 rd dredge-up reduce AGB mass-loss?	529
<i>Stefan Uttenthaler, Iain McDonald, Klaus Bernhard, Sergio Cristallo and David Gobrecht</i>	
The chemistry in clumpy AGB outflows	531
<i>M. Van de Sande, J. O. Sundqvist, T. J. Millar, D. Keller and L. Decin</i>	

Radial velocity variability in post-AGB stars: V448 Lac	533
<i>G. C. Van de Steene, B. J. Hrivnak and H. Van Winckel</i>	
Circumstellar chemistry of Si-C bearing molecules in the C-rich AGB star IRC+10216	535
<i>L. Velilla-Prieto, J. Cernicharo, M. Agúndez, J. P. Fonfría, A. Castro-Carrizo, G. Quintana-Lacaci, N. Marcelino, M. C. McCarthy, C. A. Gottlieb, C. Sánchez Contreras, K. H. Young, N. A. Patel, C. Joblin and J. A. Martín-Gago</i>	
Measuring spatially resolved gas-to-dust ratios in AGB stars	538
<i>Sofia Wallström, T. Dharmawardena, B. Rodríguez Marquina, P. Scicluna, S. Srinivasan, F. Kemper and The NESS Collaboration</i>	
WD+AGB star systems as the progenitors of type Ia supernovae	540
<i>Bo Wang</i>	
Exploring dust mass and dust properties of nearby AGB stars	542
<i>J. Wiegert, M. A. T. Groenewegen and the STARLAB team</i>	
K-Type Supergiants in the Large Magellanic Cloud	544
<i>Robert F. Wing</i>	
The carbon star R Sculptoris sheds its skin	546
<i>Markus Wittkowski</i>	
TIG <i>vival</i> : High-resolution spectroscopic monitoring of LPV stars	548
<i>Uwe Wolter, Dieter Engels, Bernhard Aringer and Bernd Freytag</i>	
Author Index	551

Preface

Stars are the main components of galaxies, and the sites of the creation of most chemical elements in our universe. As such they are among the most important ingredients in our physical description of the Universe. Due to their high luminosity and production of heavy elements and cosmic dust, stars on the Asymptotic Giant Branch (AGB) play an important role in their capacity as both actors and probes. In addition, AGB stars are prime laboratories for studying complicated physics, such as hydro-dynamical instabilities, double-shell nuclear burning, and dynamical atmospheres where physical and chemical processes, active on different temporal and spatial scales, are at work simultaneously. Understanding these stars sheds light on different processes of great relevance to the understanding of stellar and galactic evolution in general.

Our IAU symposium follows in the tradition of great symposia like *Planetary Nebulae* (No. 155, Innsbruck, 1992), *The Carbon Star Phenomenon* (No. 177, Antalya, 1996), *Asymptotic Giant Branch Stars* (No. 191, Montpellier, 1998), and several other symposia related to variability research or the stellar content of galaxies which had AGB stars as important subtopics. In 2006, a new series of conferences under the main title *Why galaxies care about AGB stars* was initiated with the aim to bring two normally separated communities together, namely those studying the AGB proper and those interested in the evolution of galaxies. Already the first incarnation of the series held in Vienna, 2006 under the subtitle: *Their importance as actors and probes* saw a good acceptance by the community. It was followed by the 2010 conference *Shining examples and common inhabitants* and the 2014 one named *A closer look in space and time*.

The growing interest in these conferences triggered the formation of an international SOC comprising scientists covering a wide range of scientific backgrounds and working on all continents with the purpose of proposing an IAU symposium following this successful tradition for the IAU General Assembly to be held in Vienna in 2018. It should extend this interdisciplinary approach to an even wider community.

Following endorsement and sponsoring by IAU Commissions and Divisions and subsequent approval by the IAU Executive Committee in 2017, speakers were invited and the community at large informed. The overwhelming, positive response materialized into the impressive programme we now have.

It is a great pleasure to acknowledge the financial support of our sponsors, the active support of the members of the SOC and LOC in coping with the big challenges and realizing the numerous details always associated with such a symposium. Especially we would like to thank Verena Baumgartner for her invaluable work as editorial assistant for these proceedings.

It is our hope that these proceedings will provide a useful resource for experts as well as newcomers to the field.



Franz Kerschbaum, Hans Olofsson, and Martin Groenewegen, editors of these proceedings.

Editors

Franz Kerschbaum
University of Vienna, Austria

Martin Groenewegen
Royal Observatory of Belgium

Hans Olofsson
Chalmers University of Technology, Sweden

Editorial Assistant

Verena Baumgartner
University of Vienna, Austria

Organising Committee

Scientific Organising Committee

SOC Chairs

Hans Olofsson (SE)

SOC Co-Chairs

Franz Kerschbaum (AT)

Paola Marigo (IT)

SOC Members

Martha Boyer (US)

Martin Groenewegen (BE)

Susanne Höfner (SE)

Atefeh Javadi (IR)

Ciska Kemper (TW)

Maria Lugaro (HU)

Claudia Maraston (UK)

Shazrene Mohamed (ZA)

Keiichi Ohnaka (CL)

Angela Speck (US)

Hans Van Winckel (BE)

Peter Wood (AU)

Albert Zijlstra (UK)

Acknowledgements

The symposium is sponsored and supported by the IAU Division G (Stars and Stellar Physics), Division H (Interstellar Matter and Local Universe), Division J (Galaxies and Cosmology) and by the IAU Commission G3 (Stellar Evolution).

*Funding by the
International Astronomical Union,
University of Vienna,*

and

*Robert Wing Support Fund at Ohio State University,
are gratefully acknowledged.*

CONFERENCE PHOTOGRAPH



Address by the Scientific Organizing Committee

Dear colleagues,

also from us a warm welcome to this IAU Symposium No. 343. We are delighted to see you all here in the beautiful city of Vienna during the 30th General Assembly of the International Astronomical Union. Vienna has already a long tradition in stellar astrophysics and hosted several successful symposia and conferences in the field and especially the very topic of our meeting, namely Asymptotic Giant Branch (AGB) stars. Many of us remember the AGB meetings in 2006, 2010 and 2014!

Symposium 343 builds a bridge between research on AGB stars themselves and its application to the modelling of stellar populations and the chemical evolution of galaxies and the Universe as a whole. Current developments and challenges seen from both domains are discussed to reach an understanding of possibilities, limitations, and needs in both areas, and hence to improve our understanding of the role of AGB stars in the context of galaxies over cosmic time. Despite the fact that major efforts have been carried out on both observational and theoretical grounds in recent years, our knowledge of AGB stars is still deficient due to uncertainties related to mass loss, convection, mixing, dredge-up efficiencies, and the role of binary interaction processes. These uncertainties in our understanding of AGB stars directly propagate into the field of extragalactic astronomy, where they affect critically the interpretation of galaxy properties, e.g. stellar masses, ages, and the chemical evolution. The complexity of the objects also makes it difficult for individual researchers to master all aspects of their role as galaxy inhabitants, a problem that the proposed symposium aims to illuminate and overcome.

New and upcoming major observational facilities like ALMA, Gaia, JWST, LSST, SKA, and the ELTs will provide exciting opportunities to tackle these challenges from the observational side, stretching from the detailed study of individual objects that are spatially resolved to AGB populations in distant galaxies. At the same time, thanks to high-performance computing, 3D modelling of stellar interiors is starting to become feasible, propelling us toward a better understanding of the uncertainties related to the physics of AGB stars. This makes it particularly important to outline a strategic programme of combined theoretical and observational activities at this time.

In order to cover the large breadth of the symposium it is divided into nine themes, each one covered by invited talks, oral contributions, and posters. The themes are:

- Stellar structure and evolution to, on, and past the AGB
- Nucleosynthesis, mixing and rotation
- Pulsation, dynamical atmospheres and dust formation
- Circumstellar envelopes of AGB stars and their progeny, planetary nebulae
- Binarity, planets and disks
- AGB stars in the cosmic matter cycle
- Resolved and unresolved AGB populations in stellar systems
- Galaxy evolution, including the first AGB stars.

There will also be two plenary talks, one on nucleosynthesis and one on new and future observational perspectives. These will be centred on AGB stars, but also give a broader perspective of interest for research on stars and galaxies in general.

We wish you all a very constructive and pleasant four working days here.

*Hans Olofsson, Franz Kerschbaum, and Paola Marigo, co-chairs SOC
Vienna, August 20, 2018*

In memoriam Thomas Posch (1974–2019)



The Department of Astrophysics of the University of Vienna and the Scientific Organizing Committee of IAU S343 mourns the loss of Thomas Posch, who passed away on the 4th of April 2019 after a long and difficult period of illness. Last year Thomas contributed in various forms at the 30th General Assembly of the International Union and until as recently as January this year he was still supervising students and holding tours of his home institute.

Thomas Posch was born on the 20th of February 1974 in Graz, Austria to Hildegard and Siegfried Posch. Between 1980 and 1984 he attended the primary school Volksschule Graben in the third district of Graz. He continued his education at the Bundesgymnasium Carnerigasse, where he chose to matriculate in the natural sciences branch of study. He graduated from the Gymnasium on the 1st of July 1992 with a high distinction. During his time at school he was the winner of the “Astronomy in Space” essay competition held by the European Space Agency (ESA). The following trips to the ESA/ESTEC institute in Noordwijk, the Netherlands and the Headquarters of the European Southern Observatory in Garching, Germany left a lasting impression on him. The 1990 Solar eclipse, which he viewed from Jansuu in southern Finland, also helped encourage his enthusiasm for astronomy and space research. It should also be mentioned that Thomas received the Bronze Medal at the 1991 Austrian Physics Olympics.

Thomas began his university education in 1992 in Graz by starting degrees in physics and astronomy. He spent an ERASMUS year at the Free University in Berlin, where he studied Physics and Philosophy. Upon returning to Austria, he moved to the University of Vienna, where he wrote his diploma thesis on the topic of “Circumstellar dust and the infrared-spectra of pulsating red giants” (“Zirkumstellarer Staub und die Infrarot-Spektren pulsierender Roter Riesen”) under the supervision of Prof. Hans Michael Maitzen. He celebrated his graduation on the 9th of February 1999. Alongside taking part in many summer schools, Thomas visited the laboratory at the Department of Astrophysics at the University of Jena, Germany. This visit would prove to be of great importance for his future work in astrominerology.

His second great academic love, philosophy, and in particular the philosophy of nature, was the central topic of his next university endeavor between 1999 and 2002. Under the supervision of Prof. Friedrich Grimmlinger (Vienna) and Prof. Renate Wahsner (Berlin) Thomas delivered his dissertation titled “The Mechanics of Heat in the Jena System Design by Hegel from 1805/06” (“Die Mechanik der Wärme in Hegels Jenaer Systementwurf von 1805/06”) which commented on the background to the development of the theories of thermodynamics between 1620 and 1840.

Thanks to a competitive research scholarship from the Austrian Academy of Science Thomas was able to submit his doctoral dissertation titled “Astrominerology of Circumstellar Oxide Dust” in 2005. His supervisors for this project were Prof. Franz Kerschbaum (Vienna) und Prof. Thomas Henning (Heidelberg). The scientific core of the dissertation was the comparison of the signatures of cosmic dust, as observed by the ISO space telescope, with terrestrial analogues. The results of which were published in several international journals. His work has inspired several students and has fully established the field of astrominerology in Vienna.

As part of his military service in 2005, Thomas Posch conducted the first systematic study of the night sky brightness in Austria. This was an important base for his future work towards the preservation of the night sky.

After having worked as a guest scientist in Jena and after receiving a scholarship from the Max-Planck-Society, Thomas took up a position as Staff Scientist at the Department of Astronomy (now Astrophysics) at the University of Vienna in April 2006, almost exactly 13 years ago. Alongside his scientific endeavors, he also took on various responsibilities regarding the institute's library and historically important archives, as well as being engaged with public outreach activities. Of these his most noteworthy contributions include the expansion of the collection related to Maximilian Hell ("Schausammlung Maximilian Hell"), the screening and analysis of historical relevant archive material, and the supervision and coordination of large events such as the International Year of Astronomy 2009.

In 2011 years of fruitful astronomical research culminated in the comprehensive habilitation dissertation titled "Studies in Astromineralogy and Stellar Mass Loss", which allowed Thomas to teach at the level of docent. He distinguished himself both through his teaching and through his supervision of students. He brought together knowledge from many fields of research ranging from star formation and evolution, mineralogy, life, as well as historical topics and didactic methods in the natural sciences. A natural extension to his university courses were his vast, comprehensive, and popular public lectures, which made him into a well-known public educator both within and outside Austria. This was surely helped by his many contributions to radio and television programmes.

His national and international reputation led to a series of important roles in professional societies, as well as honors and accolades. Several positions worth mentioning include: chairman of the advisory board for "transdisciplinary science" at the Guardini foundation (since 2013), chairman of the working group for historical astronomy of the Astronomical Society (since 2014), contributing member of the ÖNORM committee on Light-Emission (between 2008 and 2012). In 2014 Thomas Posch also received the Galileo Award from the International Dark Sky Association.

During the last three years, even as the progressing illness curtailed his abilities, Thomas remained faithful to all areas of his work. He published papers, held lectures, taught, organized, and coordinated until the very end. The General Assembly of the International Astronomical Union held in the summer of 2018 in Vienna, with its multifaceted and diverse conference formats, was the last major event where Thomas played a leading role. Here he also chaired the annual meeting of the working group for the history of astronomy. As late as January 2019 Thomas was still supervising students and holding lectures. He passed away on the 4th of April 2019.

To honour the work of Thomas Posch the International Astronomical Union decided to name the main belt asteroid 2008 TP9 (328432) Thomasposch.

The following paragraphs are devoted to the major achievements from each of Thomas Posch's fields of research:

In the realms of astrophysics Thomas Posch concentrated mainly on astromineralogy. His interest in explaining infrared emission bands from semi-periodic variable red giant stars as observed with the ISO satellite began during his time as a university student. Such bands are produced by mineral dust particles, primarily refractory oxides and silicates, condensing in stellar outflows. By working with Johann Dorschner and Thomas Henning at the Jena astrophysical laboratory Thomas was able to compare these observations with

data from laboratory measurements of analogous terrestrial material, thereby explaining the nature of cosmic dust. Furthermore his collaboration with Johann Dorschner, Dirk Fabian, Harald Mutschke, Cornelia Jäger and Gabriele Born and their work on Aluminium oxides (Corundum, Spinel, Hibonite), Iron oxides, and Titanium oxides led to several important publications. In particular, the identifications of aluminium oxides with the stellar 13 μm band and of magnesium/iron oxides with the 19.5 μm band will remain related to his name for all time.

A related and also very important topic in Thomas Posch's work was the absorptivity of minerals in the wavelength range of stellar radiation. Again in the laboratory in Jena, Thomas investigated the influence which doping ions like Chromium and Iron had on the absorption spectrum of spinel. He was the first to calculate, using laboratory data, their temperature in the radiation field of a star. Together with Simon Zeidler he wrote a highly cited paper which also included absorption spectra of titanium oxides and silicates. Thomas demonstrated the need for, and the importance of, dust observations during the preparation of the far-infrared PACS spectrograph onboard the Herschel-Mission. Afterwards he provided comparative datasets for dust spectra in the corresponding spectral range. This included measurements on carbonates for temperatures down to 10 K in the Jena laboratory, and a spectroscopic study of hydrous silicates, which can provide an important hint to liquid water in planetary systems (with H. Mutschke). During the last years, he published together with S. Zeidler temperature-dependent optical constants of oxides and silicates, ultimately putting the assignment of aluminium oxide to the 13 μm band on solid grounds.

From early on Thomas Posch was not only interested in the natural sciences, but rather also in the philosophical and epistemological questions connected to science. Quite often he would begin by using the historical approach. An example of this concerns the history of the Vienna institute during the Third Reich, which was then led by Bruno Thüring. Thüring was a long standing critic of Einstein and confidant of Wilhelm Führer. Führer, who was originally an astronomer, was Obersturmführer of the Waffen-SS and became a leading bureaucrat in the ministry of science of the Third Reich. Based on their preserved correspondence and published records, Thomas was able to build up a detailed picture of the times and also validate Thürings misuse of Hugo Dinglers philosophy.

The rare book collection of the University Observatory in Vienna dates back to the time of Peurbach and Regiomontanus. Thomas Posch re-examined key works in this collection with an emphasis towards connections to Austria (e.g. by Kepler) and to astronomical phenomena. With these insights he composed literary works, and even theatrical pieces. His dramolett: "Kepler, Galilei and the Telescope" appropriately presented during the International Year of Astronomy 2009, told the story of the academic battle in the 17th century regarding the new emerging world view, the role that observations played, and the vanity of many of the central figures. Furthermore, his edition of Littrow's text detailing the history of astronomy ("Littrows Geschichte der Astronomie", together with Günter Bräuhöfer and Karin Lackner, 2016) and the texts about Maximilian Hell's trip to Nordland based on excerpts from his on the diaries at the institute, would not have been possible without his extensive work with the archives.

Thomas Posch's research in philosophy also covered a wide range of topics. His life-long interest in Hegel began during the time he wrote his dissertation under Friedrich Grimmlinger (Wien) and Renate Wahsner (Berlin). As part of the Society of System Philosophy (Gesellschaft für Systemphilosophie), Thomas was able to fruitfully introduce Hegel's thoughts into modern day philosophical and scientific discourse. His goal was to consistently achieve the problematization of the reductionist point of view. By using

this perspective he was able to foster the conversation between the natural sciences and theology. This was manifest in his contributions to present-day debates, in the already mentioned historical studies, and especially in his Monograph about Johannes Kepler (“Johannes Kepler. Die Entdeckung der Weltharmonie”, WBG, 2017). Furthermore, he never shied away from questioning his supremely personal connection to faith and spirituality, especially given his occupation as a scientist. Given his background it is worth mentioning his well-grounded and thorough criticism of astrology, which he delivered through essays and lectures. Throughout his whole life it was important to Thomas to clearly separate science from pseudoscience and esotericism.

During the 1997 IAU General assembly in Kyoto, Japan, the problem of the rapid loss of dark night skies due to artificial light sources was raised. This motivated Franz Kerschbaum and soon thereafter also Thomas Posch to systematically quantify, and concurrently raise awareness of this ever growing problem. Simple and generally available measurement techniques needed to be developed. During Thomas’s military service, he conducted the first study of the night sky brightness in Austria. Since then Thomas has accompanied many projects to modernize communal lighting as consultant. His edited-book “Das Ende der Nacht. Die globale Lichtverschmutzung und ihre Folgen” (“The End of Night. Global light pollution and its consequences”) was released in 2009 and is currently in its second edition. It is seen as standard literature on the subject in German speaking countries and beyond. Especially in the last years of his life, one of Thomas’ greatest concerns was to spread the message of the importance of preserving a naturally dark sky to both the general population and the relevant authorities. He was a consultant during the construction of a light-measurement-network in Upper Austria between 2014 and 2016. He was also one of the authors of the “Austrian guide to outdoor lighting” (“Österreichischer Leitfaden für Außenbeleuchtung”), which was signed by many provincial environment councilors. The data and results collected from the network were able to show which areas in the state of Upper Austria could still be classed as “Dark Sky Sites”. Such places are eligible for an official certification as such. Through his role as a co-organizer of the Upper Austrian environment congress 2018 in Linz, Thomas was able to present this project to the public. It was enthusiastically received. Such protected area will serve as a role model for other regions in Austria. The implementation of such areas as well as passing on his knowledge to his doctoral student, Stefan Wallner, were top priorities for him until the very end. His work and the way he went about it will without a doubt be recognized well into the future.

Thomas’s talent and desire to share the fascinating field of astronomy with the general public was already apparent during his time as a student. This was evident not only in his series of published popular scientific works, but also in his engagement with the public outreach activities at the university observatory in Vienna. An example of this engagement was the star counting initiative “How many stars can we still see”, organized together with the Kuffner Observatory Association as part of “Science Week 2001”. This initiative was the first Austrian-wide attempt to quantitatively determine the brightness of the night sky. His wide and varied knowledge and range of interests, as well as his welcoming and calm personality, meant that Thomas Posch was predestined for working with the wider public. A role which he gladly took on in 2006 as part of his position as staff scientist. Answering questions, contributing to popular science magazines and media outlets, reporting on the newest scientific results and insights (e.g. the yearly astronomical review on science.orf.at) were all part of Thomas’s everyday activities.

One activity which Thomas Posch took on with great enthusiasm and competence, were the tours of the institute, and especially those to the large refractor telescope. During

his time at the institute he gave more than 700 tours to guests of all ages and from all walks of life, from Austria and abroad. Given his broad knowledge of astronomy and astrophysics, as well as history and philosophy, these tours were a very special experience. Furthermore his excellent knowledge of foreign languages meant that he was able to hold tours not only in German, but in English, French, and Italian. His tours were always well received.

Naturally, Thomas also always played an important role in the organization of larger events, such as the “long night of research” (“Lange Nacht der Forschung”) or the Children’s University (Kinderuni). He also often took on the role of main organizer, e.g. for the Year of Astronomy 2009. His last great challenge was most certainly the 30th General Assembly of the IAU in Vienna in 2018, where he took on a series of official roles. Most notably those of the media spokesperson, and as a member of the editorial team for the daily conference newsletter. He was able to pass his enthusiasm, enjoyment, and wealth of experience in, and for, public outreach on to his students in many different ways, as well as always maintaining an emphasis on quality. A late example of this was his very active involvement with the course associated with the institute’s mobile planetarium. Thomas Posch continued to maintain close contact to, and valued the contributions of, amateur astronomers as their contributions to public outreach was, and still is, invaluable. He also never stopped enjoying looking through his own not-so-small telescope.

Thomas’s works as an author should also not be forgotten. His various pieces of short prose and somewhat more strongly condensed lyrical (if rhymeless) verses accompanied him throughout his life. The first collection of these works appeared in the Viennese “Edition Doppelpunkt” in 2001 with the title “Miniaturen. Ein bißchen Literatur” (“Miniatures - A little bit of Literature”). In the meantime he has written enough new texts that a second volume could be filled. In his pieces of Prose, Thomas used short stories to critically, yet amusingly, illuminate typical behaviours of modern-day humans. His lyrical verses described his personal, and not seldomly painful experiences in simple, yet deep and meaningful sentences. The literary styles in both verse and prose which he found are quite clearly his own creation, and very much worthy of attention and recognition.

An obituary by Franz Kerschbaum, with contributions from Josef Hron, Cornelia Jäger, Harald Mutschke, Johann Schelkshorn, Wilhelm Schwabe and Stefan Wallner. Translated into English by Kieran Leschinski.

Vienna, April 2019