

**M.Sc Inorganic Chemistry
(Special-III) Elective Paper-1
Semester-IV**



**Course Title: Spectral Techniques in Inorganic
Chemistry**

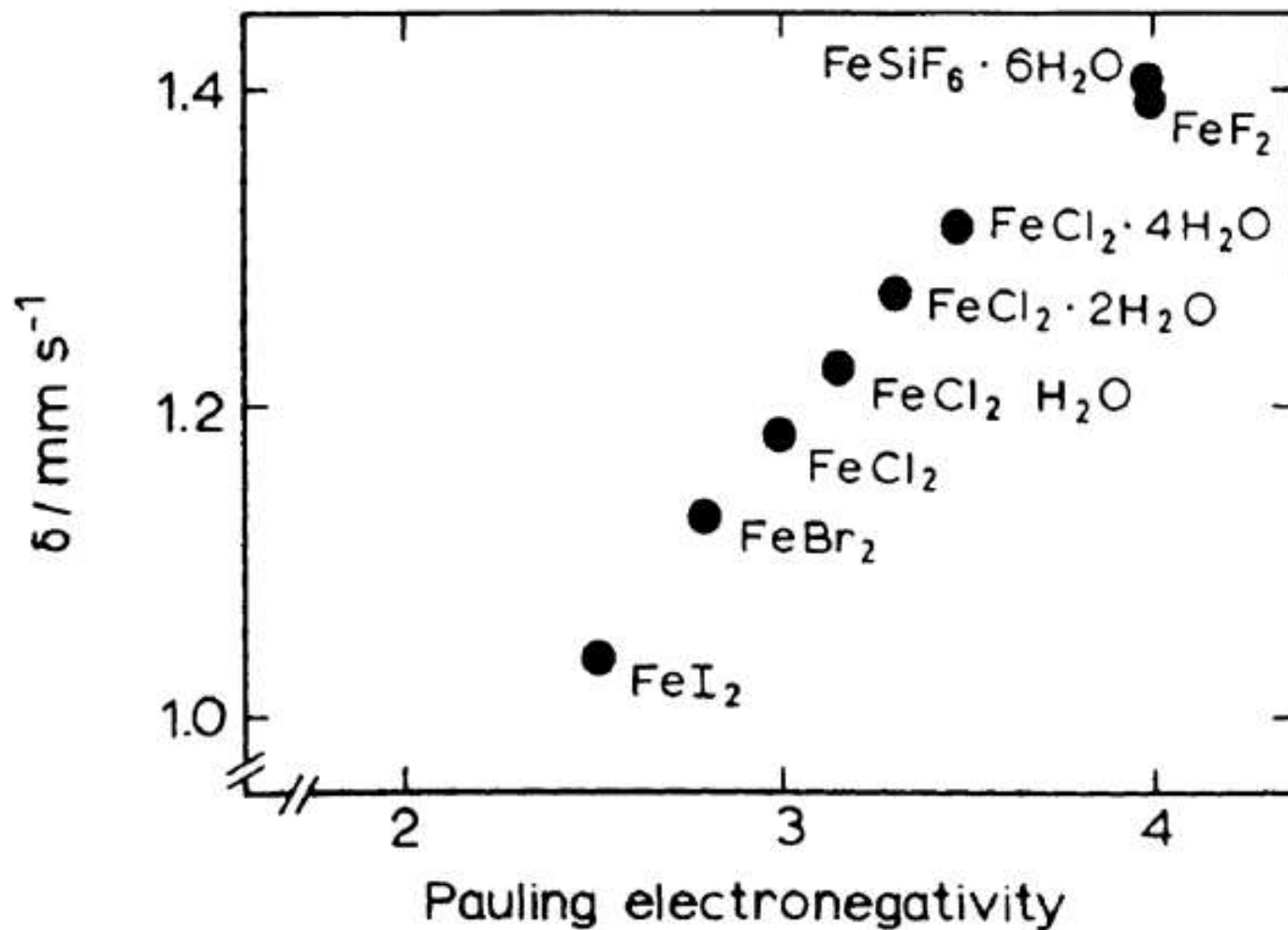
Paper Code: 4101-A

Dr. Saurabh Kumar

Inorganic Group I and II

Mössbauer Spectroscopy

Effect of ligand electronegativity



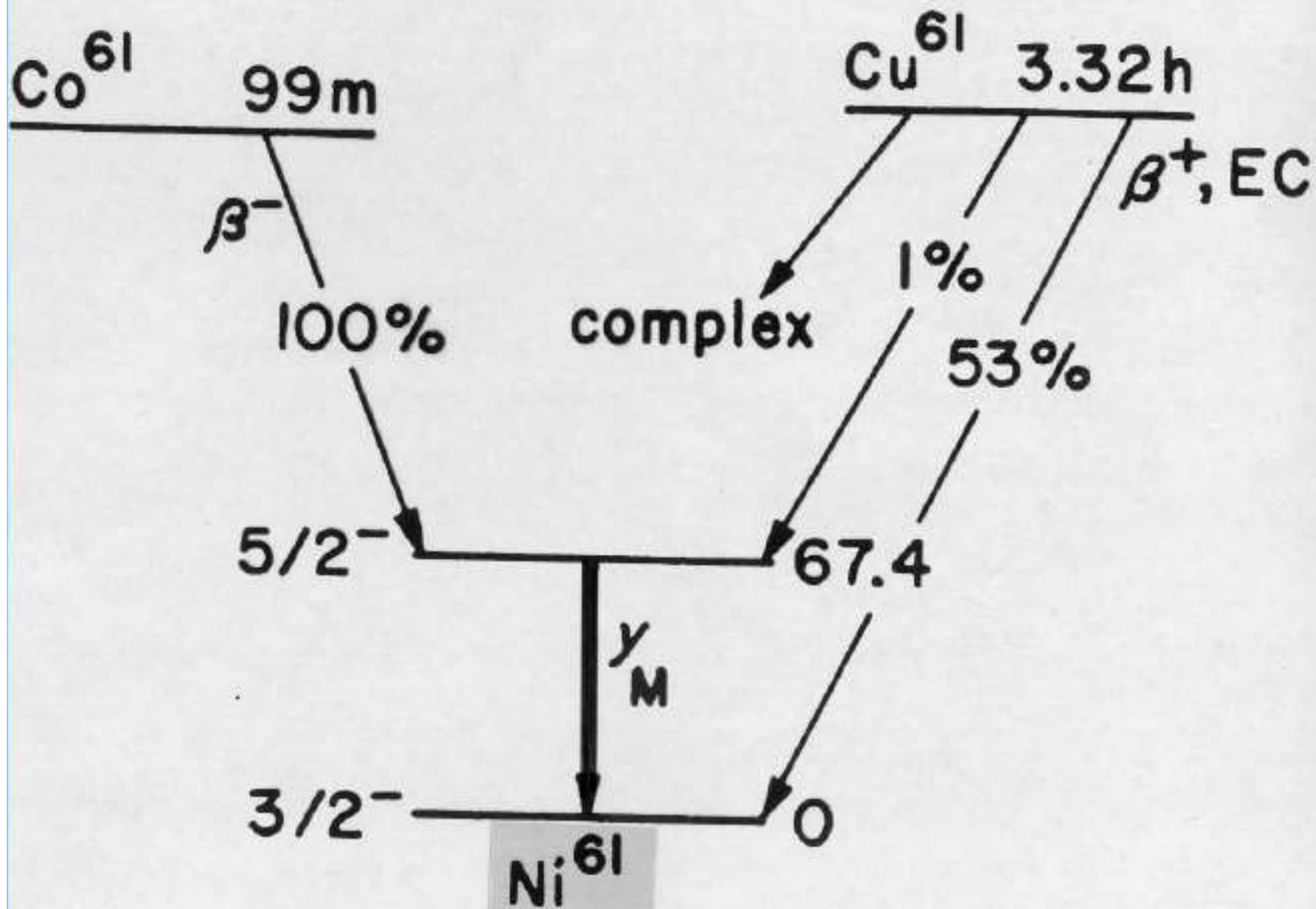
Here we see that increasing the electronegativity of the ligand will reduce the 4s electron density at the nucleus, which when combined with $(R_e^2 - R_g^2) < 0$ for ^{57}Fe will result in the isomer shift increasing with increasing ligand electronegativity, i.e. from iodide to fluoride.

Isomer Shift order of Fe(II) halides
 $\text{FeI}_2 < \text{FeBr}_2 < \text{FeCl}_2 < \text{FeF}_2$

Application of Mössbauer Spectroscopy in Structure Determination

**Characterisation of
Nickel Compounds
by
 ^{61}Ni Mössbauer Spectroscopy**

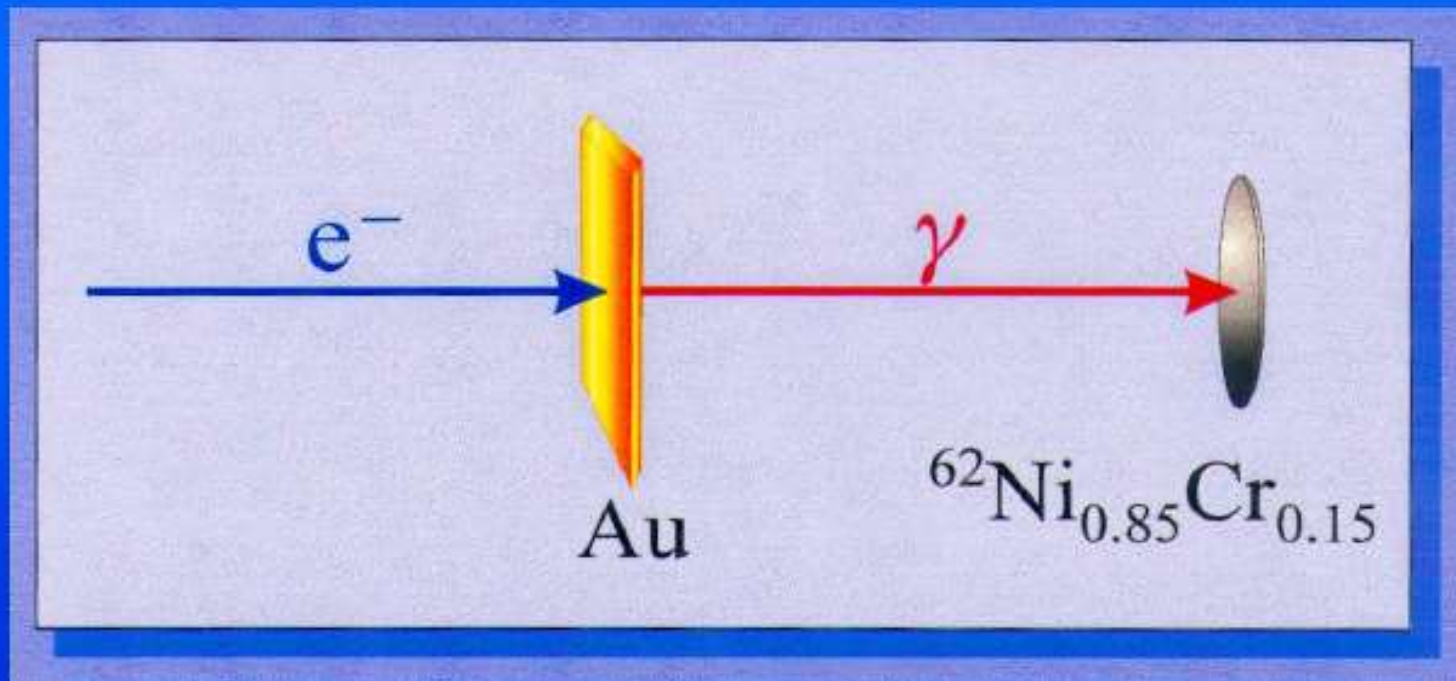
Decay Scheme of ^{61}Ni



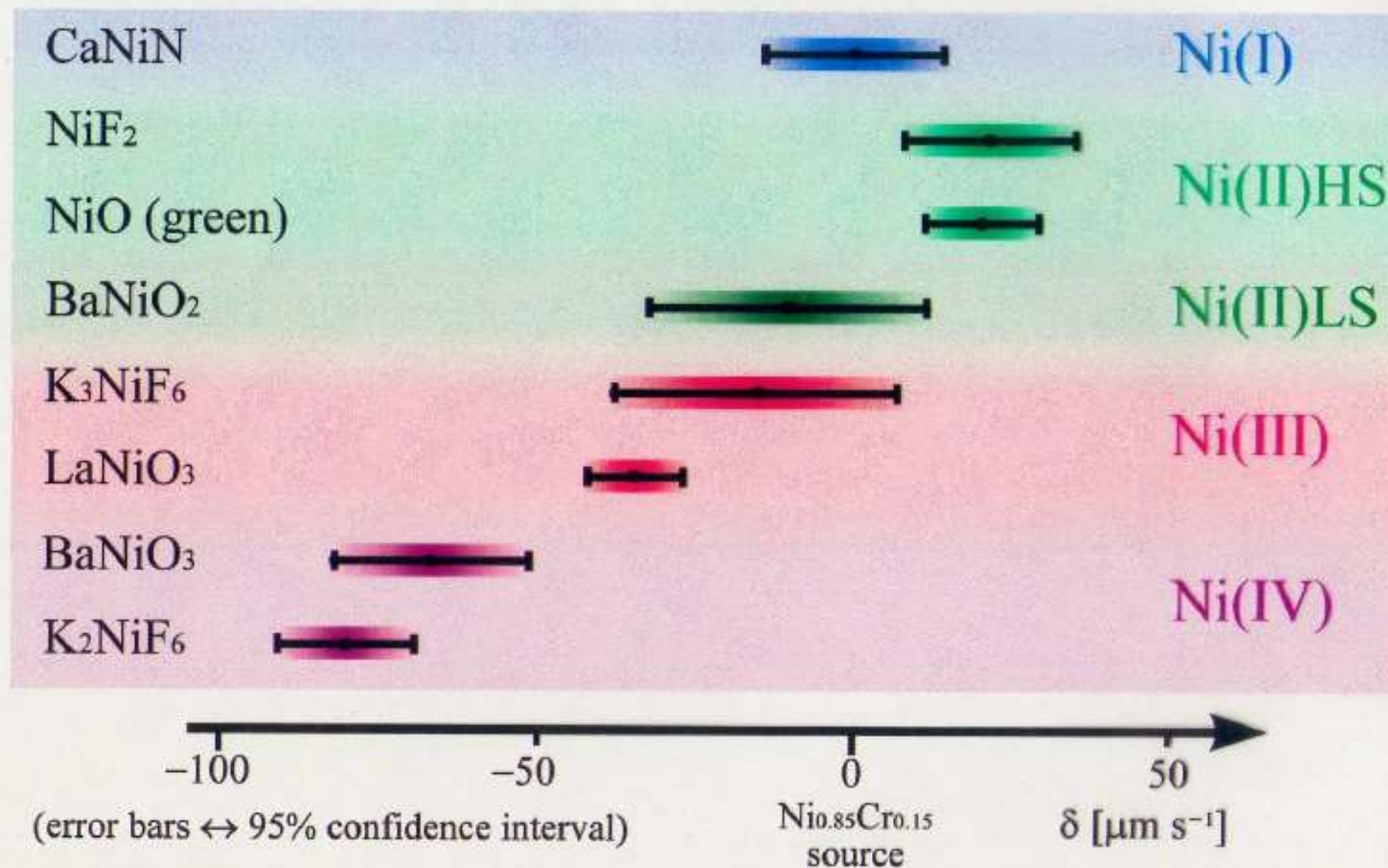
^{61}Ni Source Production

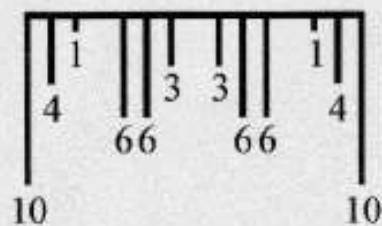
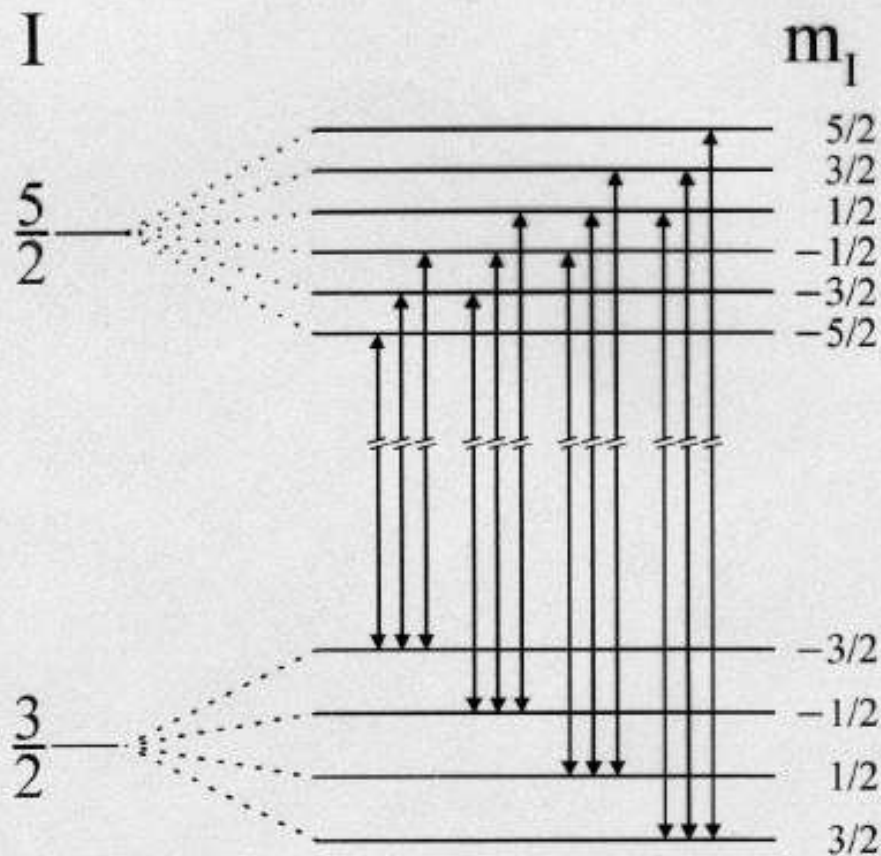


Activation with Bremsstrahlung from the
Electron beam of the MAInz MIcrotron (MAMI)



^{61}Ni Isomer Shifts





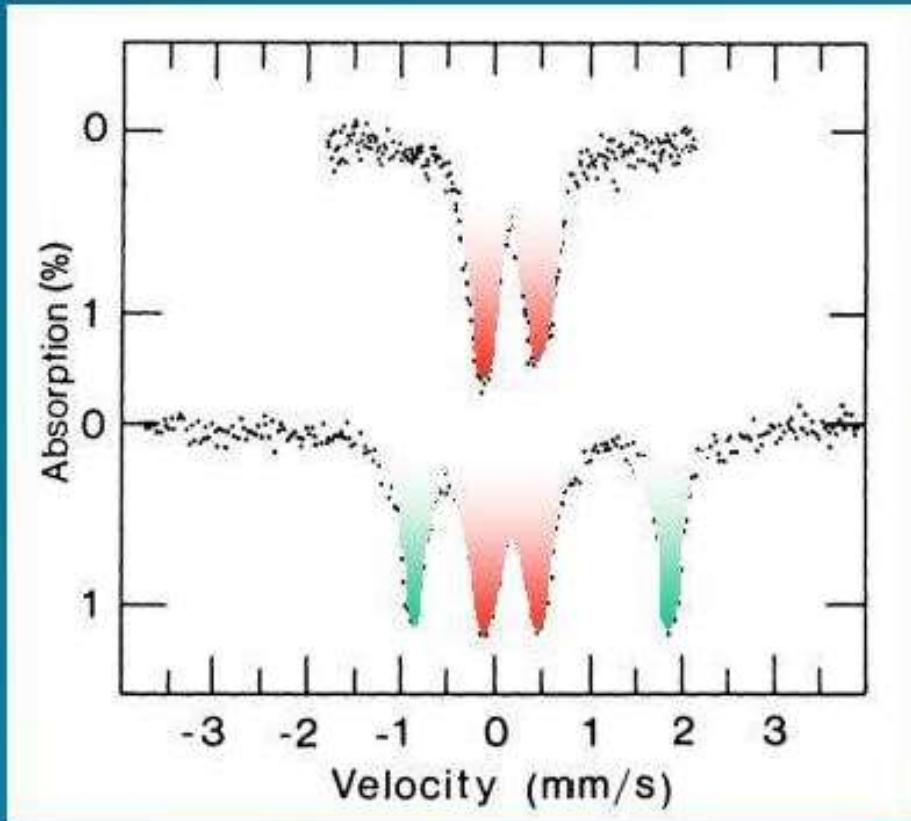
^{61}Ni Magnetic Splitting

12 transition lines
completely resolved
at H_{eff} ca. 50 T

Bioinorganic Compounds

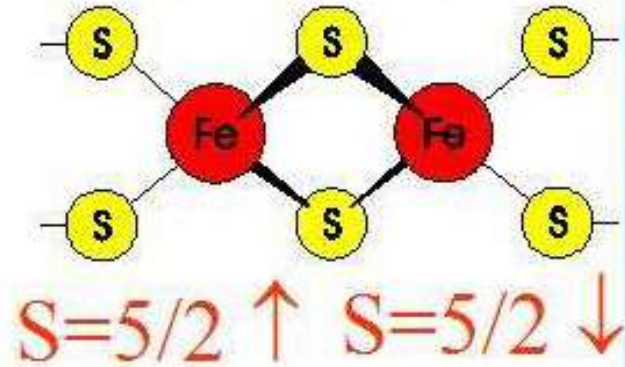
- ❖ **Bioinorganic chemistry** is another discipline where Mössbauer spectroscopy has widely been employed by chemists and physicists. Early Mössbauer effect studies by Johnson et al. of ferredoxin.
- ❖ The study of ferredoxin, a Fe-S protein, which assists in-vivo e^- transfer reactions.
- ❖ The two-iron centres are not equivalent in the reduced form.
- ❖ Ferredoxin, the two-iron centre of proteins, demonstrate convincingly, as seen in this picture, that the oxidized form with two Fe(III)-high spin centres can be distinguished from the reduced form with one Fe(III)-high spin centre and one Fe(II)-high spin centre, only by using MB spectrum.

Ferredoxin (green alga) Two-Iron Center Protein

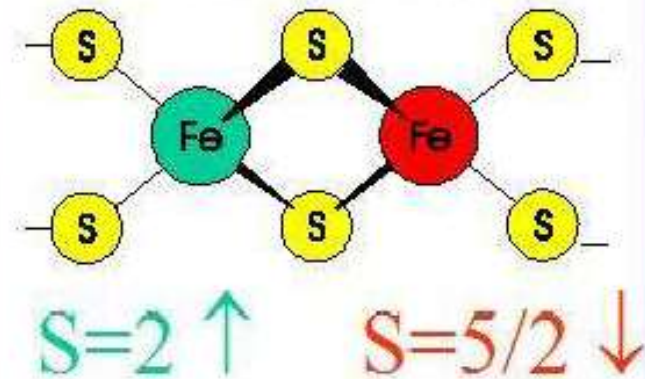


C. E. Johnson et al. (1971)

Oxidized



Reduced



N.B: E-Study material for the next unit will be available soon.