

## Mössbauer Spectroscopy – A Powerful Tool in Molecular Magnetism

Philipp Gütlich

*Institut für Anorganische Chemie und Analytische Chemie,  
Johannes Gutenberg-Universität Mainz,  
Staudingerweg 9, D-55099 Mainz, Germany  
e-mail: [guetlich@uni-mainz.de](mailto:guetlich@uni-mainz.de)  
<http://ak-guetlich.chemie.uni-mainz.de>*

Molecular magnetism with all its fascinating facets like spin crossover, intramolecular magnetic interactions, valence tautomerism, mixed valency has gained increasing interest in recent years among chemists and physicists due to their potential towards applications in devices and sensors. Particularly iron(II) coordination compounds exhibiting thermal, optical and pressured-induced spin state switching properties have been subject to extensive studies. Among the various physical techniques that are commonly employed to investigate such coordination compounds, like magnetic susceptibility measurements, optical and vibrational spectroscopy, X-ray and neutron diffraction techniques, thermodynamic analysis, Mössbauer spectroscopy has developed to an extremely powerful tool in following the phase transitions initiated by external perturbations like variation of temperature, light irradiation or application of pressure. The hyperfine interactions that can be extracted from a Mössbauer spectrum yields information on electronic and molecular structure, valence state and magnetic properties. This will be demonstrated on selected examples exhibiting

- thermal spin crossover in iron coordination compounds,
- light-induced creation of long-lived metastable spin states (LIESST effect),
- spin crossover under applied pressure,
- interplay of spin crossover and antiferromagnetic coupling in dinuclear iron complexes,
- mixed-valency, transition between “trapped” and “delocalized” states,
- ferromagnetic coupling in large-spin clusters,
- electron transfer, magnetic transition and photomagnetism in Prussian Blue analogue systems.

Suggested reading may be found in:

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- [3] P. Gütlich, Y. Garcia, H. Spiering, in: “Magnetism: Molecules to Materials IV“, J.S. Miller, M. Drillon (eds.), Wiley-VCH, Weinheim/Germany, 2003.
- [4] P. Gütlich, H.A. Goodwin (eds.), “Spin Crossover in Transition Metal Compounds”, *Topics in Current Chemistry*, Volumes 233, 234, 235, Springer, Heidelberg, Berlin, 2004.
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- [7] P. Gütlich, A. B. Gaspar, Y. Garcia, V. Ksenofontov, *Comptes Rendus Chimie* 10 (2007) 21.