

Laboratory exercise

Mössbauer course

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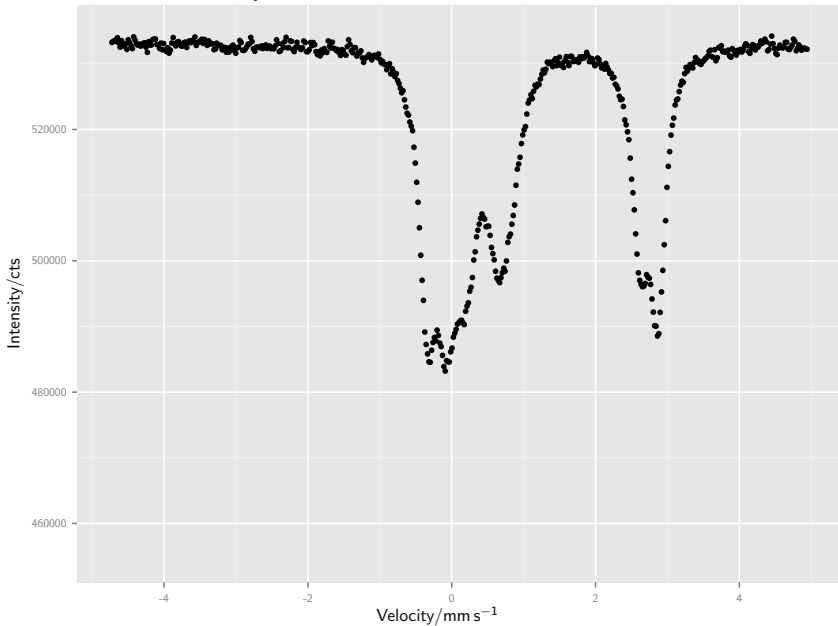
Department of Chemistry

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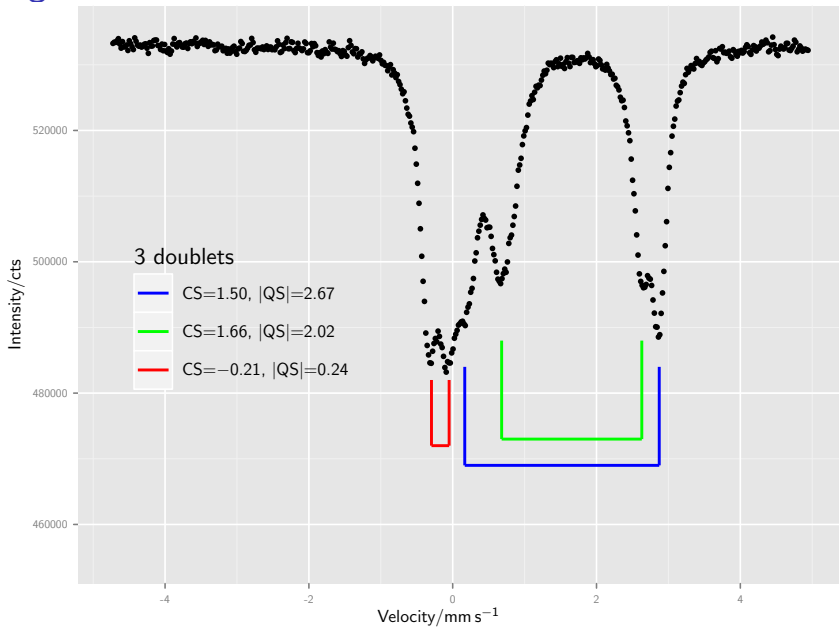


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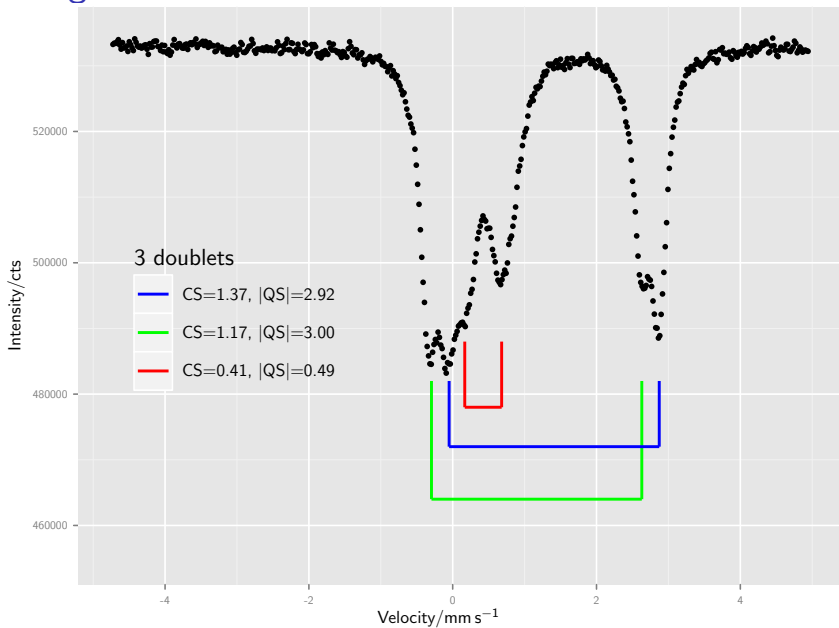
Folded Mössbauer spectra



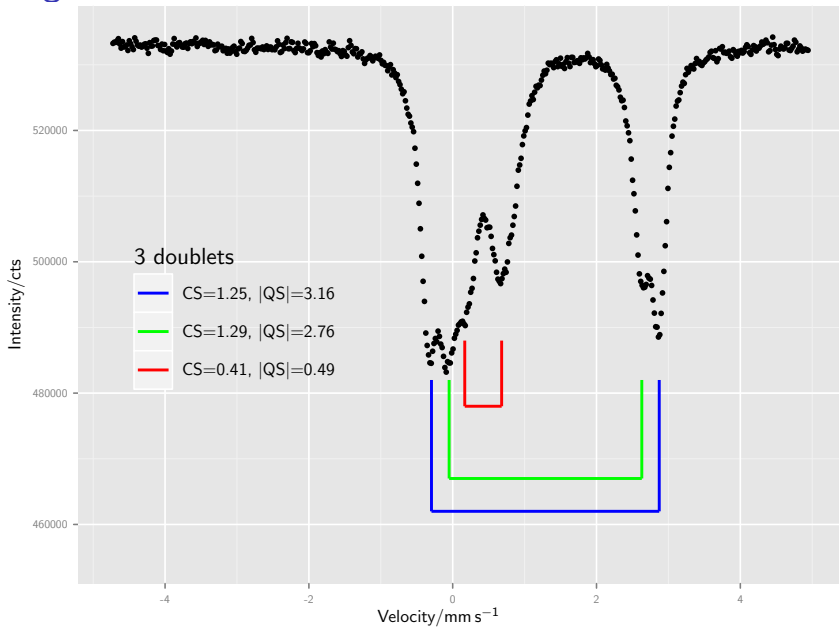
First guess



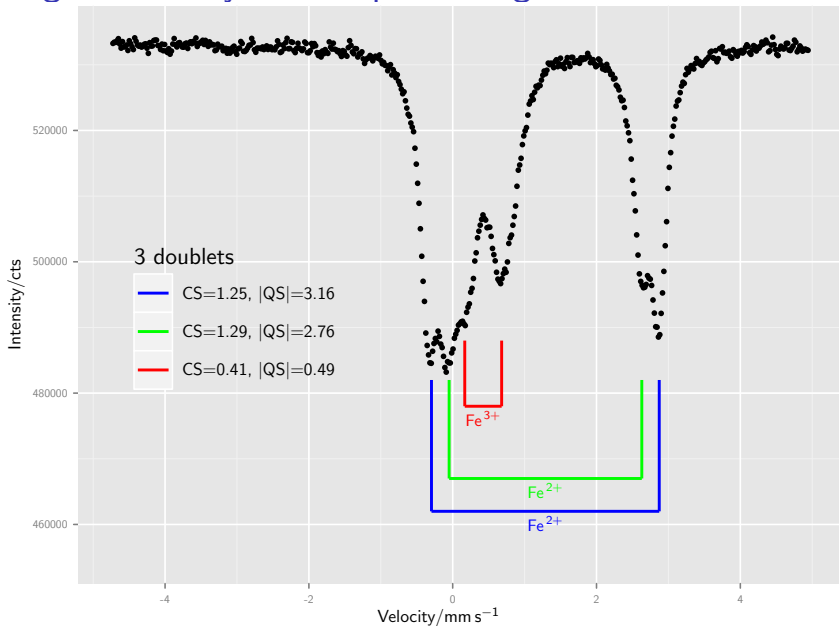
Second guess



Third guess



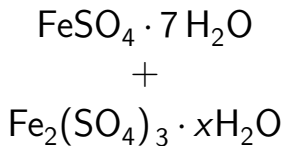
Third guess—likely correct peak assignment



Peak assignment

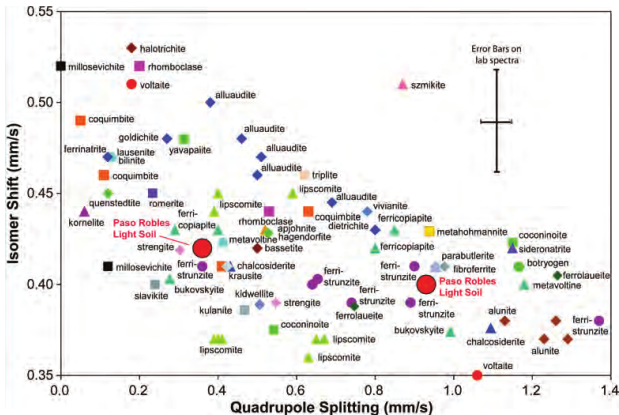
Doublet	Velocity/ mm s^{-1}	CS & QS	Likely iron-species
Blue peaks	-0.33	CS=1.25	Fe^{2+} , hs (8CN)
	2.83	QS =3.16	Fe^{2+} , hs (4CNT, 6CN)
Green peaks	-0.09	CS=1.29	Fe^{2+} , hs (8CN)
	2.67	QS =2.76	Fe^{2+} , hs (4CNT, 6CN)
Red peaks	0.16	CS=0.41	Fe^{3+} , hs (6CN, 4CN)
	0.65	QS =0.49	Fe^{3+} , hs (6CN, 4CNT)

And then we were told it was...

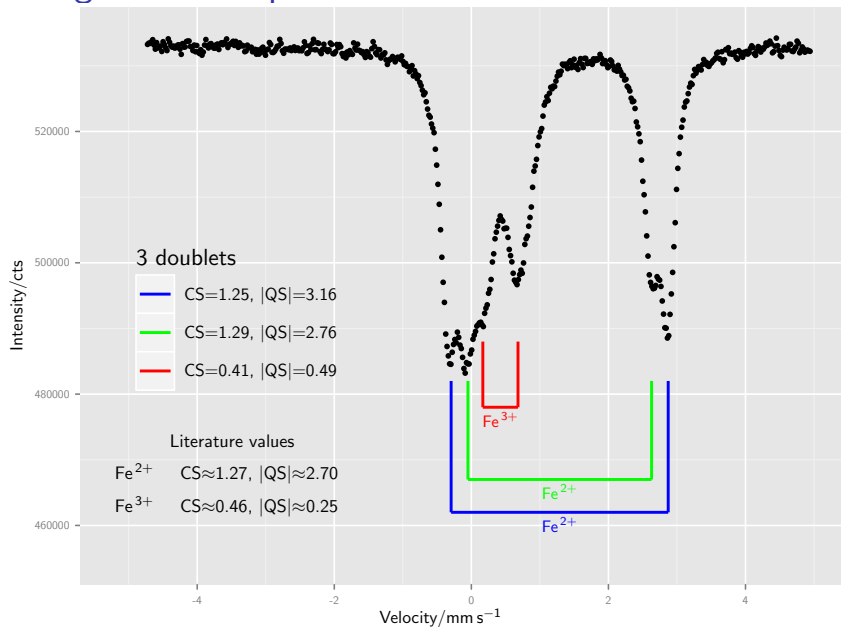


Mössbauer parameters from literature

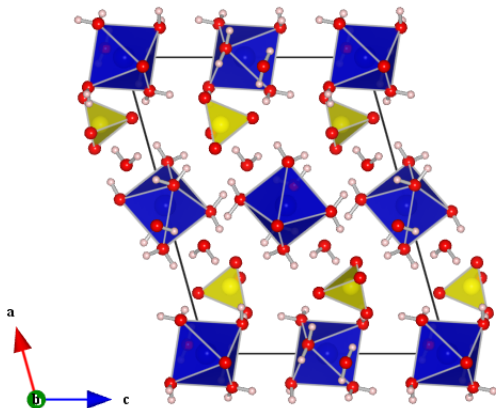
Sample	Compound	CS/mm s ⁻¹	QS/mm s ⁻¹
natural	FeSO ₄	1.27 ± 0.02	2.71 ± 0.02
	FeSO ₄	1.25 ± 0.03	2.71 ± 0.03
	FeSO ₄	1.30 ± 0.05	2.65 ± 0.05
synthetic	Pure FeSO ₄	1.27 ± 0.01	2.72 ± 0.02



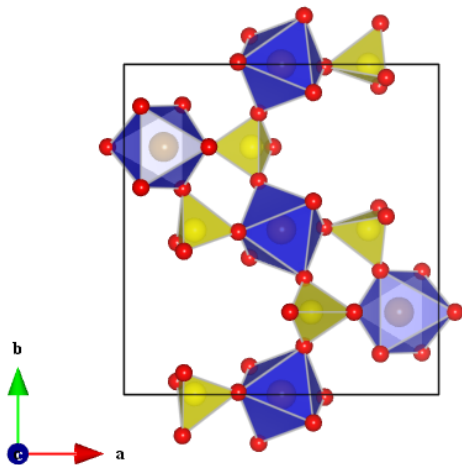
Our assignment compared to literature



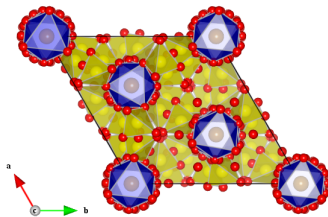
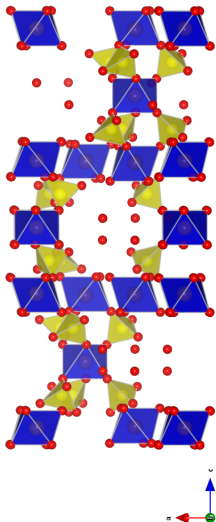
Iron sulfate heptahydrate: $\text{Fe}^{\text{II}}(\text{SO}_4) \cdot 7 \text{H}_2\text{O}$



Iron sulfate pentahydrate: $\text{Fe}_2^{\text{III}}(\text{SO}_4)_3 \cdot 5 \text{H}_2\text{O}$



Iron sulfate nonahydrate: $\text{Fe}_2^{\text{III}}(\text{SO}_4)_3 \cdot 9 \text{H}_2\text{O}$



Bibliography

- [1] Tore Ericsson. *Mössbauer in Uppsala*. Uppsala: Uppsala universitet, Fysiska institutionen, 2000.
- [2] M. D. Lane et al. 'Mineralogy of the Paso Robles soils on Mars'. *American Mineralogist* 93.5-6 (May 2008), pp. 728–739. DOI: 10.2138/am.2008.2757.
- [3] Pedro A. Montano. 'Mössbauer spectroscopy of iron compounds found in West Virginia coals'. *Fuel* 56.4 (Oct. 1977), pp. 397–400. DOI: 10.1016/0016-2361(77)90066-7.