Full wwPDB X-ray Structure Validation Report ⓘ

Apr 3, 2024 – 02:09 pm BST

PDB ID	:	8P9U
Title	:	Crystal Structure of Two-Domain Laccase mutant M199A/D268N from Streptomyces griseoflavus
Authors	:	Kolyadenko, I.A.; Tishchenko, S.V.; Gabdulkhakov, A.G.
Deposited on	:	2023-06-06
Resolution	:	2.00 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references ⓘ) were used in the production of this report:

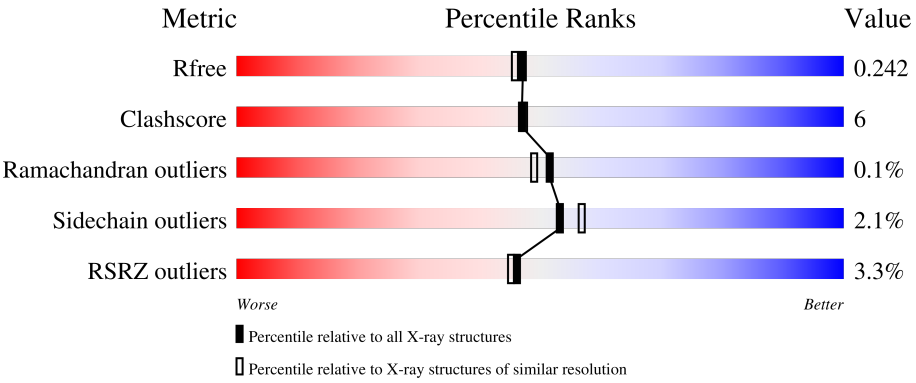
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	278	89% 10%
1	B	278	3% 82% 18%
1	D	278	5% 80% 19%
1	E	278	3% 88% 11%
1	F	278	5% 83% 15%

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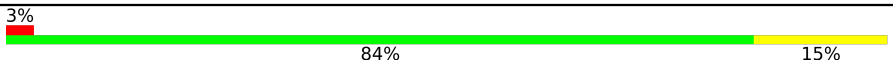
Mol	Chain	Length	Quality of chain
2	C	278	

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 13851 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Two-domain laccase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	278	Total	C	N	O	S	0	10	0
			2211	1381	407	411	12			
1	B	278	Total	C	N	O	S	0	7	0
			2189	1362	405	410	12			
1	D	278	Total	C	N	O	S	0	9	0
			2196	1370	403	411	12			
1	E	277	Total	C	N	O	S	0	3	0
			2146	1336	395	403	12			
1	F	277	Total	C	N	O	S	0	3	0
			2146	1337	395	402	12			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	199	ALA	MET	engineered mutation	UNP A0A0M4FJ81
A	268	ASN	ASP	engineered mutation	UNP A0A0M4FJ81
B	199	ALA	MET	engineered mutation	UNP A0A0M4FJ81
B	268	ASN	ASP	engineered mutation	UNP A0A0M4FJ81
D	199	ALA	MET	engineered mutation	UNP A0A0M4FJ81
D	268	ASN	ASP	engineered mutation	UNP A0A0M4FJ81
E	199	ALA	MET	engineered mutation	UNP A0A0M4FJ81
E	268	ASN	ASP	engineered mutation	UNP A0A0M4FJ81
F	199	ALA	MET	engineered mutation	UNP A0A0M4FJ81
F	268	ASN	ASP	engineered mutation	UNP A0A0M4FJ81

- Molecule 2 is a protein called Two-domain laccase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	278	Total	C	N	O	S	0	5	0
			2173	1354	400	406	13			

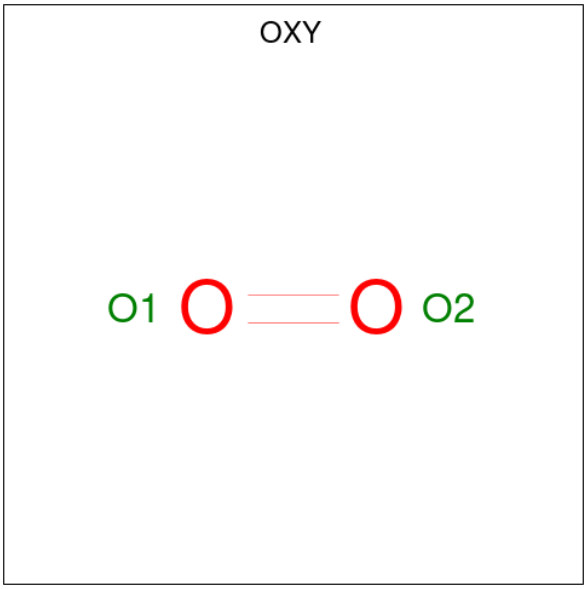
There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	199	ALA	MET	engineered mutation	UNP A0A0M4FJ81
C	268	ASN	ASP	engineered mutation	UNP A0A0M4FJ81

- Molecule 3 is COPPER (II) ION (three-letter code: CU) (formula: Cu) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	3	Total Cu 3 3	0	0
3	B	3	Total Cu 3 3	0	0
3	C	4	Total Cu 4 4	0	0
3	D	3	Total Cu 3 3	0	0
3	E	3	Total Cu 3 3	0	0
3	F	4	Total Cu 4 4	0	0

- Molecule 4 is OXYGEN MOLECULE (three-letter code: OXY) (formula: O_2) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O 2 2	0	0
4	B	1	Total O 2 2	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	C	1	Total O 2 2	0	0
4	D	1	Total O 2 2	0	0
4	F	1	Total O 2 2	0	0

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total Ca 1 1	0	0
5	F	1	Total Ca 1 1	0	0

- Molecule 6 is water.

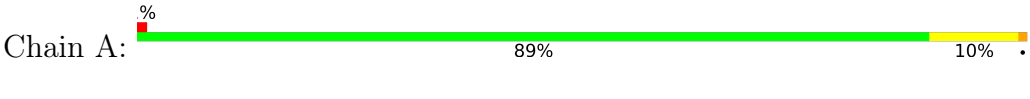
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	190	Total O 190 190	0	0
6	B	110	Total O 110 110	0	0
6	C	120	Total O 120 120	0	0
6	D	82	Total O 82 82	0	0
6	E	134	Total O 134 134	0	0
6	F	122	Total O 122 122	0	0

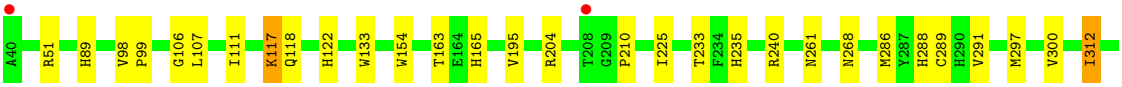
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: Two-domain laccase

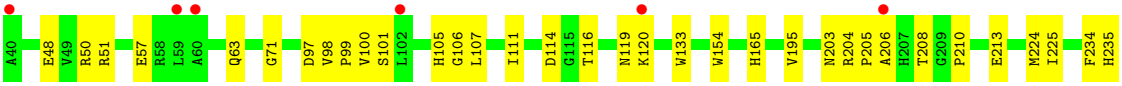
Chain A:

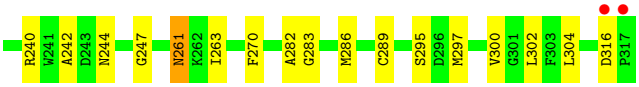




• Molecule 1: Two-domain laccase

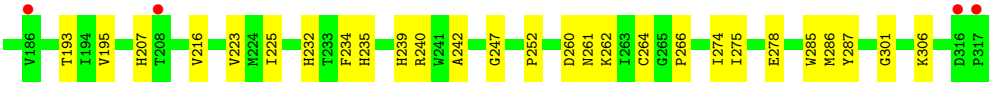
Chain B:





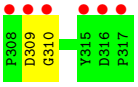
• Molecule 1: Two-domain laccase

Chain D:



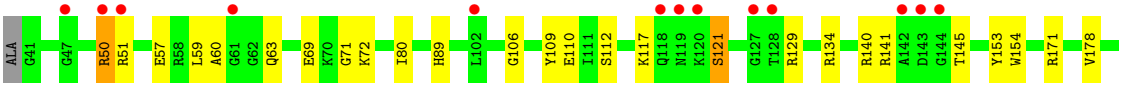
• Molecule 1: Two-domain laccase

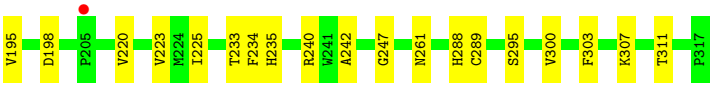
Chain E:



• Molecule 1: Two-domain laccase

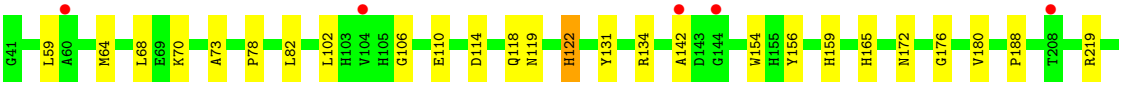
Chain F:

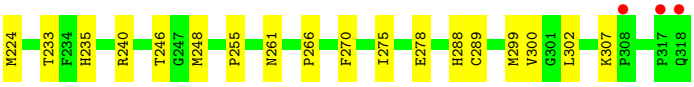




• Molecule 2: Two-domain laccase

Chain C:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	74.30Å 94.03Å 118.93Å 90.00° 91.10° 90.00°	Depositor
Resolution (Å)	23.54 – 2.00 23.54 – 2.00	Depositor EDS
% Data completeness (in resolution range)	94.5 (23.54-2.00) 94.5 (23.54-2.00)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.33 (at 1.99Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.201 , 0.242 0.201 , 0.242	Depositor DCC
R_{free} test set	5234 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	21.5	Xtriage
Anisotropy	0.084	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 55.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.46$, $< L^2 > = 0.29$	Xtriage
Estimated twinning fraction	0.044 for h,-k,-l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	13851	wwPDB-VP
Average B, all atoms (Å^2)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.22% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CA, OXY, CU

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| > 5$	RMSZ	$\#\|Z\| > 5$
1	A	0.44	0/2273	0.65	0/3086
1	B	0.39	0/2251	0.65	0/3056
1	D	0.44	3/2259 (0.1%)	0.62	0/3070
1	E	0.42	0/2208	0.63	0/3000
1	F	0.38	0/2208	0.64	0/3000
2	C	0.40	0/2235	0.66	0/3034
All	All	0.41	3/13434 (0.0%)	0.64	0/18246

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	207[A]	HIS	C-N	-6.55	1.19	1.34
1	D	207[B]	HIS	C-N	-6.55	1.19	1.34
1	D	260	ASP	C-N	6.12	1.48	1.34

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2211	0	2098	25	0
1	B	2189	0	2060	36	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	2196	0	2066	34	0
1	E	2146	0	2016	21	0
1	F	2146	0	2018	24	0
2	C	2173	0	2048	34	0
3	A	3	0	0	0	0
3	B	3	0	0	0	0
3	C	4	0	0	0	0
3	D	3	0	0	0	0
3	E	3	0	0	0	0
3	F	4	0	0	0	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
4	C	2	0	0	0	0
4	D	2	0	0	0	0
4	F	2	0	0	0	0
5	B	1	0	0	0	0
5	F	1	0	0	0	0
6	A	190	0	0	1	0
6	B	110	0	0	4	0
6	C	120	0	0	2	0
6	D	82	0	0	3	0
6	E	134	0	0	3	0
6	F	122	0	0	2	0
All	All	13851	0	12306	158	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 6.

All (158) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:288:HIS:HB3	1:A:300:VAL:HG13	1.57	0.84
1:F:69:GLU:HB2	1:F:72:LYS:HE3	1.72	0.71
1:F:288:HIS:HB3	1:F:300[B]:VAL:HG13	1.73	0.71
2:C:114:ASP:OD2	2:C:119:ASN:ND2	2.27	0.67
1:F:235:HIS:HB2	1:F:261:ASN:HD22	1.59	0.67
1:F:51:ARG:HG2	1:F:89:HIS:HB2	1.78	0.65
1:D:286:MET:HG3	6:F:514:HOH:O	1.96	0.65
1:F:235:HIS:HB2	1:F:261:ASN:ND2	2.12	0.64
1:B:63:GLN:NE2	1:B:203:ASN:HD22	1.96	0.63
1:A:99:PRO:HD2	1:E:98:VAL:HG12	1.82	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:111:ILE:HG13	1:E:283:GLY:HA3	1.81	0.61
1:B:224:MET:HE3	1:B:270:PHE:HE1	1.66	0.60
1:F:50[B]:ARG:HB2	1:F:50[B]:ARG:HH11	1.64	0.60
1:D:64:MET:HE1	1:D:161:VAL:HG21	1.84	0.60
1:E:224:MET:HE3	1:E:270:PHE:CE1	2.37	0.59
1:D:134:ARG:NH2	6:D:505:HOH:O	2.31	0.59
2:C:224:MET:HE2	2:C:270:PHE:CE1	2.38	0.59
1:D:69:GLU:HB2	1:D:72:LYS:HD2	1.85	0.58
2:C:64:MET:HG3	2:C:172:ASN:HB3	1.86	0.57
1:D:75:ILE:HG12	1:D:173:GLY:HA3	1.87	0.57
1:D:275:ILE:HB	1:D:278:GLU:HB2	1.88	0.56
1:B:234:PHE:O	1:B:261[A]:ASN:HA	2.05	0.56
1:B:107:LEU:HD23	1:B:133:TRP:HB3	1.88	0.55
1:F:59:LEU:HB2	1:F:63:GLN:HB2	1.88	0.55
1:A:235:HIS:HB2	1:A:261:ASN:ND2	2.21	0.55
1:E:79:LEU:HD11	1:E:179:ILE:HG13	1.87	0.55
1:B:224:MET:HE3	1:B:270:PHE:CE1	2.41	0.55
1:A:51[A]:ARG:HG2	1:A:89:HIS:HB2	1.89	0.54
2:C:122:HIS:CD2	2:C:122:HIS:H	2.25	0.54
1:A:235:HIS:HB2	1:A:261:ASN:HD22	1.72	0.54
1:A:268:ASN:HA	1:B:261[A]:ASN:HD21	1.72	0.54
2:C:246:THR:HB	2:C:248[B]:MET:HE3	1.88	0.54
1:A:111[B]:ILE:HG12	1:B:282:ALA:O	2.08	0.54
2:C:224:MET:HE2	2:C:270:PHE:HE1	1.73	0.54
1:A:111[B]:ILE:HG21	1:B:283:GLY:HA3	1.90	0.54
1:E:99:PRO:HB3	1:E:122:HIS:HD2	1.73	0.54
1:E:309:ASP:OD1	1:E:310:GLY:N	2.41	0.54
2:C:188:PRO:HA	2:C:219:ARG:HG2	1.90	0.53
1:E:235:HIS:HB2	1:E:261:ASN:ND2	2.24	0.53
1:D:106:GLY:HA3	1:D:154:TRP:CD2	2.43	0.53
1:B:213:GLU:HG2	1:B:304:LEU:HB2	1.91	0.52
1:D:122:HIS:H	1:D:122:HIS:CD2	2.26	0.52
1:A:297:MET:HE1	1:F:198:ASP:HB3	1.91	0.51
1:A:312[A]:ILE:HG13	1:A:315:TYR:HD2	1.73	0.51
1:B:165:HIS:CE1	2:C:300:VAL:HG11	2.46	0.51
2:C:289:CYS:CB	2:C:299:MET:HE2	2.39	0.51
2:C:156:TYR:CZ	2:C:176:GLY:HA3	2.45	0.51
2:C:159:HIS:CE1	2:C:165:HIS:HA	2.45	0.51
1:B:204:ARG:HD3	1:B:210:PRO:HD3	1.93	0.50
2:C:288:HIS:HB2	2:C:300:VAL:HG12	1.93	0.50
1:D:239:HIS:CD2	1:D:274:ILE:HD12	2.46	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:57:GLU:OE2	1:B:71:GLY:N	2.20	0.50
1:F:242:ALA:O	1:F:247:GLY:HA2	2.11	0.50
1:D:234:PHE:O	1:D:261[B]:ASN:HA	2.12	0.49
1:F:307:LYS:HD3	1:F:311:THR:OG1	2.13	0.49
2:C:118:GLN:OE1	2:C:118:GLN:N	2.35	0.49
1:E:224:MET:HE3	1:E:270:PHE:HE1	1.76	0.49
1:D:235:HIS:HB2	1:D:261[A]:ASN:ND2	2.28	0.48
6:A:538:HOH:O	1:B:286:MET:HG3	2.13	0.48
1:F:80:ILE:HB	1:F:178:VAL:HG13	1.95	0.48
1:F:233:THR:O	1:F:289:CYS:HA	2.14	0.48
1:B:100:VAL:HG13	6:B:517:HOH:O	2.12	0.48
2:C:142:ALA:O	6:C:501:HOH:O	2.20	0.48
1:D:69:GLU:CB	1:D:72:LYS:HD2	2.44	0.48
1:B:206:ALA:HB1	1:B:297:MET:O	2.14	0.47
1:E:45:ALA:HB2	1:E:183:LYS:HE2	1.96	0.47
2:C:288:HIS:CB	2:C:300:VAL:HG12	2.44	0.47
1:F:57:GLU:OE2	1:F:71:GLY:N	2.29	0.47
1:A:291:VAL:HA	2:C:266:PRO:HG2	1.96	0.47
2:C:219:ARG:HH12	2:C:248[A]:MET:CE	2.27	0.47
1:B:50:ARG:NH1	6:B:508:HOH:O	2.47	0.47
1:B:205:PRO:HG2	1:B:208:THR:HG21	1.97	0.47
1:A:117[B]:LYS:HD2	1:A:122:HIS:CD2	2.50	0.47
1:D:242:ALA:O	1:D:247:GLY:HA2	2.15	0.46
1:F:121:SER:HA	1:F:129:ARG:CZ	2.46	0.46
1:A:98:VAL:HG12	1:E:99:PRO:HD2	1.96	0.46
1:B:106:GLY:HA3	1:B:154:TRP:CD2	2.51	0.46
1:D:285:TRP:HZ3	1:F:109:TYR:CE2	2.34	0.46
2:C:106:GLY:HA3	2:C:154:TRP:CD2	2.51	0.46
2:C:122:HIS:H	2:C:122:HIS:HD2	1.64	0.46
1:F:106:GLY:HA3	1:F:154:TRP:CD2	2.51	0.46
1:B:116:THR:HG23	1:B:119:ASN:H	1.80	0.45
1:B:235:HIS:HB2	1:B:261[B]:ASN:ND2	2.31	0.45
2:C:102:LEU:HB3	2:C:131:TYR:CE2	2.51	0.45
1:A:118:GLN:HE22	1:B:302:LEU:HD21	1.81	0.45
1:D:117:LYS:HD3	1:D:122:HIS:CE1	2.51	0.45
1:E:118:GLN:HG2	6:E:634:HOH:O	2.16	0.45
1:E:188:PRO:HA	1:E:219:ARG:HG2	1.97	0.45
1:E:242:ALA:O	1:E:247:GLY:HA2	2.17	0.45
1:A:233:THR:O	1:A:289:CYS:HA	2.17	0.45
2:C:233:THR:O	2:C:289:CYS:HA	2.17	0.45
1:B:48:GLU:HB3	1:B:50:ARG:HH11	1.80	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:106:GLY:HA3	1:A:154:TRP:CD2	2.52	0.45
2:C:110:GLU:HG3	2:C:134[B]:ARG:HH22	1.82	0.45
2:C:122:HIS:HE1	6:C:605:HOH:O	1.99	0.45
1:A:312[A]:ILE:HG13	1:A:315:TYR:CD2	2.52	0.44
1:A:163:THR:HA	6:E:505:HOH:O	2.17	0.44
1:D:287:TYR:CE2	1:D:301:GLY:HA3	2.52	0.44
1:D:286:MET:HB2	1:D:286:MET:HE3	1.89	0.44
1:E:214:ALA:O	1:E:306:LYS:HG3	2.16	0.44
1:D:109:TYR:CE1	1:E:285:TRP:HZ3	2.36	0.44
1:B:106:GLY:HA3	1:B:154:TRP:CE3	2.53	0.44
1:B:242:ALA:O	1:B:247:GLY:HA2	2.18	0.44
1:A:312[A]:ILE:HG13	1:A:315:TYR:HB3	1.99	0.44
1:F:141:ARG:NH1	6:F:509:HOH:O	2.47	0.44
1:A:107:LEU:HD12	1:A:133:TRP:HB3	1.99	0.43
1:B:48:GLU:HB3	1:B:50:ARG:NH1	2.33	0.43
2:C:59[B]:LEU:HD11	2:C:73:ALA:HB3	2.00	0.43
1:D:216:VAL:HG23	1:D:306:LYS:O	2.17	0.43
1:A:204:ARG:HE	1:A:210:PRO:HB3	1.83	0.43
1:B:286:MET:HE2	1:B:286:MET:HB3	1.73	0.43
1:D:95:THR:O	1:D:95:THR:OG1	2.33	0.43
1:D:177:PRO:HG3	1:D:193:THR:OG1	2.19	0.43
1:D:122:HIS:H	1:D:122:HIS:HD2	1.66	0.43
1:D:252:PRO:O	6:D:502:HOH:O	2.21	0.43
1:A:165:HIS:CE1	1:B:300:VAL:HG11	2.54	0.43
1:E:117:LYS:HE2	6:E:622:HOH:O	2.17	0.43
1:D:232:HIS:NE2	6:D:501:HOH:O	2.20	0.43
1:F:220:VAL:HG21	1:F:303:PHE:HZ	1.84	0.43
1:D:266:PRO:HG2	1:E:291:VAL:HG22	2.01	0.42
1:F:195:VAL:HG22	1:F:225:ILE:HB	2.01	0.42
1:B:195:VAL:HG22	1:B:225:ILE:HB	2.01	0.42
2:C:302:LEU:HD23	2:C:302:LEU:HA	1.79	0.42
1:B:195:VAL:HA	1:B:225:ILE:O	2.20	0.42
1:F:60:ALA:O	1:F:63:GLN:HG2	2.19	0.42
1:F:153:TYR:CD1	1:F:223:VAL:HG22	2.54	0.42
1:D:121:SER:HA	1:D:129:ARG:CZ	2.50	0.42
2:C:307:LYS:HZ2	2:C:307:LYS:HB3	1.84	0.42
1:F:110:GLU:HG3	1:F:134:ARG:HH22	1.85	0.42
1:B:98:VAL:HG22	1:B:99:PRO:HD2	2.02	0.42
1:E:224:MET:HE1	1:E:264[A]:CYS:SG	2.60	0.42
1:E:287:TYR:CE2	1:E:301:GLY:HA3	2.55	0.42
1:A:111[B]:ILE:H	1:A:111[B]:ILE:HG13	1.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:195:VAL:HA	1:A:225:ILE:O	2.19	0.42
2:C:82:LEU:O	2:C:180:VAL:HA	2.20	0.42
1:B:111:ILE:HD12	1:B:114:ASP:HB2	2.02	0.41
1:E:288:HIS:HB3	1:E:300:VAL:HG13	2.02	0.41
1:D:195:VAL:HG22	1:D:225:ILE:HB	2.02	0.41
1:B:244:ASN:HB2	2:C:255:PRO:O	2.20	0.41
2:C:68:LEU:HG	2:C:78:PRO:HG3	2.01	0.41
2:C:235:HIS:HB2	2:C:261:ASN:ND2	2.35	0.41
1:D:51:ARG:HG2	1:D:89:HIS:HB2	2.01	0.41
1:F:289:CYS:O	1:F:295:SER:HB3	2.20	0.41
1:B:101:SER:HA	6:B:517:HOH:O	2.21	0.41
2:C:219:ARG:HH12	2:C:248[A]:MET:HE3	1.85	0.41
1:D:96:MET:HE1	1:D:98:VAL:HG22	2.02	0.41
1:A:286:MET:HB3	1:A:286:MET:HE2	1.75	0.41
1:B:105:HIS:CE1	2:C:235:HIS:CE1	3.08	0.41
2:C:289:CYS:HB2	2:C:299:MET:HE2	2.02	0.41
1:E:206:ALA:HB1	1:E:297:MET:O	2.21	0.41
1:D:55:TYR:CD1	1:D:93:GLU:HB3	2.56	0.41
1:F:234:PHE:O	1:F:261:ASN:HA	2.21	0.41
1:D:59:LEU:HB2	1:D:63:GLN:HB2	2.02	0.41
1:D:153:TYR:CD1	1:D:223:VAL:HG22	2.56	0.40
1:B:289:CYS:O	1:B:295:SER:HB3	2.22	0.40
2:C:275:ILE:HB	2:C:278:GLU:HB2	2.02	0.40
1:D:111:ILE:HD13	1:D:111:ILE:HA	1.86	0.40
1:B:263:ILE:HG22	6:B:580:HOH:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	286/278 (103%)	282 (99%)	4 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	283/278 (102%)	272 (96%)	11 (4%)	0	100 100
1	D	285/278 (102%)	270 (95%)	14 (5%)	1 (0%)	34 30
1	E	278/278 (100%)	272 (98%)	6 (2%)	0	100 100
1	F	278/278 (100%)	268 (96%)	10 (4%)	0	100 100
2	C	281/278 (101%)	273 (97%)	8 (3%)	0	100 100
All	All	1691/1668 (101%)	1637 (97%)	53 (3%)	1 (0%)	51 49

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	143	ASP

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	228/218 (105%)	223 (98%)	5 (2%)	52 55
1	B	225/218 (103%)	217 (96%)	8 (4%)	35 34
1	D	227/218 (104%)	218 (96%)	9 (4%)	31 29
1	E	221/218 (101%)	221 (100%)	0	100 100
1	F	221/218 (101%)	212 (96%)	9 (4%)	30 28
2	C	224/219 (102%)	221 (99%)	3 (1%)	69 74
All	All	1346/1309 (103%)	1312 (98%)	34 (2%)	53 49

All (34) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	117[A]	LYS
1	A	117[B]	LYS
1	A	240	ARG
1	A	312[A]	ILE
1	A	312[B]	ILE

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Mol	Chain	Res	Type
1	B	51[A]	ARG
1	B	51[B]	ARG
1	B	97	ASP
1	B	120	LYS
1	B	240	ARG
1	B	261[A]	ASN
1	B	261[B]	ASN
1	B	316	ASP
2	C	70	LYS
2	C	122	HIS
2	C	240	ARG
1	D	51	ARG
1	D	95	THR
1	D	112[A]	SER
1	D	112[B]	SER
1	D	122	HIS
1	D	240	ARG
1	D	262	LYS
1	D	264[A]	CYS
1	D	264[B]	CYS
1	F	50[A]	ARG
1	F	50[B]	ARG
1	F	112	SER
1	F	117	LYS
1	F	121	SER
1	F	140	ARG
1	F	145	THR
1	F	171	ARG
1	F	240	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	119	ASN
1	A	268	ASN
1	B	63	GLN
1	B	119	ASN
2	C	122	HIS
2	C	165	HIS
2	C	207	HIS
1	D	103	HIS
1	D	122	HIS

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Mol	Chain	Res	Type
1	D	165	HIS
1	D	268	ASN
1	E	207	HIS
1	E	261	ASN
1	E	268	ASN
1	F	119	ASN
1	F	261	ASN
1	F	268	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 27 ligands modelled in this entry, 22 are monoatomic - leaving 5 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
4	OXY	F	405	3	1,1,1	0.18	0	-		
4	OXY	B	404	3	1,1,1	0.19	0	-		
4	OXY	A	404	3	1,1,1	0.16	0	-		
4	OXY	D	404	3	1,1,1	0.15	0	-		
4	OXY	C	405	3	1,1,1	0.14	0	-		

There are no bond length outliers.

There are no bond angle outliers.

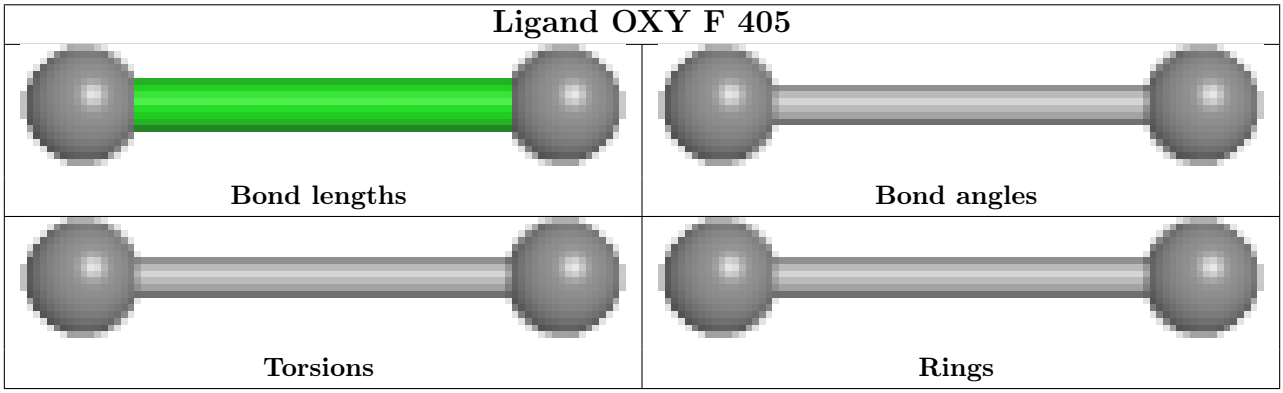
There are no chirality outliers.

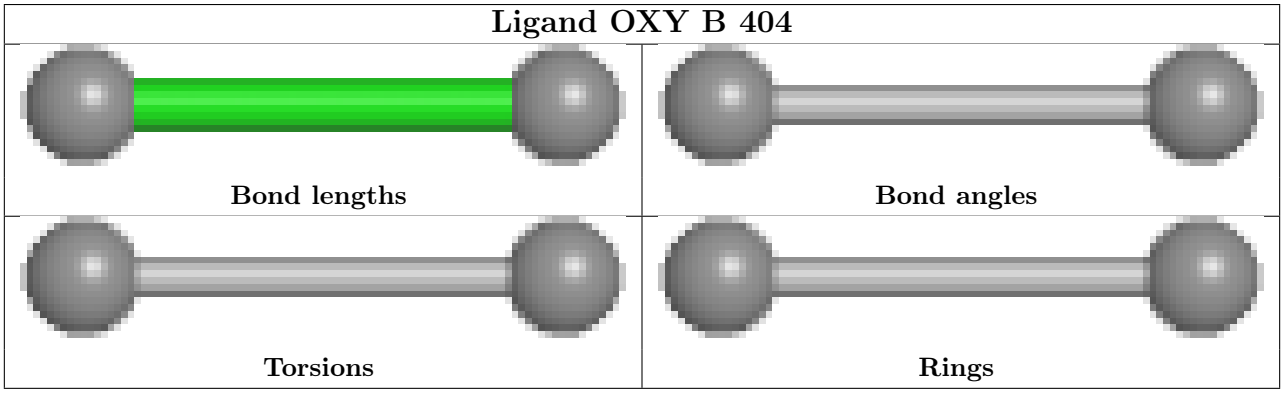
There are no torsion outliers.

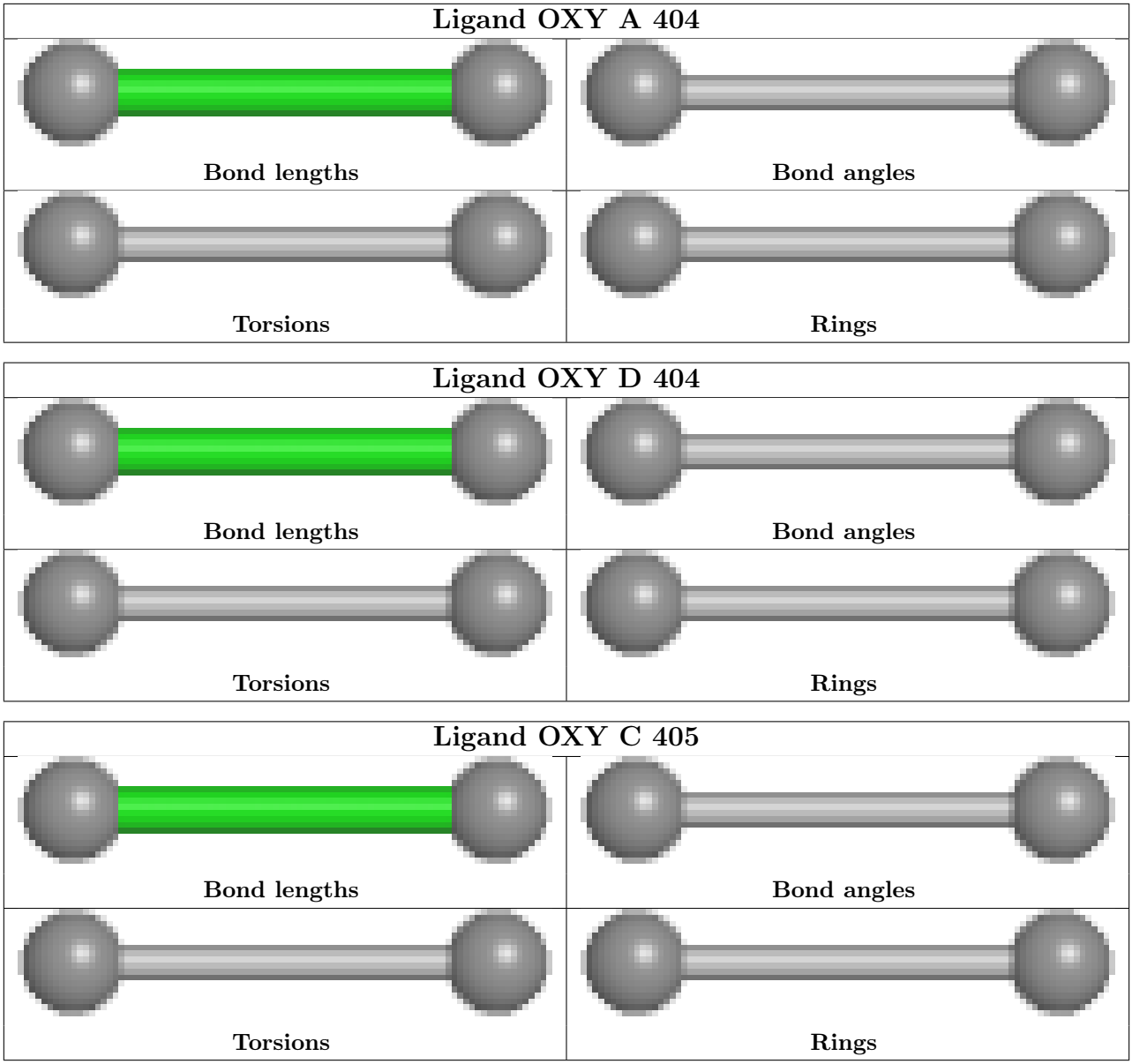
There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.







5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	D	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	D	207[A]:HIS	C	208:THR	N	1.19

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2		OWAB(Å^2)	Q<0.9
1	A	278/278 (100%)	-0.21	4 (1%)	75 74	11, 18, 32, 67	0
1	B	278/278 (100%)	0.15	8 (2%)	51 50	12, 26, 45, 76	0
1	D	278/278 (100%)	0.38	13 (4%)	31 30	20, 33, 51, 64	0
1	E	277/278 (99%)	-0.06	8 (2%)	51 50	11, 22, 44, 77	0
1	F	277/278 (99%)	0.32	14 (5%)	28 27	13, 29, 48, 68	0
2	C	278/278 (100%)	0.18	8 (2%)	51 50	15, 25, 43, 66	0
All	All	1666/1668 (99%)	0.13	55 (3%)	46 45	11, 26, 46, 77	0

All (55) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	317	PRO	6.9
1	B	316	ASP	5.4
1	F	144	GLY	4.8
1	E	308	PRO	4.6
1	F	118	GLN	4.5
2	C	60	ALA	4.3
1	E	316	ASP	4.2
1	D	71	GLY	4.0
1	F	142	ALA	4.0
2	C	317	PRO	4.0
1	F	143	ASP	3.7
1	D	316	ASP	3.6
1	E	315	TYR	3.5
1	E	310	GLY	3.5
1	D	126	GLY	3.5
2	C	308	PRO	3.4
1	F	205	PRO	3.3
1	F	47	GLY	3.3
1	D	208	THR	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	60	ALA	3.2
1	D	60	ALA	3.1
1	A	40	ALA	3.1
1	F	61	GLY	3.1
2	C	142	ALA	3.0
1	B	40	ALA	3.0
1	B	206	ALA	3.0
1	B	317	PRO	2.9
1	E	309	ASP	2.8
2	C	318	GLN	2.8
1	A	316	ASP	2.8
1	E	144	GLY	2.8
1	F	120	LYS	2.7
1	B	102	LEU	2.6
1	D	317	PRO	2.6
1	D	40	ALA	2.6
1	D	119	ASN	2.5
1	F	51	ARG	2.5
1	A	208	THR	2.4
1	F	102	LEU	2.4
1	F	128	THR	2.4
1	A	317	PRO	2.4
1	F	127	GLY	2.4
1	D	128	THR	2.3
1	D	143	ASP	2.3
1	D	142	ALA	2.3
2	C	144	GLY	2.3
1	D	97	ASP	2.2
1	D	186[A]	VAL	2.2
2	C	208	THR	2.2
1	F	119	ASN	2.2
1	B	120	LYS	2.1
2	C	104	VAL	2.1
1	E	207	HIS	2.0
1	F	50[A]	ARG	2.0
1	B	59	LEU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

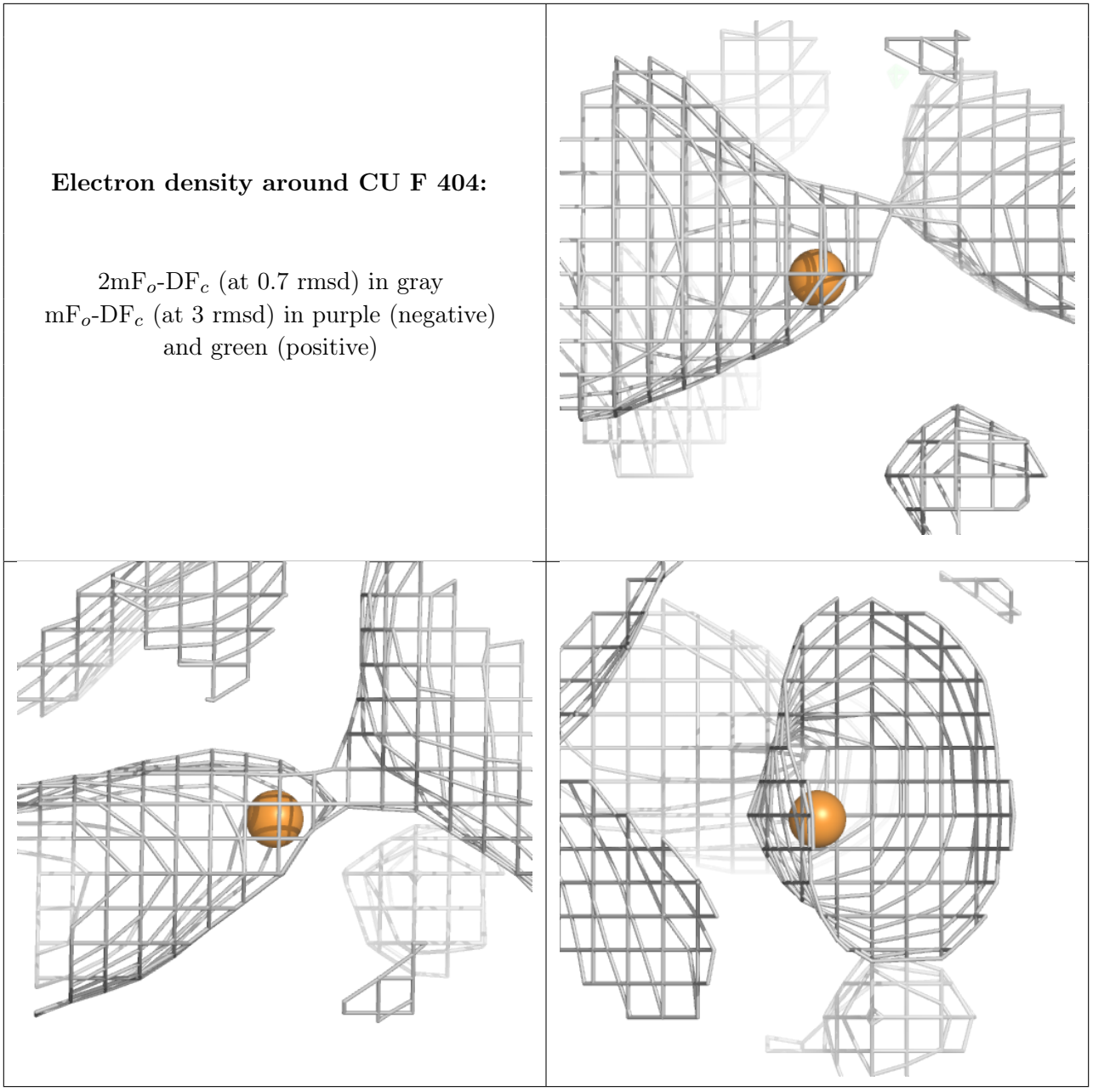
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	CU	F	404	1/1	0.83	0.44	27,27,27,27	1
3	CU	D	403	1/1	0.95	0.06	55,55,55,55	1
3	CU	C	404	1/1	0.97	0.17	20,20,20,20	1
3	CU	E	402	1/1	0.97	0.06	44,44,44,44	1
3	CU	D	402	1/1	0.97	0.05	35,35,35,35	1
4	OXY	C	405	2/2	0.97	0.12	36,36,36,36	2
5	CA	F	406	1/1	0.97	0.11	44,44,44,44	0
4	OXY	D	404	2/2	0.98	0.07	32,32,32,36	2
4	OXY	F	405	2/2	0.98	0.12	16,16,16,18	2
5	CA	B	405	1/1	0.98	0.17	45,45,45,45	0
3	CU	A	402	1/1	0.98	0.05	31,31,31,31	1
3	CU	B	401	1/1	0.99	0.04	22,22,22,22	0
3	CU	E	401	1/1	0.99	0.03	29,29,29,29	1
3	CU	B	403	1/1	0.99	0.07	32,32,32,32	1
3	CU	E	403	1/1	0.99	0.09	22,22,22,22	1
3	CU	F	401	1/1	0.99	0.05	28,28,28,28	0
3	CU	F	402	1/1	0.99	0.09	30,30,30,30	1
3	CU	C	401	1/1	0.99	0.04	27,27,27,27	1
4	OXY	A	404	2/2	0.99	0.10	18,18,18,25	2
4	OXY	B	404	2/2	0.99	0.13	16,16,16,19	2
3	CU	C	402	1/1	0.99	0.08	24,24,24,24	1
3	CU	C	403	1/1	0.99	0.05	39,39,39,39	1
3	CU	A	401	1/1	0.99	0.05	18,18,18,18	1
3	CU	D	401	1/1	0.99	0.04	28,28,28,28	1
3	CU	A	403	1/1	0.99	0.05	26,26,26,26	1
3	CU	B	402	1/1	1.00	0.03	35,35,35,35	1
3	CU	F	403	1/1	1.00	0.06	22,22,22,22	1

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

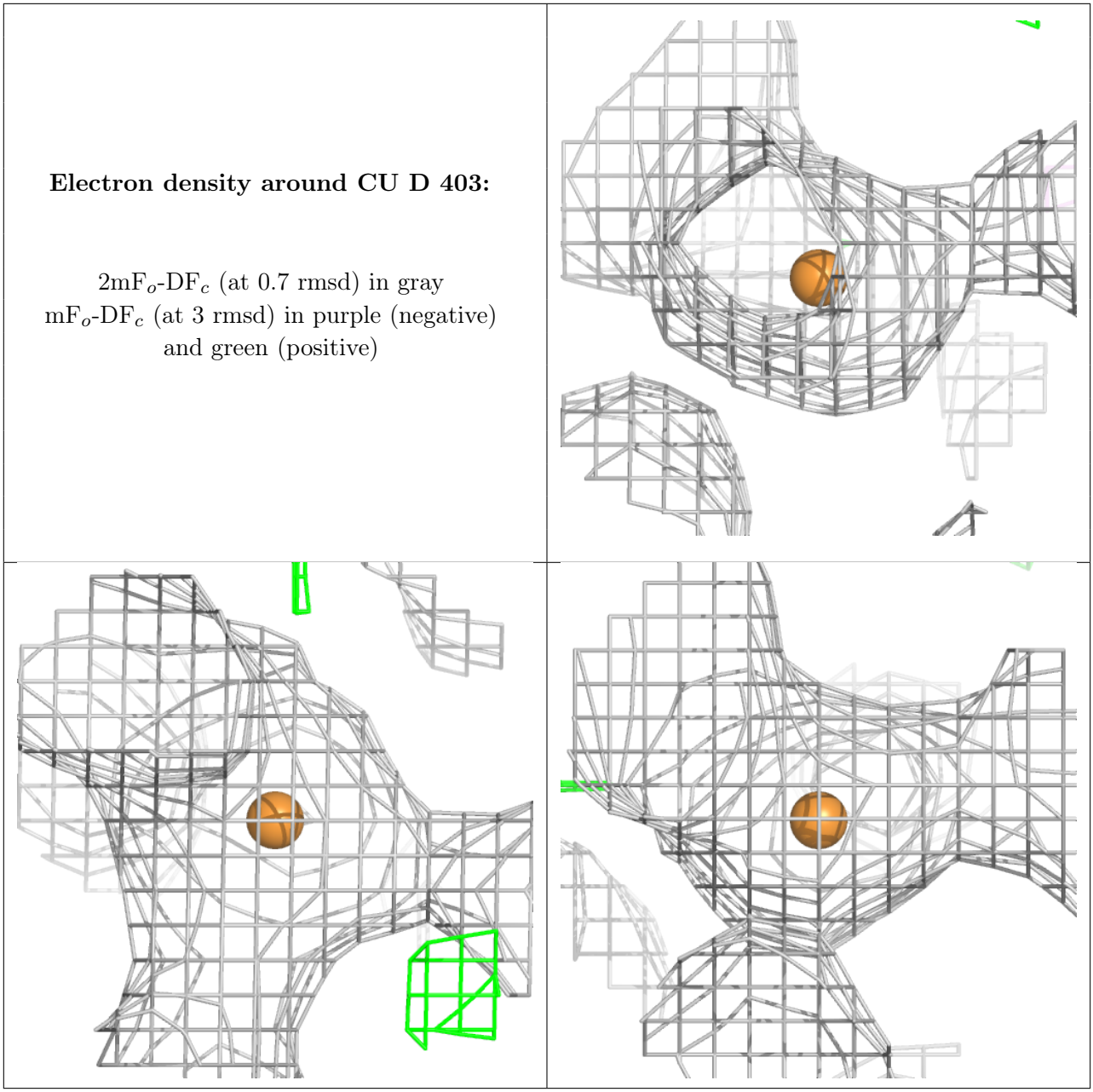
Electron density around CU F 404:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



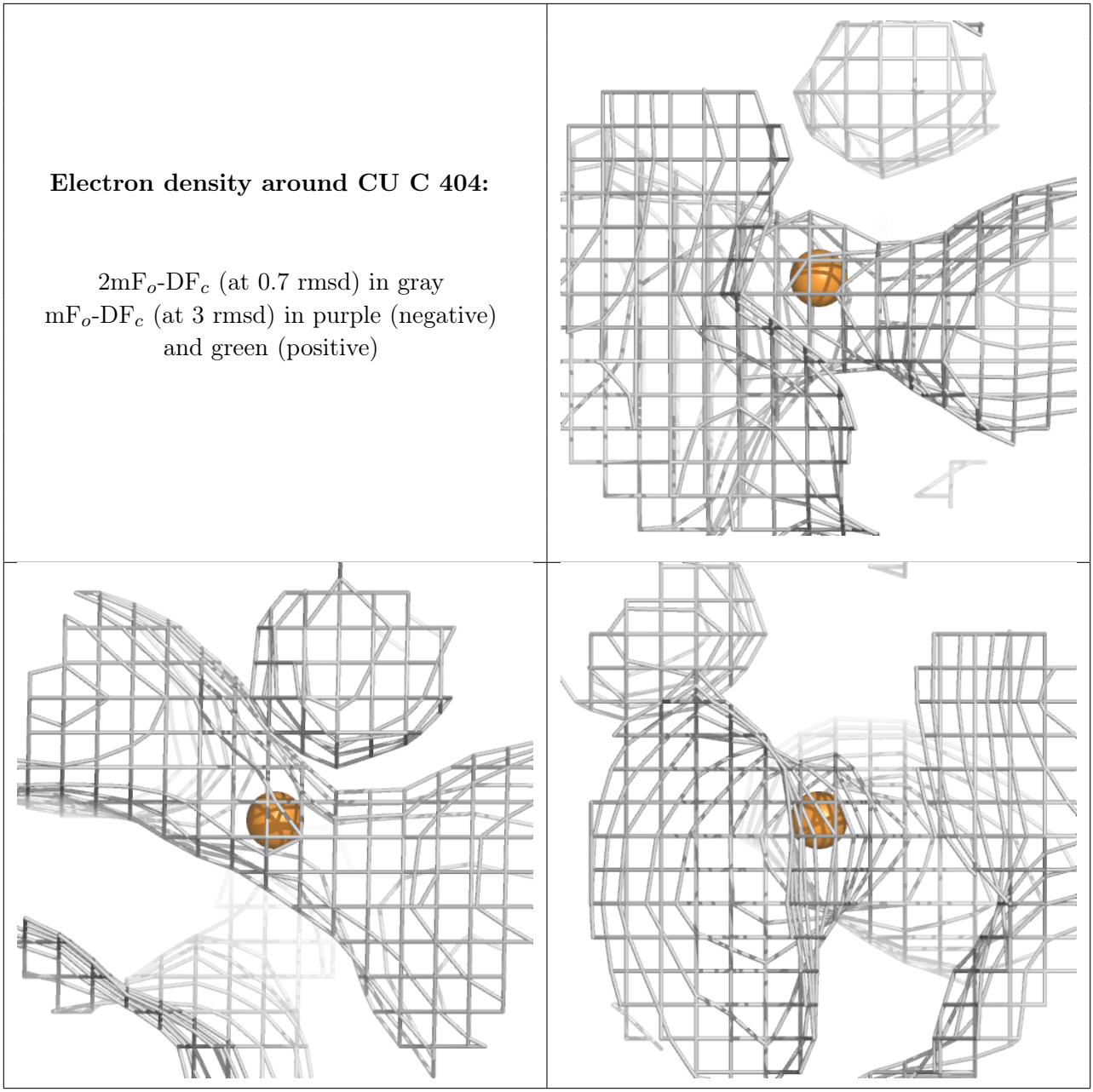
Electron density around CU D 403:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



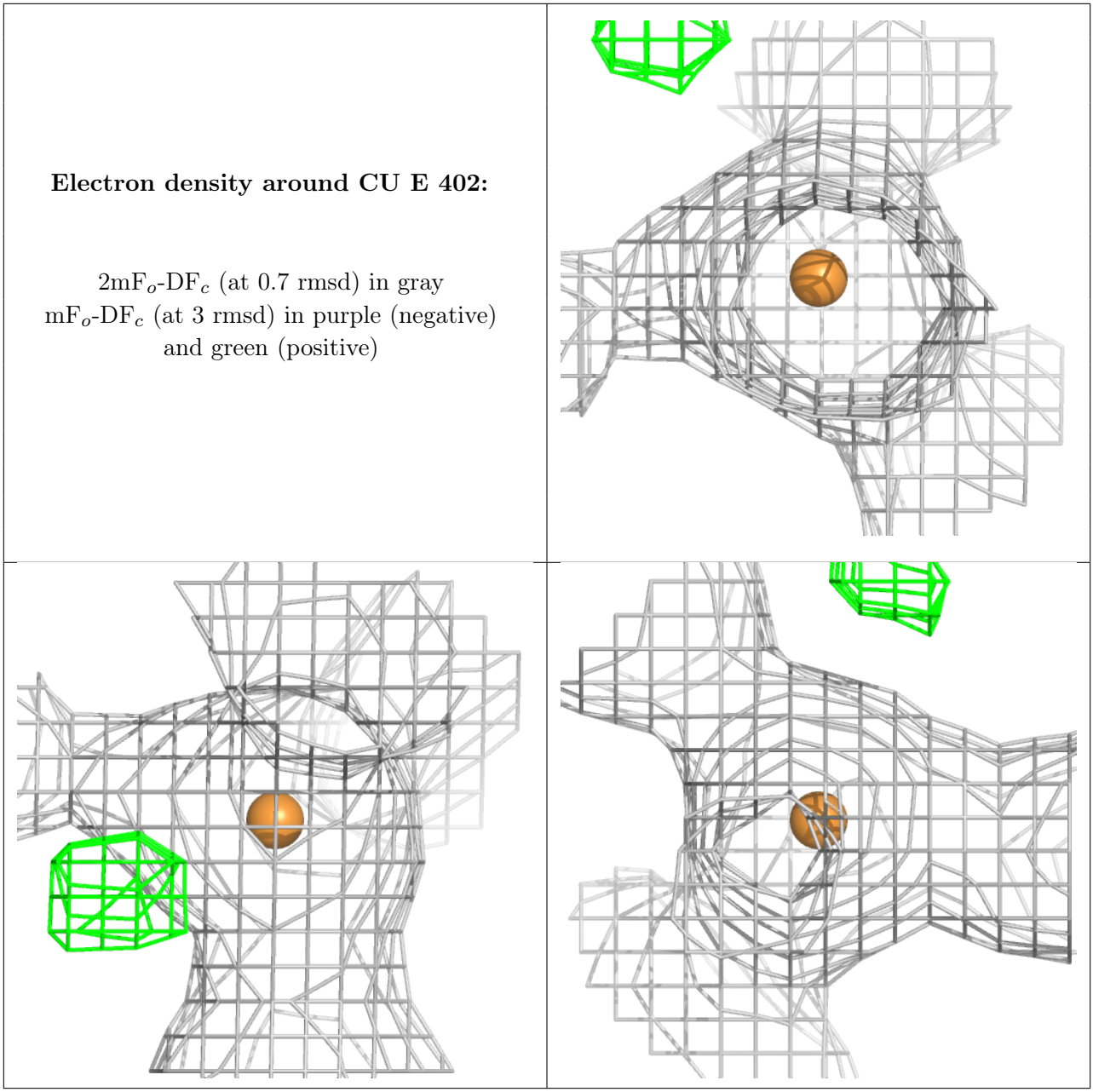
Electron density around CU C 404:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



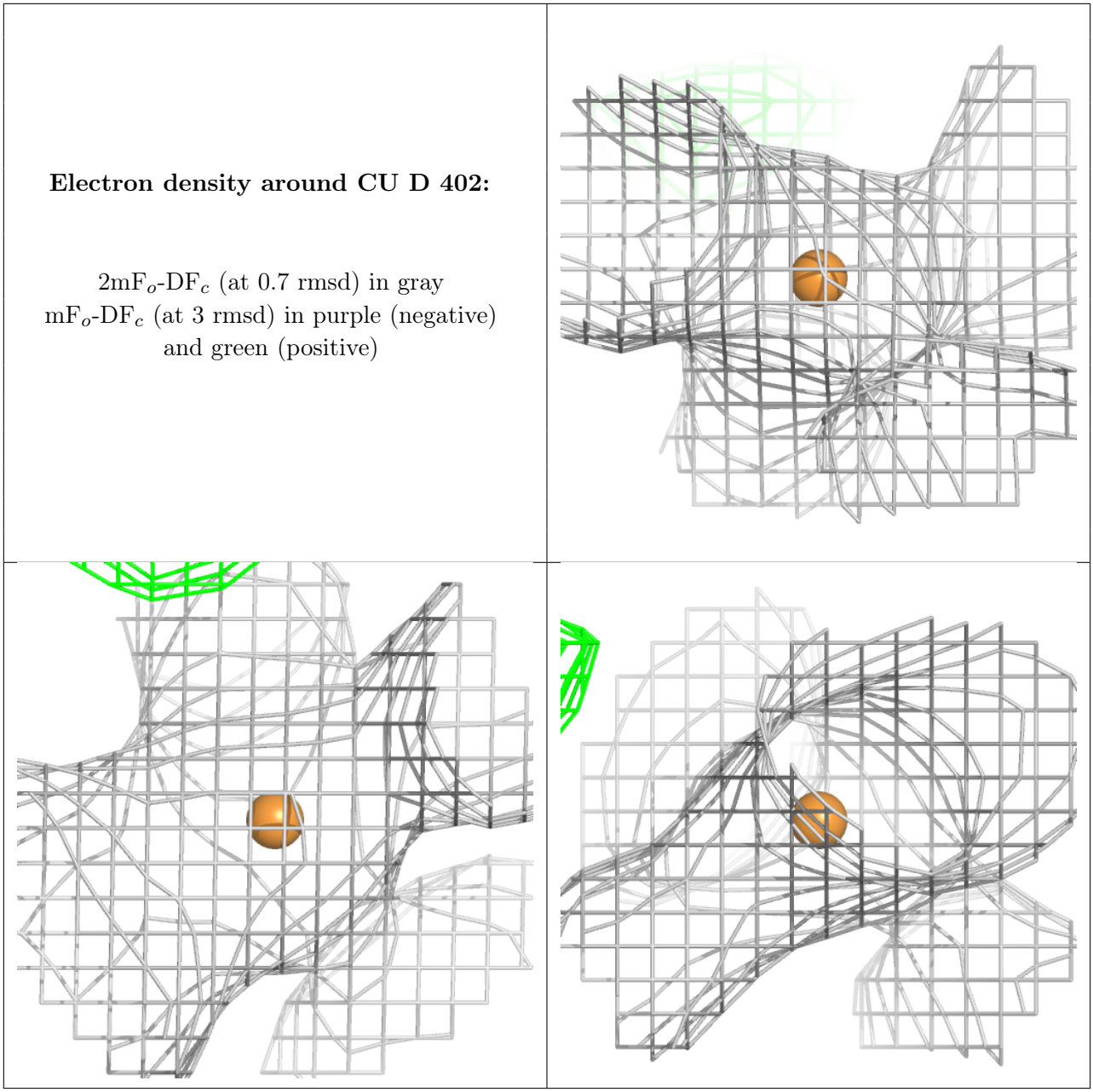
Electron density around CU E 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



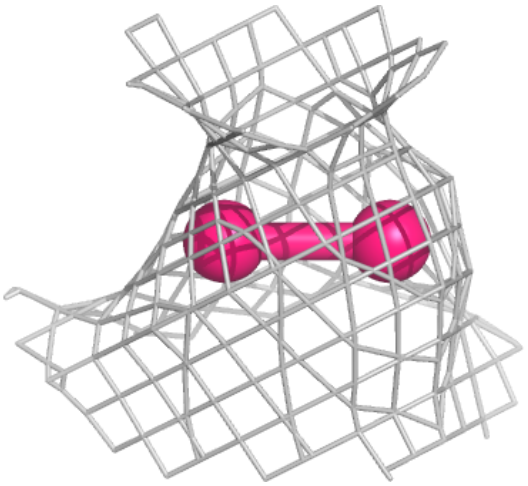
Electron density around CU D 402:

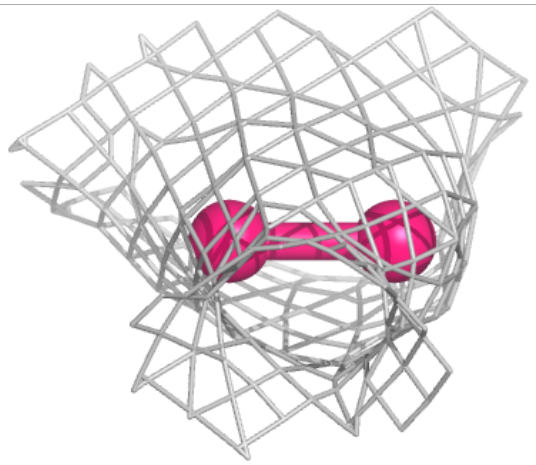
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

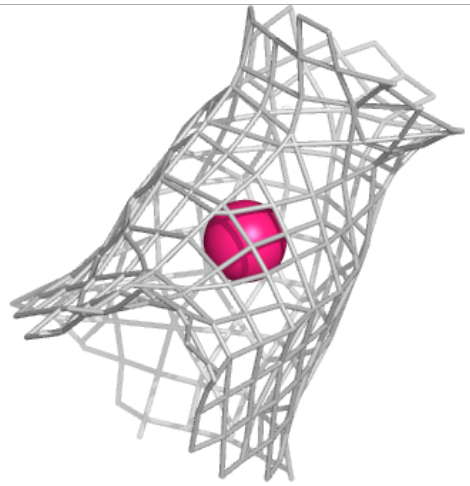


Electron density around OXY C 405:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

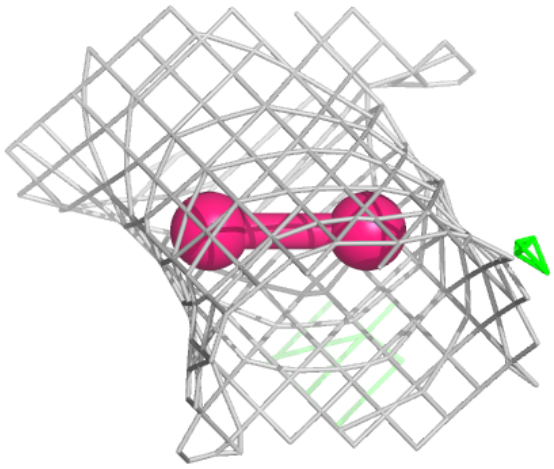


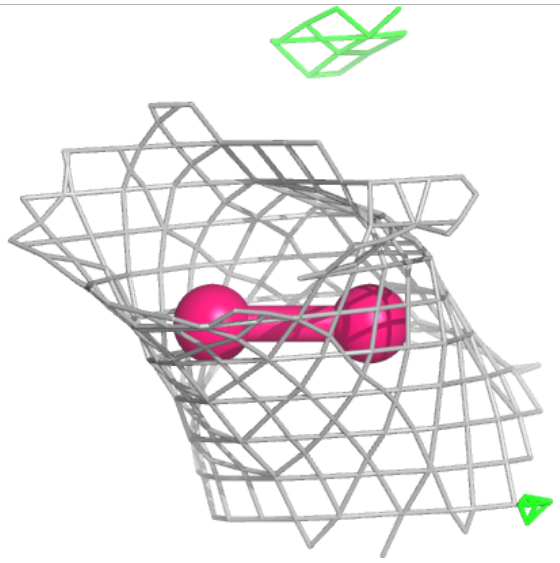


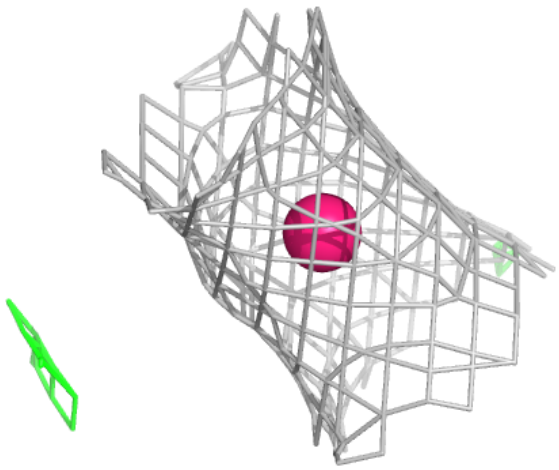


Electron density around OXY D 404:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

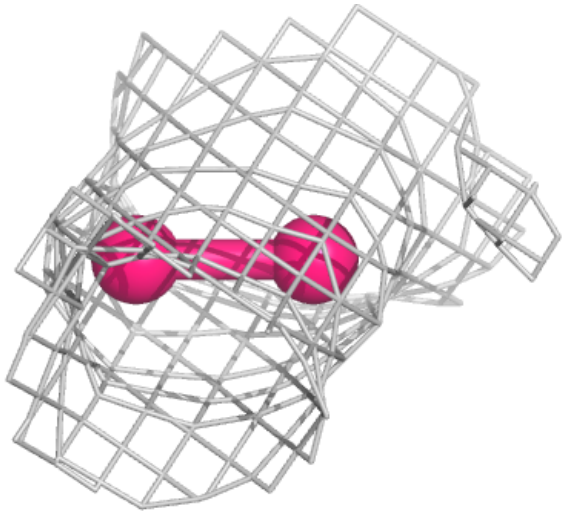


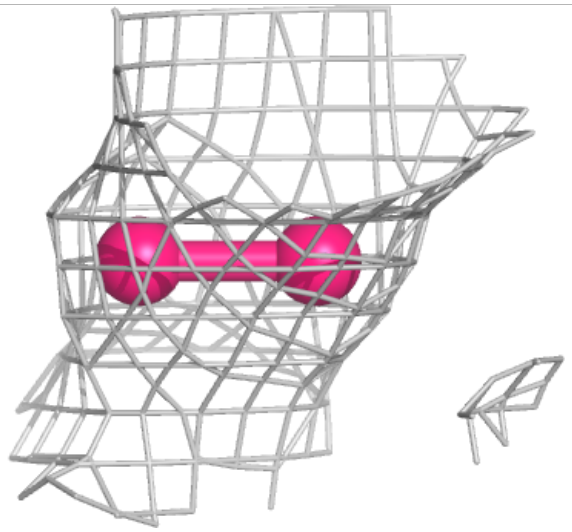


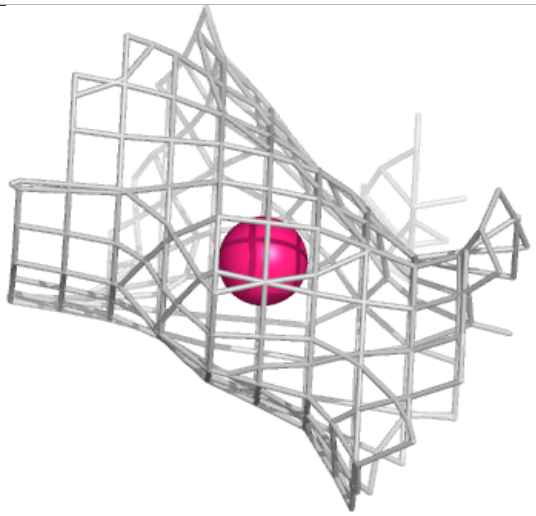


Electron density around OXY F 405:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

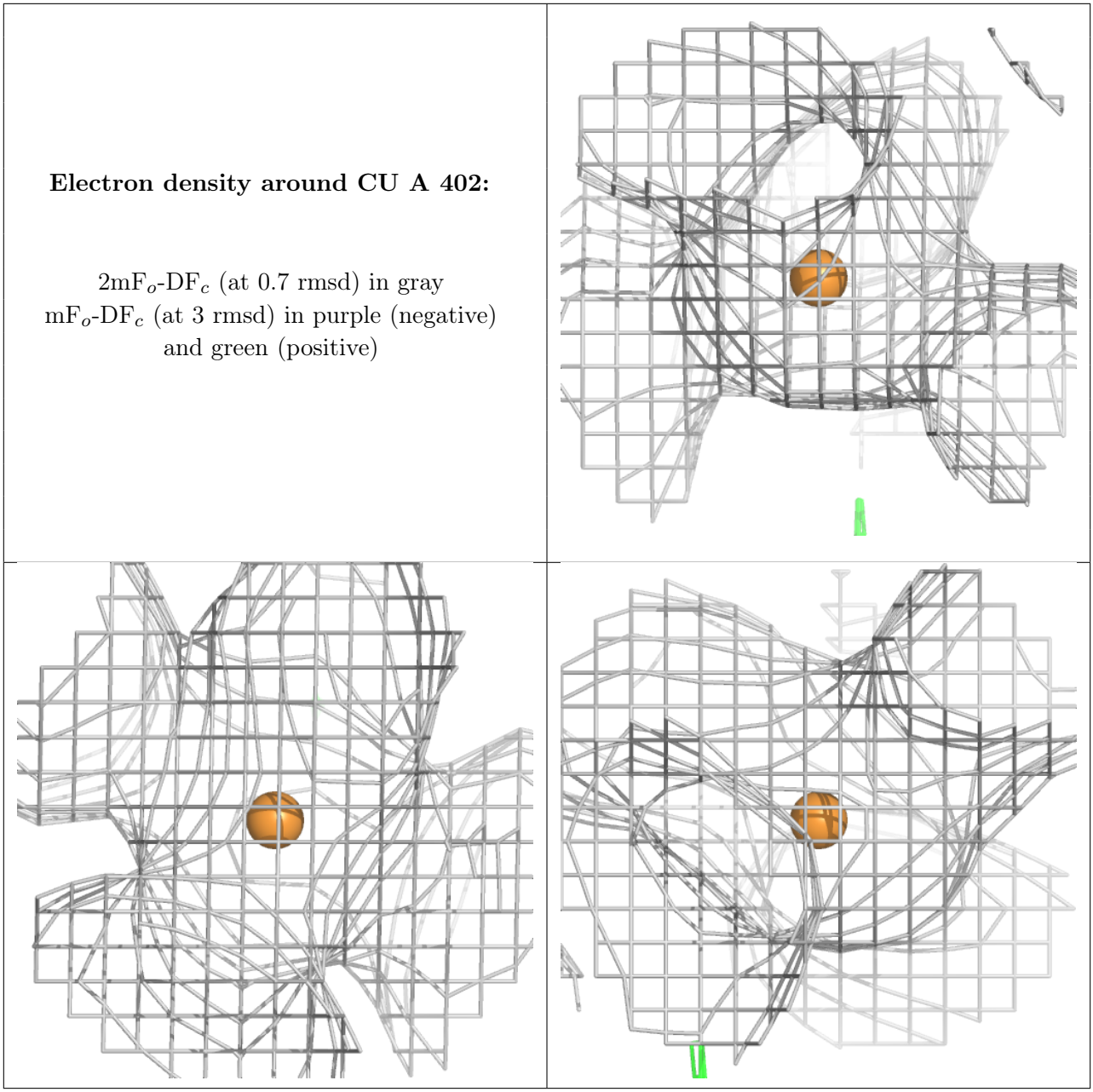






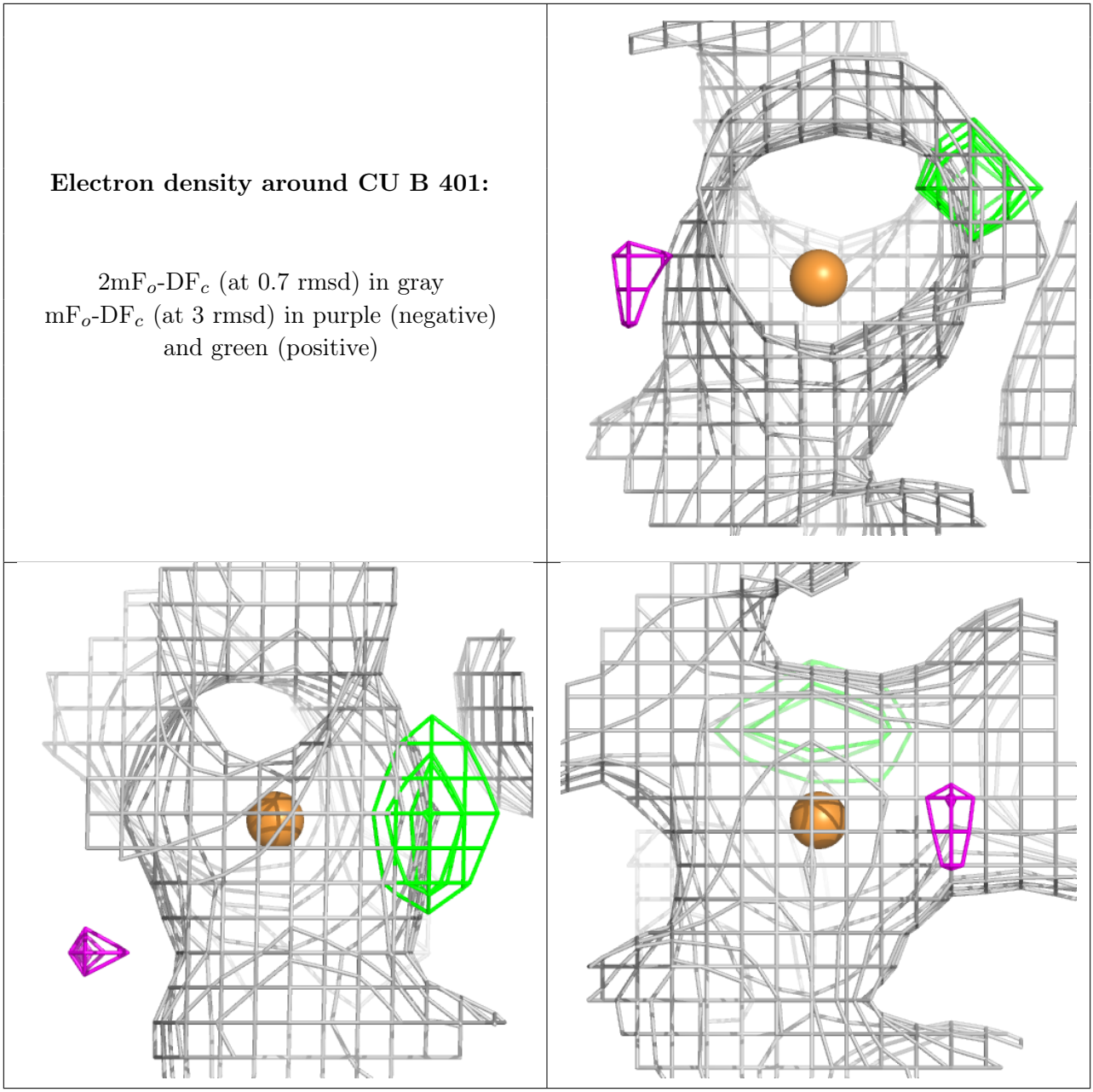
Electron density around CU A 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



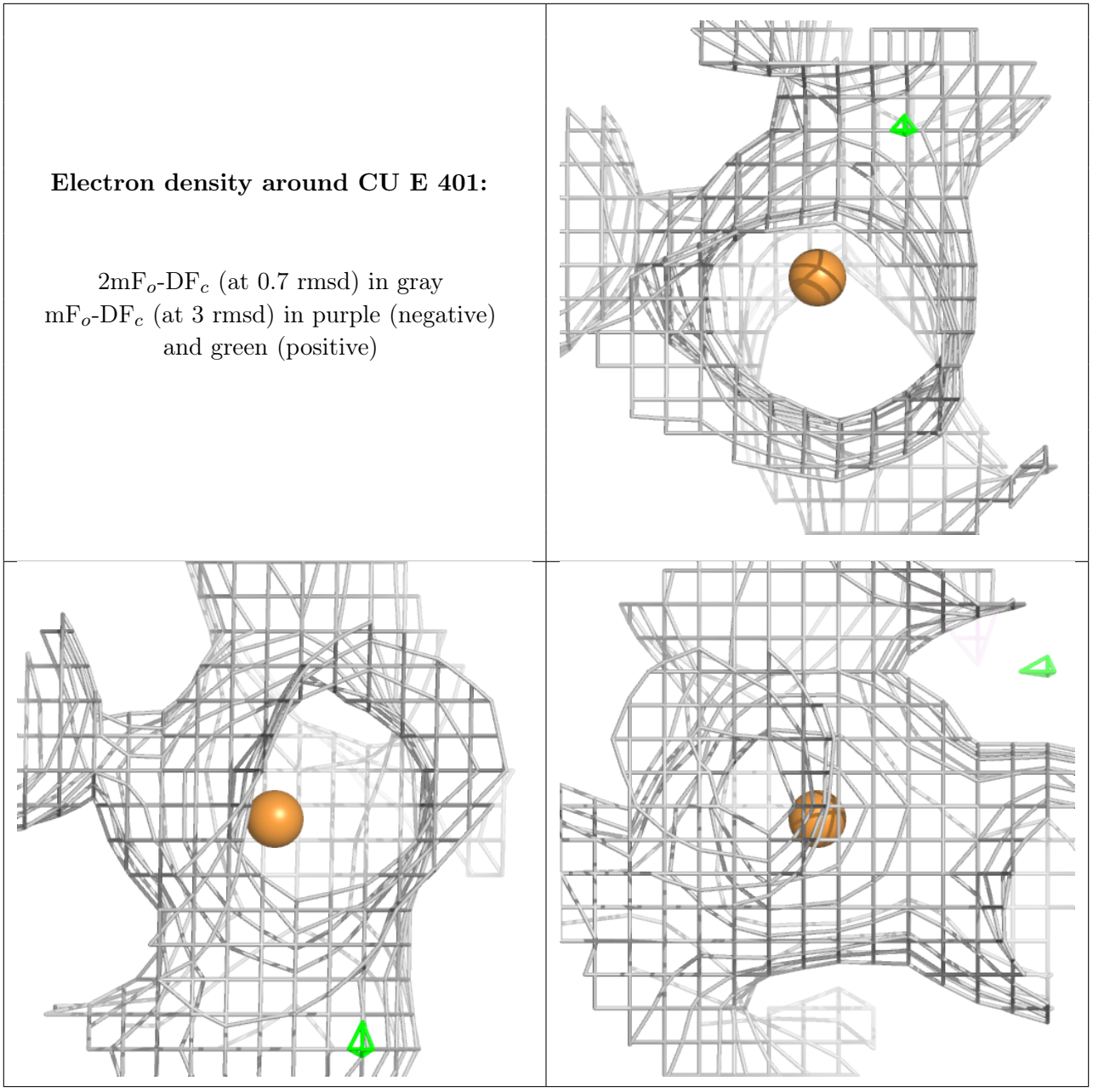
Electron density around CU B 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



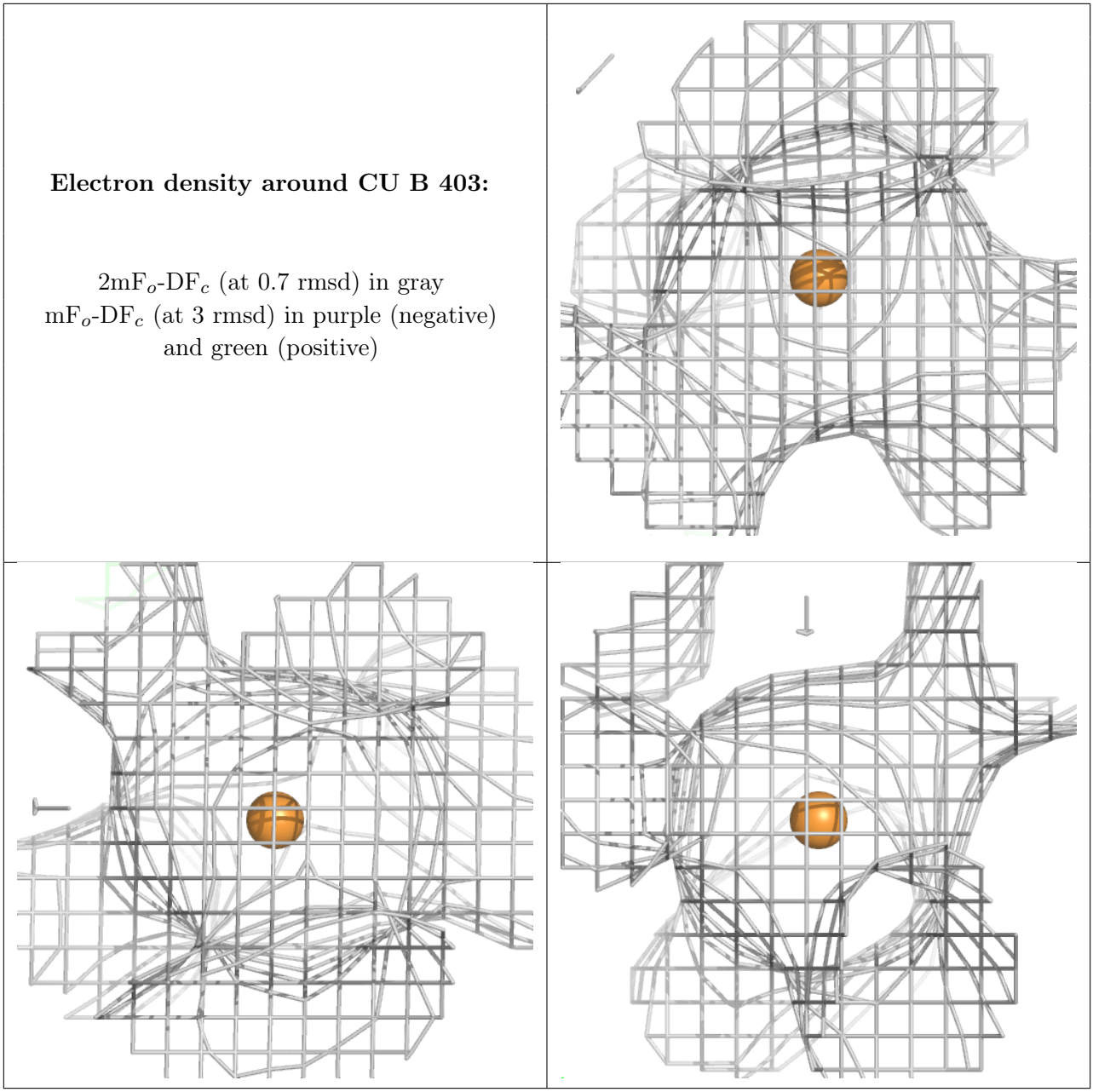
Electron density around CU E 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



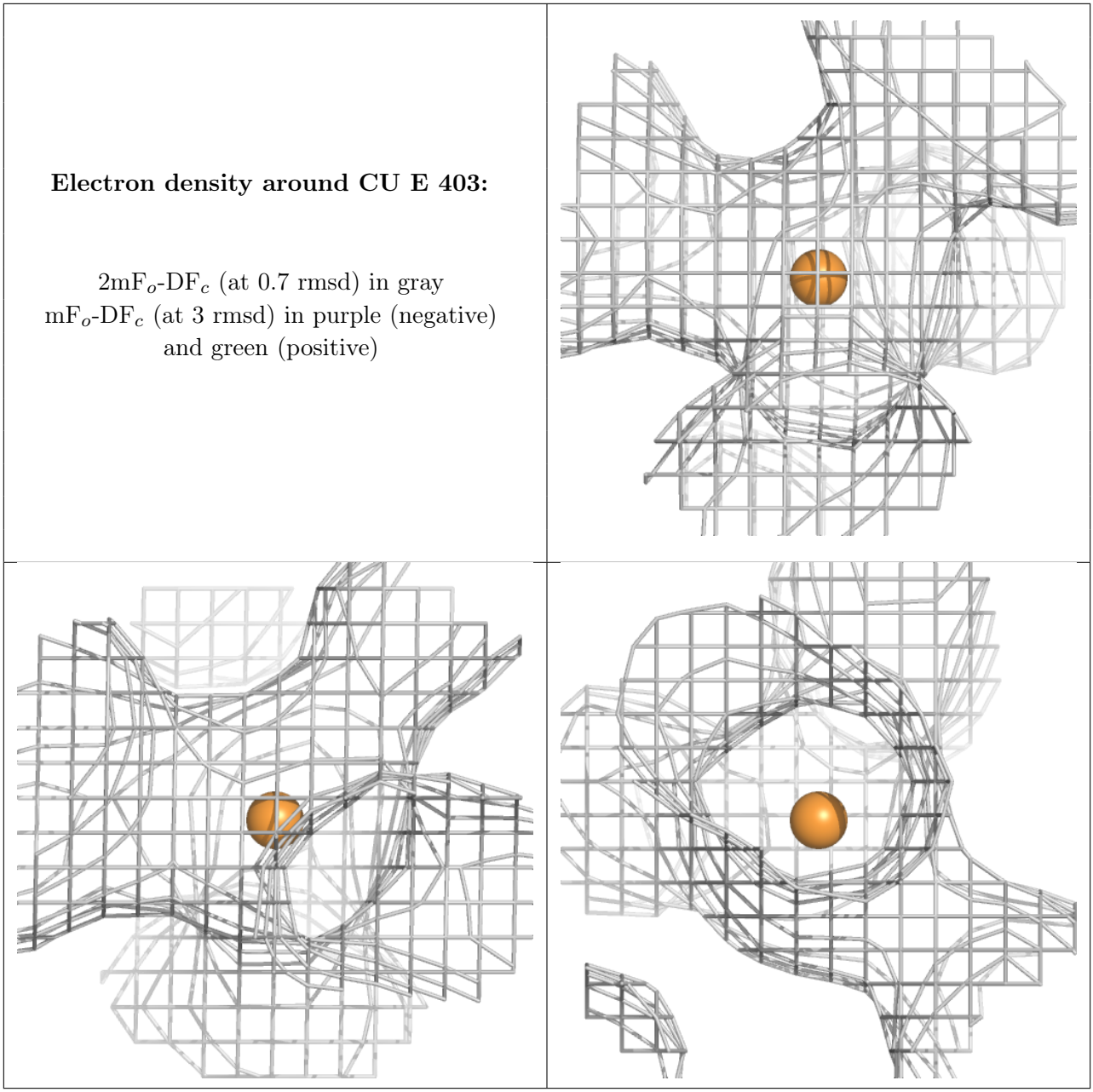
Electron density around CU B 403:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



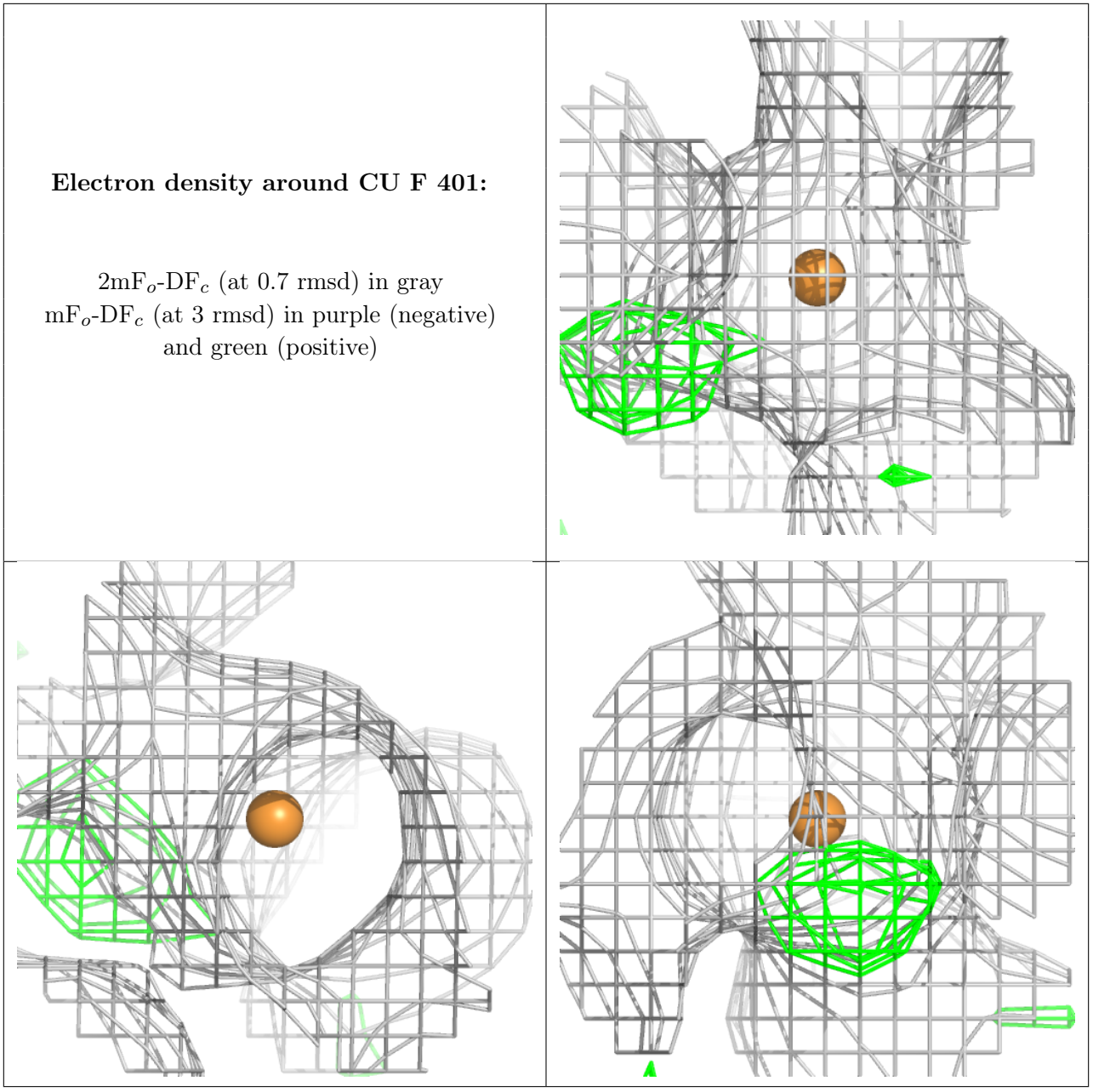
Electron density around CU E 403:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



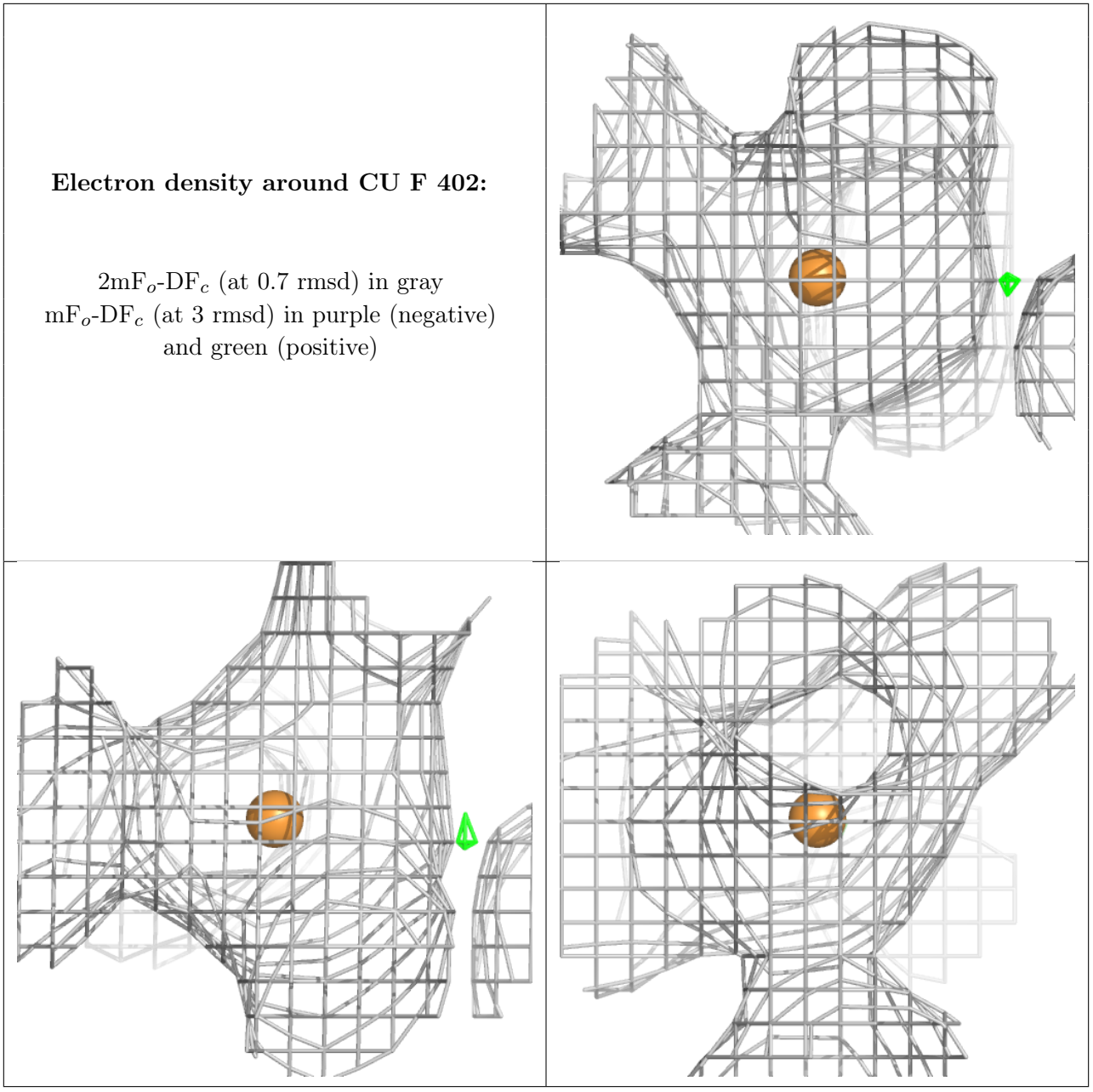
Electron density around CU F 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



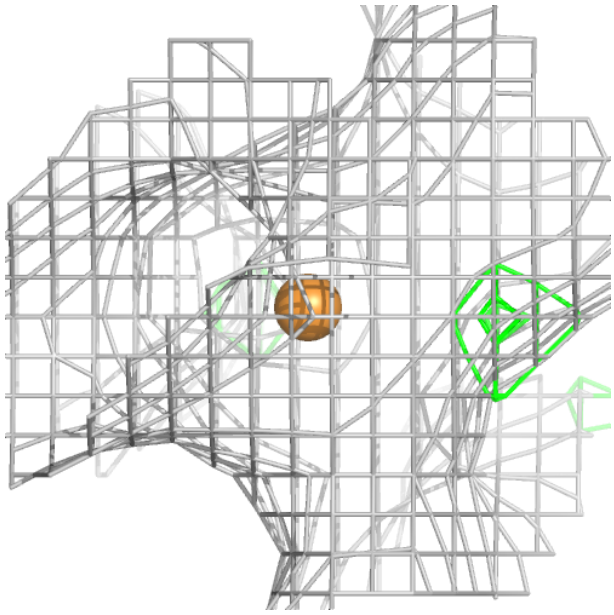
Electron density around CU F 402:

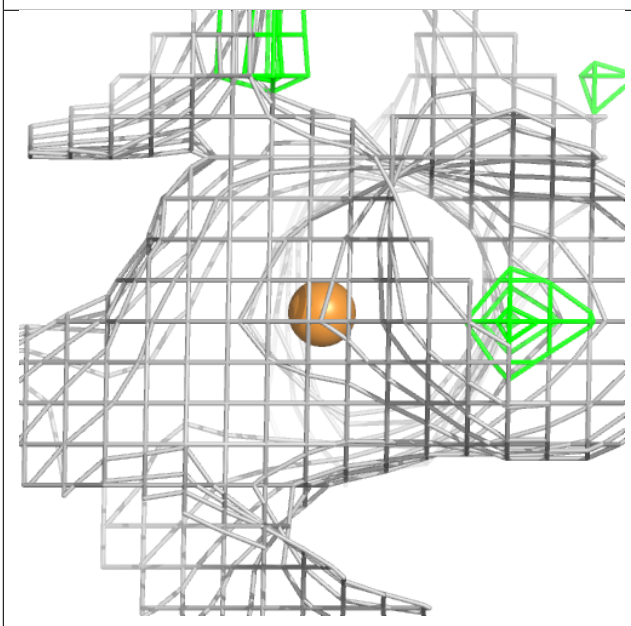
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

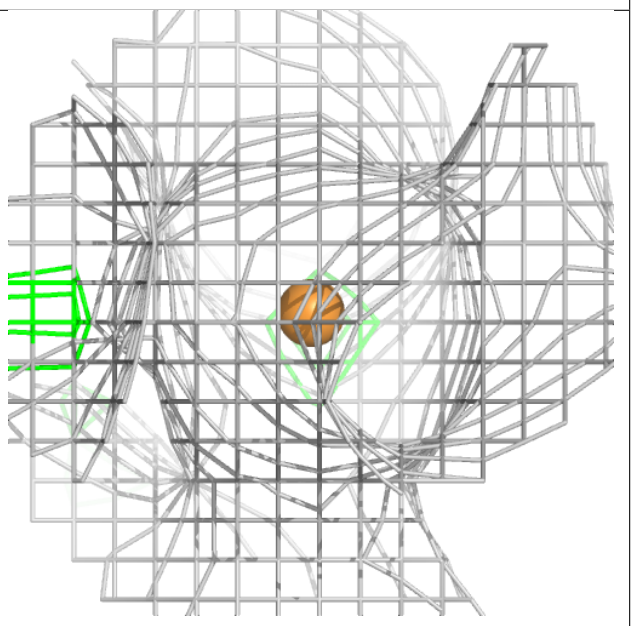


Electron density around CU C 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

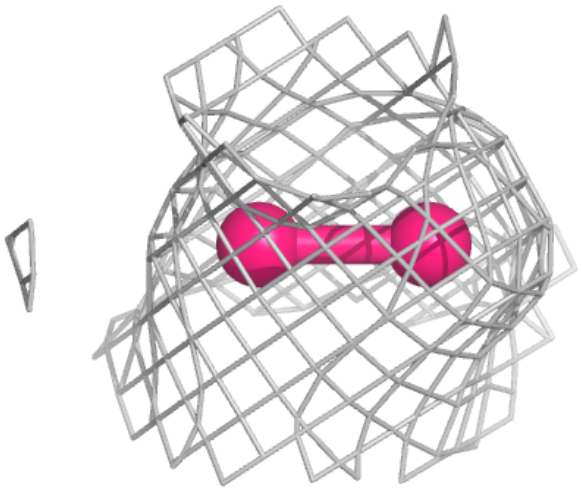


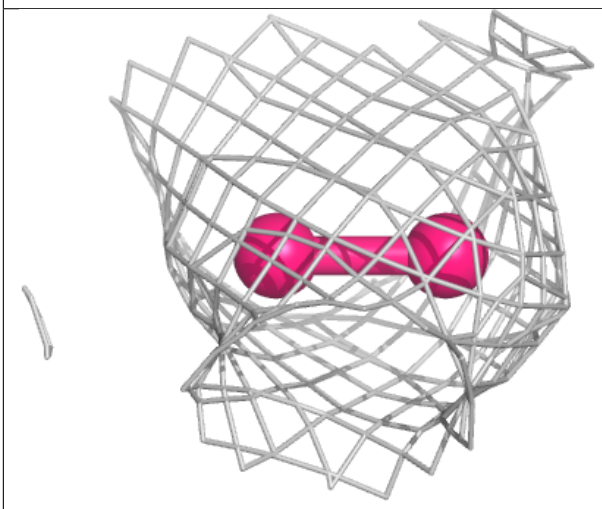


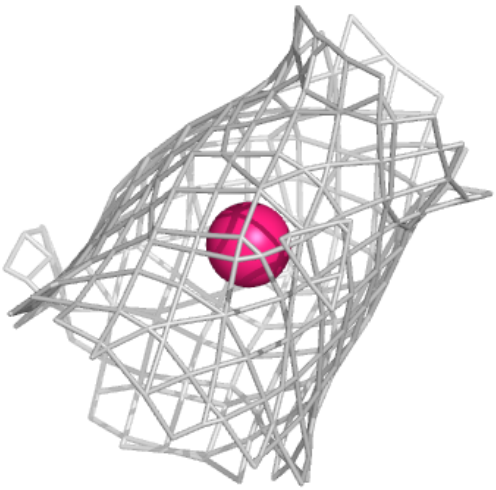


Electron density around OXY A 404:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

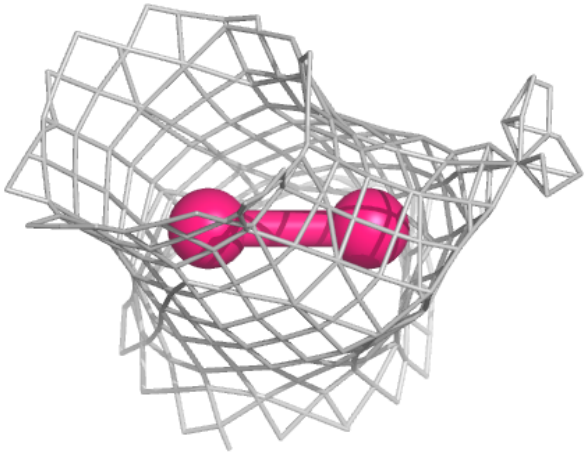


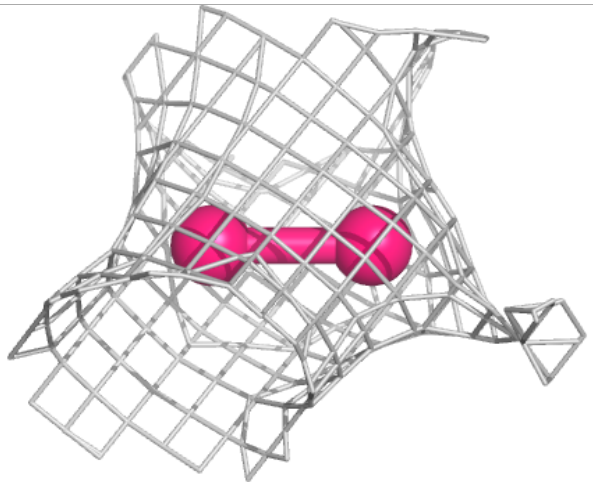


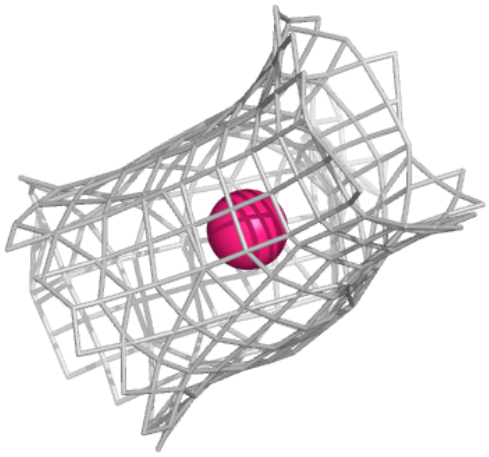


Electron density around OXY B 404:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

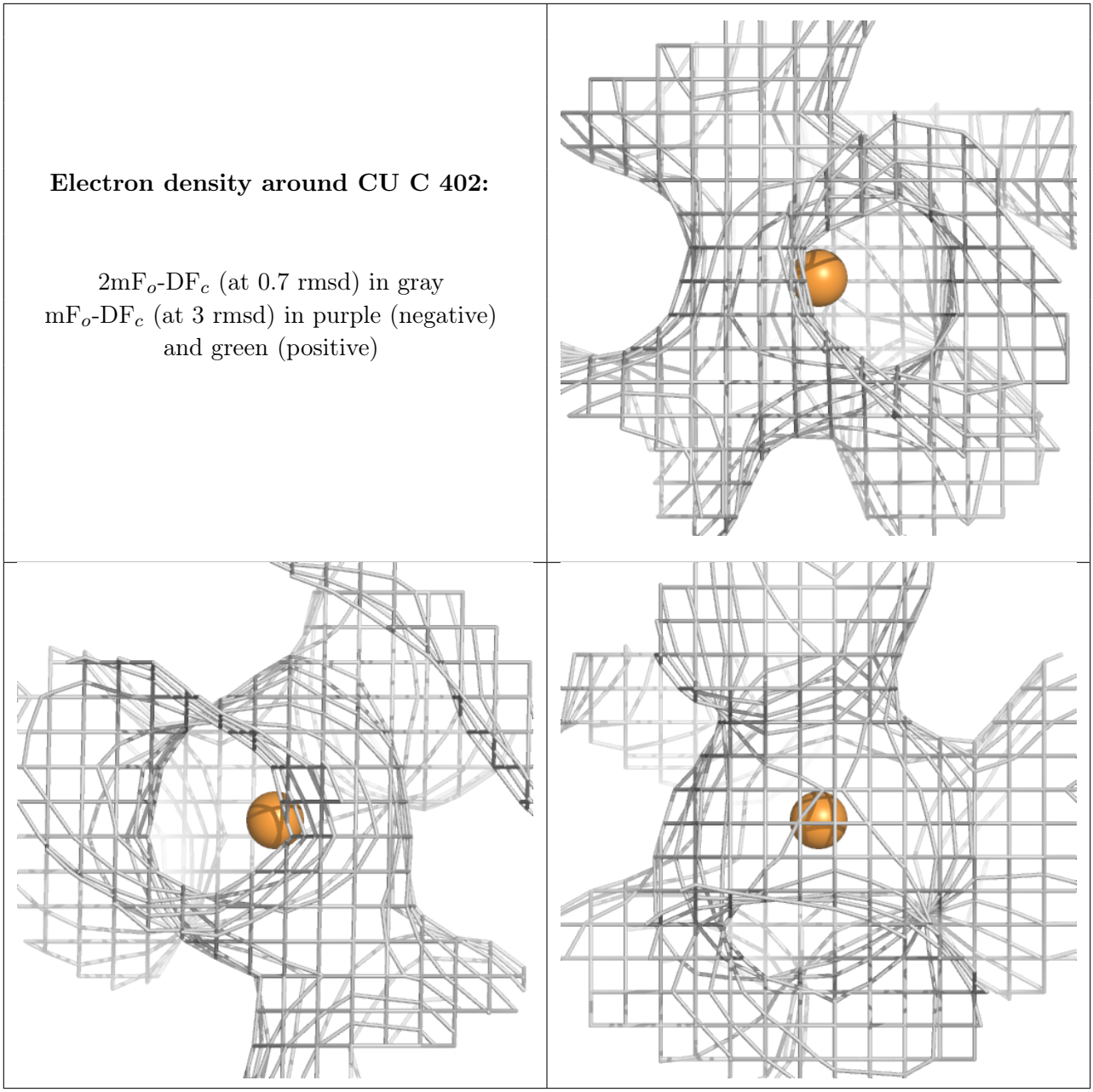






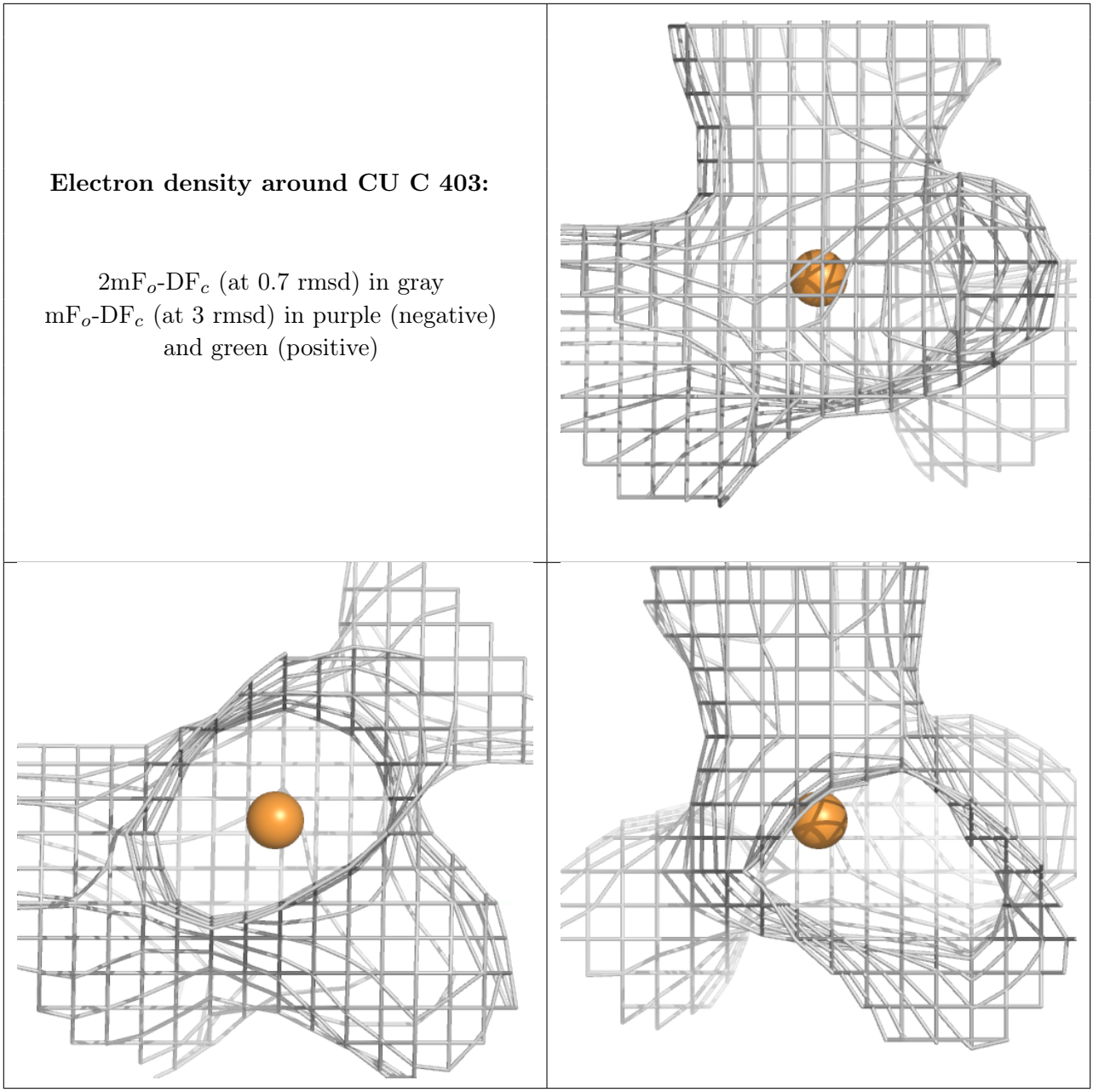
Electron density around CU C 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



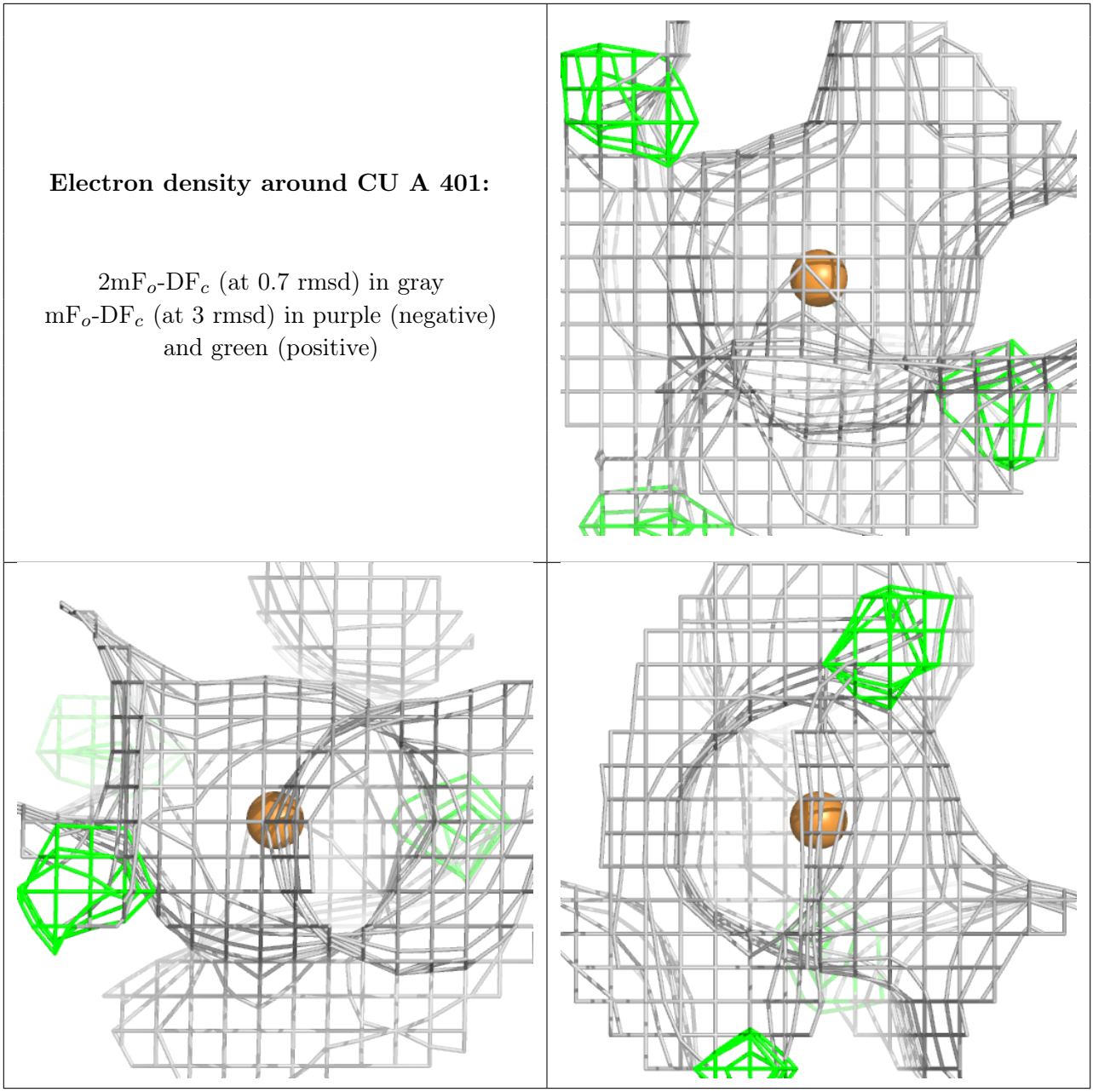
Electron density around CU C 403:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



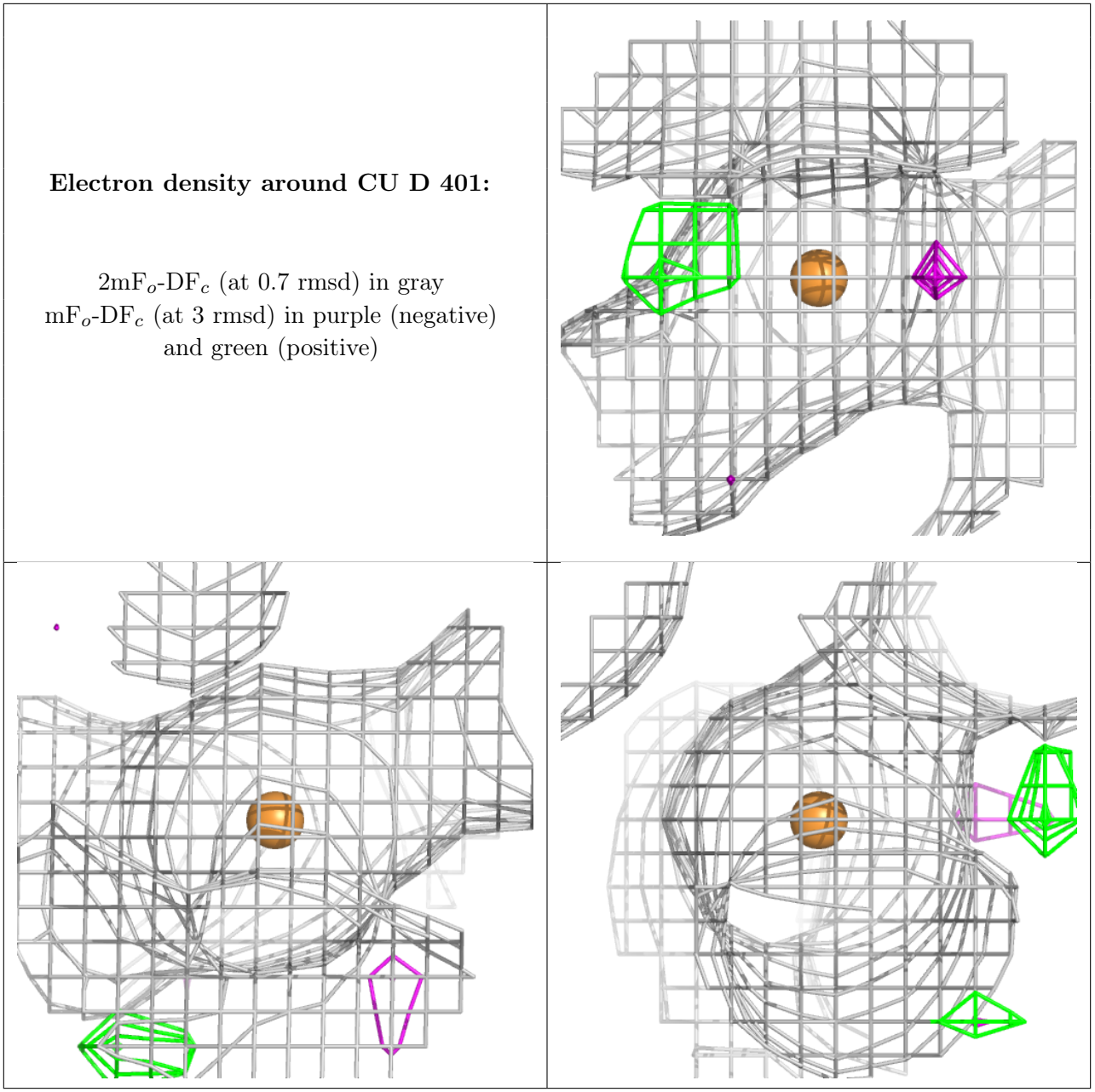
Electron density around CU A 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



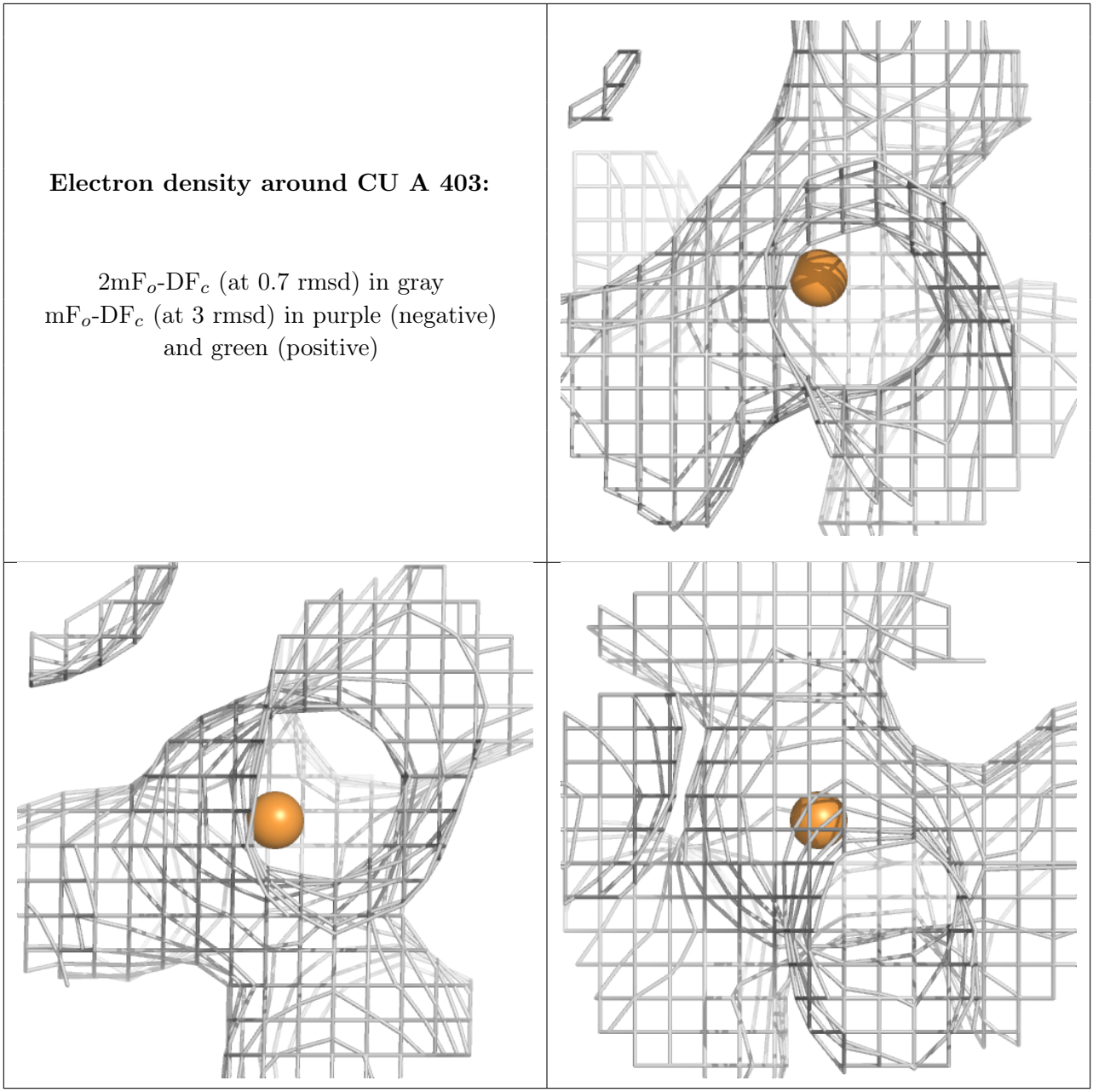
Electron density around CU D 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



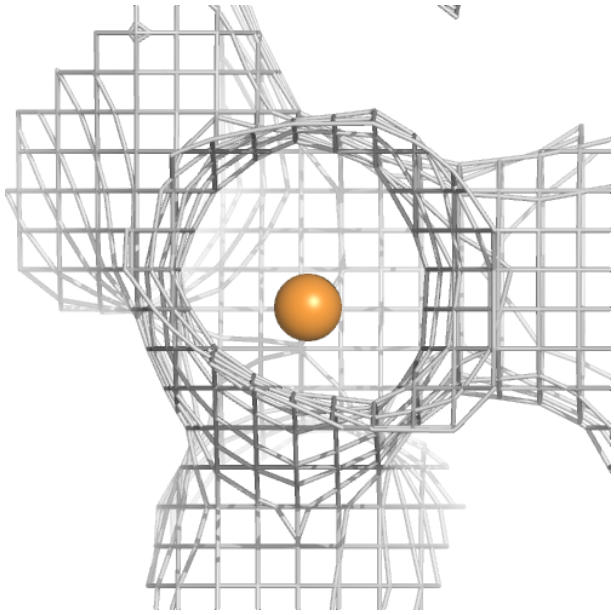
Electron density around CU A 403:

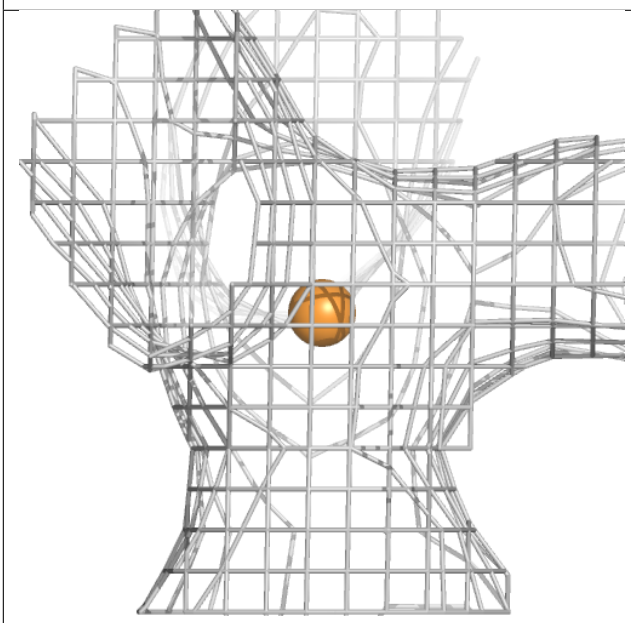
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

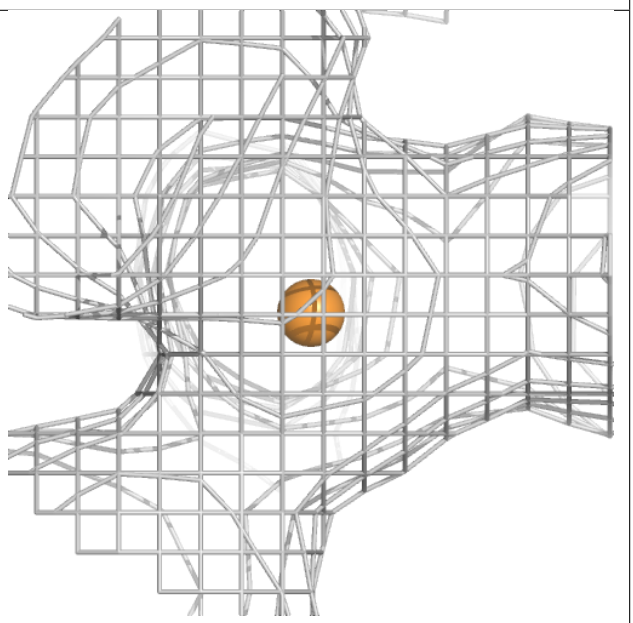


Electron density around CU B 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

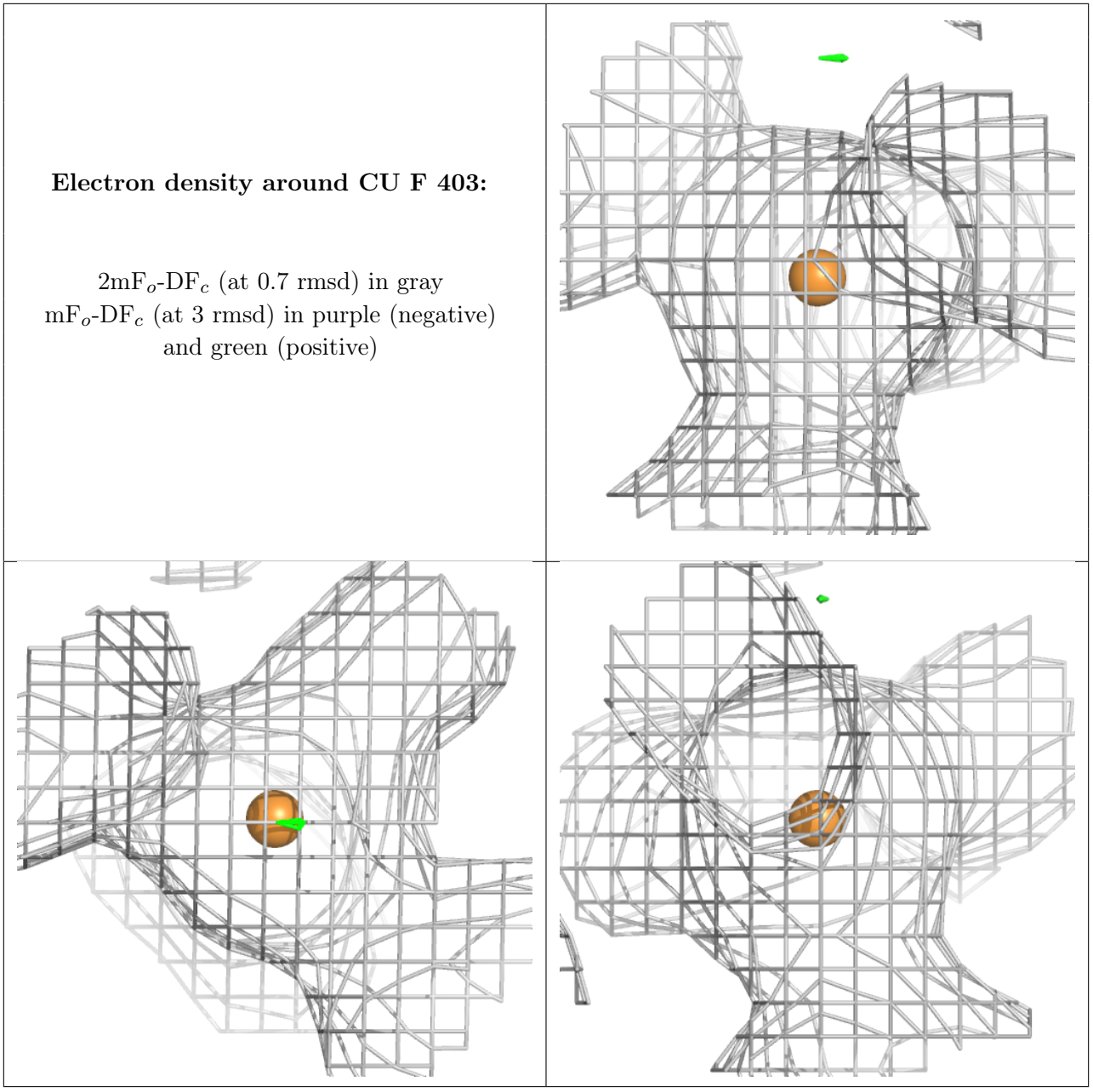






Electron density around CU F 403:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers

There are no such residues in this entry.