

Contents

Abstract	i
Preface	iii
List of Publications	v
1. Introduction	1
1.1. X-ray Spectroscopy	3
1.1.1. X-ray Absorption Spectroscopy	5
1.1.2. X-ray Emission Spectroscopy	5
1.1.3. Resonant Inelastic X-ray Scattering	5
2. Instrumentation	9
2.1. Experimental Setup for High Resolution X-ray Spectroscopy of Solids and Liquid Samples	9
2.2. A New Compact Cpectrometer for Resonant Inelastic X-ray Scatter- ing Studies at PETRA III	19
2.3. An End Station for Resonant Inelastic X-ray Scattering Studies of Solid and Liquid Samples	27
3. Application	41
3.1. Probing the Hofmeister Effect with Ultrafast Core-Hole-Spectroscopy	41
3.2. Ionic Solution Probed by Resonant Inelastic X-ray Scattering	49
3.3. Cationic and Anionic Impact on the Electronic Structure of Liquid Water	65
3.4. Limited Impact of Ions on the Electronic Strcuture of Water	85
3.5. Probing the <i>Trans</i> - and <i>Cis</i> - Isomerization of Azobenzene with RIXS	103
4. Time-Resolved Studies	115
4.1. Time-resolved RIXS at P04	115
4.2. Time-resolved RIXS at FLASH	117
5. Discussion and Outlook	119
5.1. Instrumentation	119
5.2. Aqueous Solutions	122
5.3. Isomerization	125
5.4. Time-resolved RIXS	127

A. Supporting Information	129
A.1. Cationic and Anionic Impact on the Electronic Structure of Liquid Water	129
A.2. Probing the <i>Trans</i> - and <i>Cis</i> - Isomerization of Azobenzene with RIXS	137
Bibliography	141
Acknowledgments	153