

Contents

Preface	xi
<i>Claudio Mendoza, Sylvaine Turck-Chièze, and James Colgan</i>	
Participants	xiii
Conference Photograph	
	xvii

Part I. Stellar Opacities and the Solar Abundance Problem

Stellar Atomic Opacities	3
<i>Sylvaine Turck-Chièze</i>	
Helioseismic Tests of Stellar Equations of State and Opacities	13
<i>Sarbani Basu</i>	
Equations of State for Opacity Calculations	23
<i>D. P. Kilcrease, J. Colgan, P. Hakel, C. J. Fontes, and M. E. Sherrill</i>	
The Dark Side of the Sun	29
<i>Regner Trampedach</i>	

Part II. Computation and Measurement of Atomic Opacities

Detailed Opacity Calculations for Stellar Models	35
<i>Jean-Christophe Pain, Franck Gilleron, and Maxime Comet</i>	
Including All the Lines: Data Releases for Spectra and Opacities through 2017	47
<i>Robert L. Kurucz</i>	
New Los Alamos Opacities	55
<i>J. Colgan, D. P. Kilcrease, N. H. Magee, M. E. Sherrill, C. J. Fontes, and P. Hakel</i>	
STAR – a New STA Code for the Calculation of Solar Opacities	63
<i>Menahem Krief and Doron Gazit</i>	
A Quantitative Comparison of Opacities Calculated Using the Distorted-Wave and R-Matrix Methods	69
<i>F. Delahaye, N. R. Badnell, C. P. Ballance, P. Palmeri, S. Preval, P. Quinet, C. Ramsbottom, R. T. Smyth, M. Turkington, and C. J. Zeippen</i>	
Recalculation of Astrophysical Opacities: Overview, Methodology, and Atomic Calculations	79
<i>Anil K. Pradhan and Sultana N. Nahar</i>	

Converged <i>R</i> -Matrix Calculations of the Photoionization of Fe xvii in Astrophysical Plasmas: from Convergence to Completeness	89
<i>L. Zhao, W. Eissner, S. N. Nahar, and A. K. Pradhan</i>	
The IRON Project: Photoionization of Fe Ions	93
<i>Sultana N. Nahar</i>	
Progress on a Double Ablation Front Scheme for Iron Spectral Opacity Measurements in Solar Conditions	104
<i>A. Colaitis, J.-E. Ducret, S. Turck-Chièze, M. Le Pennec, L. Jacquet, and C. Blancard</i>	
Update on the Iron Opacity Experiments on the NIF	115
<i>T. S. Perry, R. F. Heeter, Y. P. Opachich, J. A. King, E. S. Dodd, B. G. DeVolder, M. E. Sherrill, B. G. Wilson, C. A. Iglesias, J. L. Kline, K. A. Flippo, T. Cardenas, J. A. Emig, T. N. Archuleta, E. J. Huffman, M. F. Ahmed, M. B. Schneider, D. A. Liedahl, T. J. Urbatsch, J. E. Bailey, and G. A. Rochau</i>	

Part III. Computation and Measurement of Molecular Opacities

An Overview of Molecular Opacities	125
<i>Peter Bernath</i>	
Molecular Line Lists and Absorption Cross Sections Based on Laboratory Measurements	132
<i>Peter Bernath</i>	
The ExoMol Project: Molecular Opacity Calculations at University College London	137
<i>Jonathan Tennyson</i>	
The Los Alamos National Laboratory Molecular Opacity Project and the Photodissociation Isotopic Effects of H ₂ ⁺ and D ₂ ⁺	145
<i>Mark C. Zammit, Jeremy S. Savage, James Colgan, Dmitry V. Fursa, Igor Bray, Jeffery Leiding, Cristiano Nisoli, Christopher J. Fontes, David P. Kilcrease, Peter Hakel, and Eddy Timmermans</i>	
Accurate and Consistent Prediction of Molecular IR Line Lists Based on Ab Initio Theory and High-Resolution Experimental Data	155
<i>Xinchuan Huang, David W. Schwenke, and Timothy J. Lee</i>	

Part IV. Stellar Atomic Diffusion

On the Importance of Atomic Data and Opacities in Evaluating the Effects of Atomic Diffusion in Stars	169
<i>Georges Alecian</i>	
Opacity Enhancement Due to Diffusion-Induced Element Accumulation inside B-Type Stars	176
<i>A. Hui-Bon-Hoa, S. Vauclair, and M. Deal</i>	

Hydrodynamical Instabilities Induced by Atomic Diffusion in F and A Stars	181
<i>M. Deal, O. Richard, and S. Vauclair</i>	

Part V. Stellar Models

The Role of Opacities in Stellar Pulsation	189
<i>S. M. Kanbur, M. Marconi, A. Bhardwaj, R. Kundu, and H. P. Singh</i>	
Testing Opacities Using the SED Variability of Chemically Peculiar Stars	195
<i>J. Krtička, L. Huang, T. Lüftinger, Z. Mikulášek, E. Niemczura, M. Prvák, J. Silvester, G. Wade, and J. Zverko</i>	
METUJE Global Hot Star Wind Models	201
<i>J. Krtička and J. Kubát</i>	
Rayleigh Scattering as an Opacity Source in Stellar Atmospheres	207
<i>Jakub Fišák, Jiří Kubát, and Jiří Krtička</i>	
The Bedisk and Beray Circumstellar Disk Codes	213
<i>T. A. A. Sigut</i>	

Part VI. Brown Dwarfs, Exoplanets, and Protoplanetary Disks

Opacities from Molecules and Aerosols in Exoplanet and Brown Dwarf Atmospheres	221
<i>Caroline V. Morley</i>	
The Role of Opacities in Calculating the Structure and Evolution of Protoplanetary Disks	231
<i>Nuria Calvet</i>	
ATMOS: Towards Resolving Ambiguities in the Spectroscopic Detection of Life	241
<i>Clara Sousa-Silva, Janusz J. Petkowski, and Sara Seager</i>	
Monte Carlo Simulations of Biophysical Factors for Viability of Life in Exoplanetary Atmospheres	249
<i>Maximillian S. Westphal and Anil K. Pradhan</i>	

Part VII. Astrophysical Processes and Atomic Data

The Belgian Repository of Fundamental Atomic Data and Stellar Spectra: Atomic Line Data Validation	255
<i>A. Lobel, P. Royer, C. Martayan, M. Laverick, T. Merle, P. A. M. van Hoof, M. Van der Swaelmen, M. David, H. Hensberge, and E. Thienpont</i>	
The Belgian Repository of Fundamental Atomic Data and Stellar Spectra: an Insight into Systematic Line Selection	263
<i>M. Laverick, A. Lobel, P. Royer, C. Martayan, T. Merle, P. A. M. van Hoof, M. Van der Swaelmen, M. David, H. Hensberge, and E. Thienpont</i>	

Dielectronic Recombination Calculations for Si-like Ions and the S ²⁺ Orion Nebula Abundance Conundrum	269
<i>Jagjit Kaur and T. W. Gorczyca</i>	
X-Ray Absorption by Interstellar Atomic Gases near the K Edges of C, O, Ne, Mg, and Si and the L Edge of Fe	275
<i>M. F. Hasoglu and T. W. Gorczyca</i>	
The Problem of the High Iron Abundance in Accretion Disks around Black Holes	282
<i>J. A. García, T. R. Kallman, M. Bautista, C. Mendoza, J. Deprince, P. Palmeri, and P. Quinet</i>	
Plasma-Environment Effects on the Atomic Structure and K Lines of He- and Li-like Oxygen Ions	289
<i>J. Deprince, P. Palmeri, P. Quinet, S. Fritzsche, M. Bautista, C. Mendoza, T. R. Kallman, and J. A. García</i>	
On the Light-Curve Anomalies of Radio Pulsars	295
<i>H. L. Hakobyan, A. A. Philippov, V. S. Beskin, A. K. Galishnikova, E. M. Novoselov, and M. M. Rashkovetskyi</i>	

Part VIII. Epilogue

Current State of Astrophysical Opacities: a White Paper	301
<i>A. E. Lynas-Gray, S. Basu, M. A. Bautista, J. Colgan, C. Mendoza, J. Tennyson, R. Trampedach, and S. Turck-Chièze</i>	
A Modelers' Opacity Wish List	319
<i>Regner Trampedach</i>	
<i>Author Index</i>	323