Full wwPDB X-ray Structure Validation Report ⓘ

Sep 25, 2023 – 06:29 PM EDT

PDB ID	:	6AYK
Title	:	Crystal structure of TEM1 beta-lactamase mutant I263A in the presence of 1.2 MPa xenon
Authors	:	Roose, B.W.; Dmochowski, I.J.
Deposited on	:	2017-09-08
Resolution	:	1.44 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:

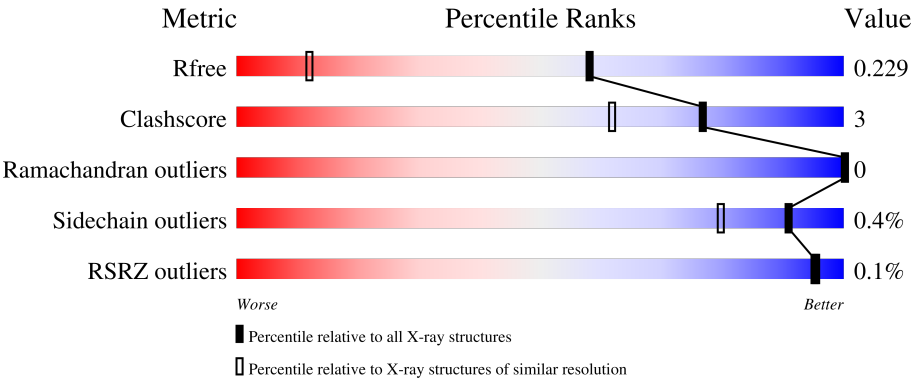
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 1.44 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	2021 (1.46-1.42)
Clashscore	141614	2086 (1.46-1.42)
Ramachandran outliers	138981	2047 (1.46-1.42)
Sidechain outliers	138945	2047 (1.46-1.42)
RSRZ outliers	127900	1993 (1.46-1.42)

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	263	95% 5%
1	B	263	95% 5%
1	C	263	92% 8%
1	D	263	96% .

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	XE	A	301	-	-	X	-
2	XE	B	301	-	-	X	-
2	XE	C	301	-	-	X	-
2	XE	C	303	-	-	X	-
2	XE	D	301	-	-	X	-
2	XE	D	303	-	-	X	-

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 9024 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 Beta-lactamase TEM.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	263	Total	C	N	O	S	0	2	0
			1987	1238	353	386	10			
1	B	263	Total	C	N	O	S	0	1	0
			1999	1248	354	387	10			
1	C	263	Total	C	N	O	S	0	3	0
			2005	1254	354	387	10			
1	D	263	Total	C	N	O	S	0	3	0
			2005	1255	356	384	10			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	182	THR	MET	engineered mutation	UNP P62593
A	263	ALA	ILE	engineered mutation	UNP P62593
B	182	THR	MET	engineered mutation	UNP P62593
B	263	ALA	ILE	engineered mutation	UNP P62593
C	182	THR	MET	engineered mutation	UNP P62593
C	263	ALA	ILE	engineered mutation	UNP P62593
D	182	THR	MET	engineered mutation	UNP P62593
D	263	ALA	ILE	engineered mutation	UNP P62593

- Molecule 2 is XENON (three-letter code: XE) (formula: Xe) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	3	Total	Xe	0	0
			3	3		
2	B	3	Total	Xe	0	0
			3	3		
2	C	3	Total	Xe	0	0
			3	3		
2	D	5	Total	Xe	0	0
			5	5		

- Molecule 3 is water.

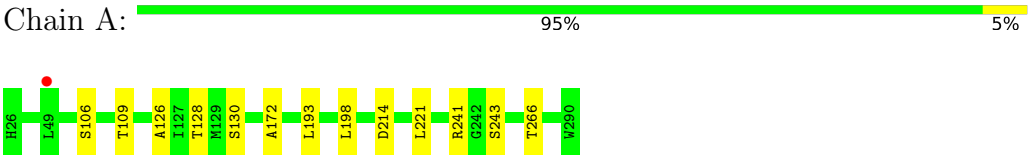
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	270	Total O 270 270	0	0
3	B	264	Total O 264 264	0	0
3	C	232	Total O 232 232	0	0
3	D	248	Total O 248 248	0	0

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.

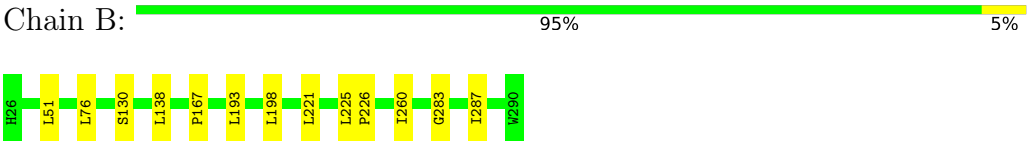
• Molecule 1: Beta-lactamase TEM

Chain A:



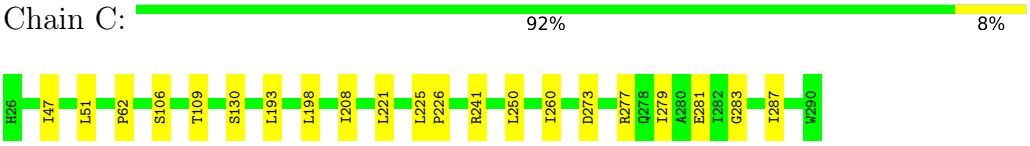
• Molecule 1: Beta-lactamase TEM

Chain B:



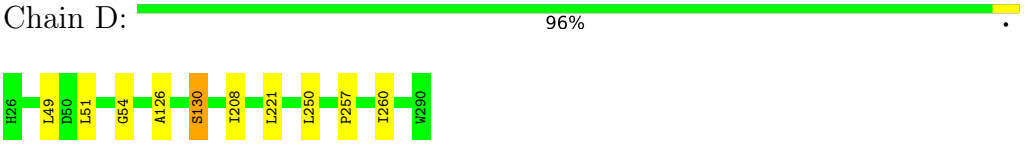
• Molecule 1: Beta-lactamase TEM

Chain C:



• Molecule 1: Beta-lactamase TEM

Chain D:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	60.65Å 84.75Å 95.97Å 90.00° 90.23° 90.00°	Depositor
Resolution (Å)	95.97 – 1.44 95.97 – 1.44	Depositor EDS
% Data completeness (in resolution range)	99.6 (95.97-1.44) 99.6 (95.97-1.44)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.05 (at 1.44Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.197 , 0.219 0.207 , 0.229	Depositor DCC
R_{free} test set	8734 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	12.1	Xtriage
Anisotropy	0.486	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 42.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.073 for h,-k,-l	Xtriage
Reported twinning fraction	0.070 for h,-k,-l	Depositor
Outliers	11 of 174454 reflections (0.006%)	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	9024	wwPDB-VP
Average B, all atoms (Å^2)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 47.08 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.0438e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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: XE

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	0.30	0/2026	0.50	0/2752
1	B	0.30	0/2038	0.50	0/2764
1	C	0.33	0/2050	0.56	0/2781
1	D	0.33	0/2050	0.55	0/2780
All	All	0.32	0/8164	0.53	0/11077

There are no bond length outliers.

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	1987	0	1945	8	0
1	B	1999	0	1984	8	0
1	C	2005	0	1995	19	0
1	D	2005	0	2003	13	0
2	A	3	0	0	2	0
2	B	3	0	0	2	0
2	C	3	0	0	8	0
2	D	5	0	0	9	0
3	A	270	0	0	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	264	0	0	1	0
3	C	232	0	0	3	0
3	D	248	0	0	0	0
All	All	9024	0	7927	48	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 3.

All (48) 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:C:221[A]:LEU:HD21	2:C:301:XE:XE	1.43	1.97
1:B:221:LEU:HD21	2:B:301:XE:XE	1.45	1.95
1:A:221:LEU:HD21	2:A:301:XE:XE	1.48	1.88
1:D:221[A]:LEU:HD21	2:D:301:XE:XE	1.70	1.68
1:C:221[A]:LEU:CD2	2:C:301:XE:XE	2.37	1.45
1:B:221:LEU:CD2	2:B:301:XE:XE	2.39	1.45
1:A:221:LEU:CD2	2:A:301:XE:XE	2.44	1.41
1:C:208:ILE:HD12	2:C:303:XE:XE	1.98	1.41
1:C:208:ILE:CD1	2:C:303:XE:XE	2.55	1.33
1:D:208:ILE:HD12	2:D:303:XE:XE	2.11	1.28
1:D:221[A]:LEU:CD2	2:D:301:XE:XE	2.66	1.21
1:D:208:ILE:CD1	2:D:303:XE:XE	2.77	1.10
1:C:208:ILE:HD11	2:C:303:XE:XE	2.40	0.96
1:D:208:ILE:HD11	2:D:303:XE:XE	2.65	0.74
1:C:51:LEU:HD21	2:C:303:XE:XE	2.74	0.65
1:D:51:LEU:HD21	2:D:303:XE:XE	2.77	0.62
1:D:257:PRO:HG3	2:D:303:XE:XE	2.85	0.55
1:B:167:PRO:HB3	3:B:499:HOH:O	2.08	0.53
1:C:221[B]:LEU:HD21	1:C:250:LEU:HD13	1.91	0.52
1:C:221[A]:LEU:HD22	2:C:301:XE:XE	2.75	0.51
1:C:281:GLU:HG3	3:C:490:HOH:O	2.11	0.51
1:B:51:LEU:HD13	1:B:260:ILE:HG13	1.93	0.50
1:C:273:ASP:HB3	1:C:277:ARG:HH12	1.78	0.49
1:C:279:ILE:HG12	2:C:302:XE:XE	2.92	0.47
1:C:283:GLY:O	1:C:287:ILE:HG12	2.16	0.46
1:D:257:PRO:CG	2:D:303:XE:XE	3.42	0.45
1:D:221[B]:LEU:HD21	1:D:250:LEU:HD13	1.98	0.45
1:C:241:ARG:NE	3:C:403:HOH:O	2.51	0.44
1:D:51:LEU:HD13	1:D:260:ILE:HG13	1.99	0.44
1:C:51:LEU:HD13	1:C:260:ILE:HG13	2.00	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:193:LEU:HD23	1:A:198:LEU:HD23	2.01	0.43
1:C:106:SER:HB3	1:C:109:THR:OG1	2.18	0.43
1:A:243[B]:SER:HB3	1:A:266:THR:HG1	1.82	0.43
1:B:193:LEU:HD23	1:B:198:LEU:HD23	2.01	0.43
1:C:241:ARG:NE	3:C:404:HOH:O	2.51	0.42
1:A:106:SER:HB3	1:A:109:THR:OG1	2.19	0.42
1:B:76:LEU:HD21	1:B:138:LEU:HB2	2.01	0.42
1:A:172:ALA:O	1:A:241:ARG:HD2	2.19	0.42
1:B:225:LEU:HA	1:B:226:PRO:HD3	1.96	0.41
1:A:128:THR:HA	1:A:214:ASP:HA	2.01	0.41
1:D:126:ALA:O	1:D:130:SER:HA	2.21	0.41
1:C:47:ILE:HD11	1:C:62:PRO:HB3	2.02	0.41
1:A:126:ALA:O	1:A:130:SER:HA	2.20	0.40
1:B:283:GLY:O	1:B:287:ILE:HG12	2.21	0.40
1:C:193:LEU:HD23	1:C:198:LEU:HD23	2.04	0.40
1:C:225:LEU:HA	1:C:226:PRO:HD3	1.98	0.40
1:D:49:LEU:HD11	1:D:54:GLY:O	2.22	0.40
1:D:221[A]:LEU:CG	2:D:301:XE:XE	3.44	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	263/263 (100%)	257 (98%)	6 (2%)	0	100	100
1	B	262/263 (100%)	257 (98%)	5 (2%)	0	100	100
1	C	264/263 (100%)	259 (98%)	5 (2%)	0	100	100
1	D	264/263 (100%)	257 (97%)	7 (3%)	0	100	100
All	All	1053/1052 (100%)	1030 (98%)	23 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains

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	206/216 (95%)	206 (100%)	0	100	100
1	B	210/216 (97%)	209 (100%)	1 (0%)	88	74
1	C	211/216 (98%)	210 (100%)	1 (0%)	88	74
1	D	211/216 (98%)	210 (100%)	1 (0%)	88	74
All	All	838/864 (97%)	835 (100%)	3 (0%)	91	80

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	130	SER
1	C	130	SER
1	D	130	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

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

5.5 Carbohydrates

There are no monosaccharides in this entry.

5.6 Ligand geometry

Of 14 ligands modelled in this entry, 14 are monoatomic - leaving 0 for Mogul analysis.

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.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

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	263/263 (100%)	-0.30	1 (0%) 92 93	8, 13, 23, 33	0
1	B	263/263 (100%)	-0.29	0 100 100	8, 12, 22, 34	0
1	C	263/263 (100%)	-0.27	0 100 100	8, 13, 23, 31	0
1	D	263/263 (100%)	-0.30	0 100 100	7, 12, 22, 37	0
All	All	1052/1052 (100%)	-0.29	1 (0%) 95 95	7, 13, 23, 37	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	49	LEU	2.6

6.2 Non-standard residues in protein, DNA, RNA chains

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

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands

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
2	XE	D	304	1/1	0.79	0.33	19,19,19,19	1

Continued on next page...

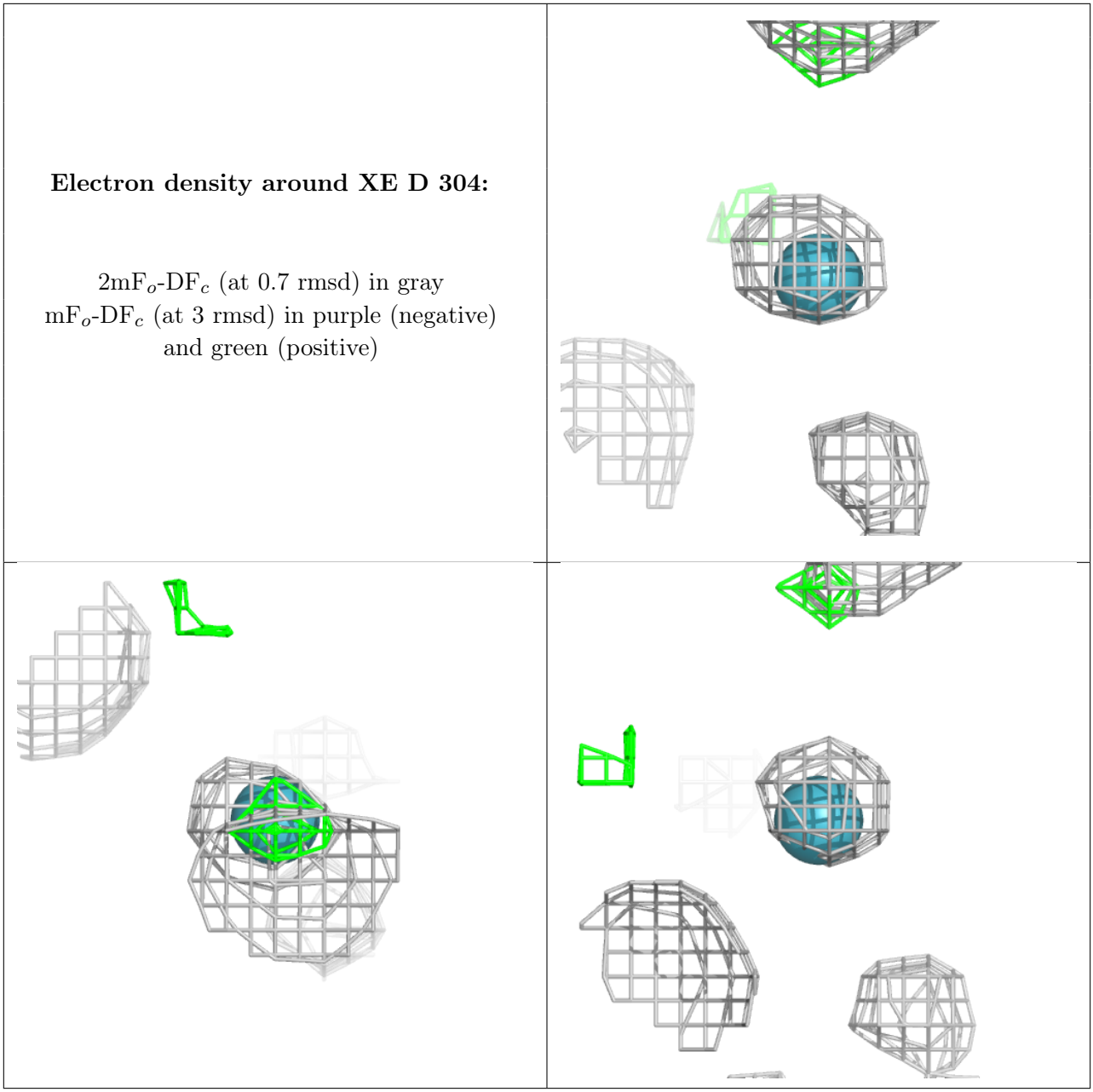
Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	XE	B	303	1/1	0.89	0.48	24,24,24,24	1
2	XE	C	303	1/1	0.93	0.10	17,17,17,17	1
2	XE	A	303	1/1	0.94	0.14	15,15,15,15	1
2	XE	D	305	1/1	0.95	0.07	31,31,31,31	1
2	XE	C	302	1/1	0.96	0.07	17,17,17,17	1
2	XE	D	302	1/1	0.97	0.07	17,17,17,17	1
2	XE	D	303	1/1	0.97	0.09	20,20,20,20	1
2	XE	C	301	1/1	0.98	0.07	15,15,15,15	1
2	XE	D	301	1/1	0.98	0.09	17,17,17,17	1
2	XE	B	302	1/1	0.98	0.07	16,16,16,16	1
2	XE	A	301	1/1	0.99	0.06	15,15,15,15	1
2	XE	B	301	1/1	0.99	0.06	15,15,15,15	1
2	XE	A	302	1/1	0.99	0.05	16,16,16,16	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.

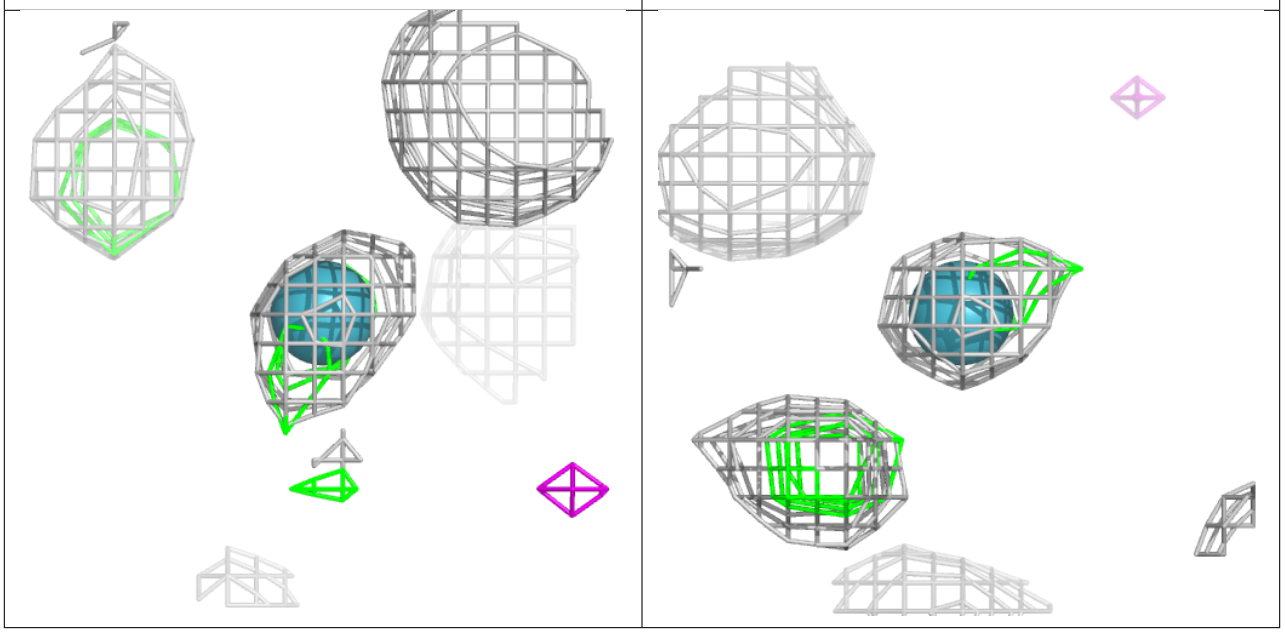
Electron density around XE D 304:

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



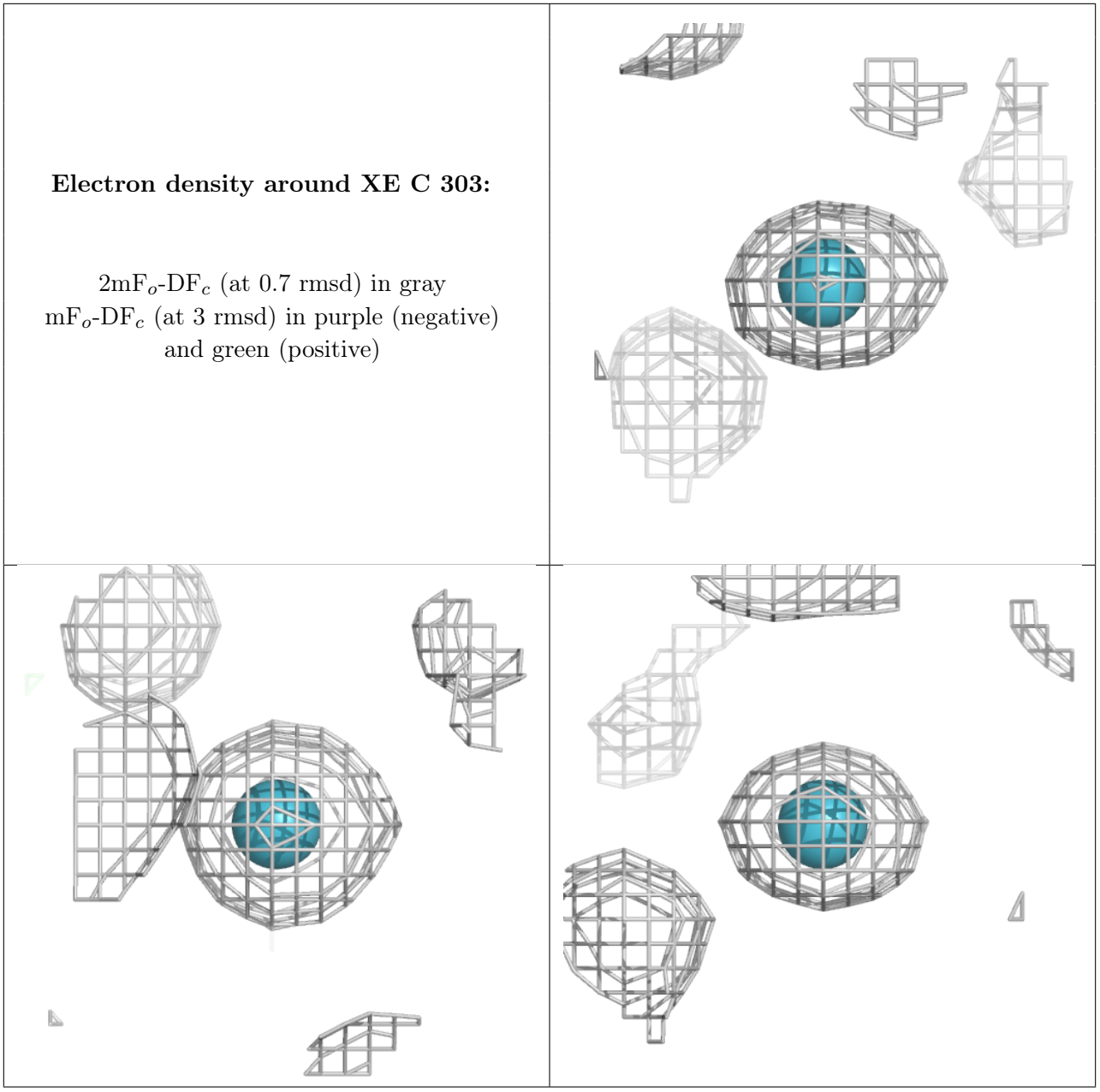
Electron density around XE B 303:

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



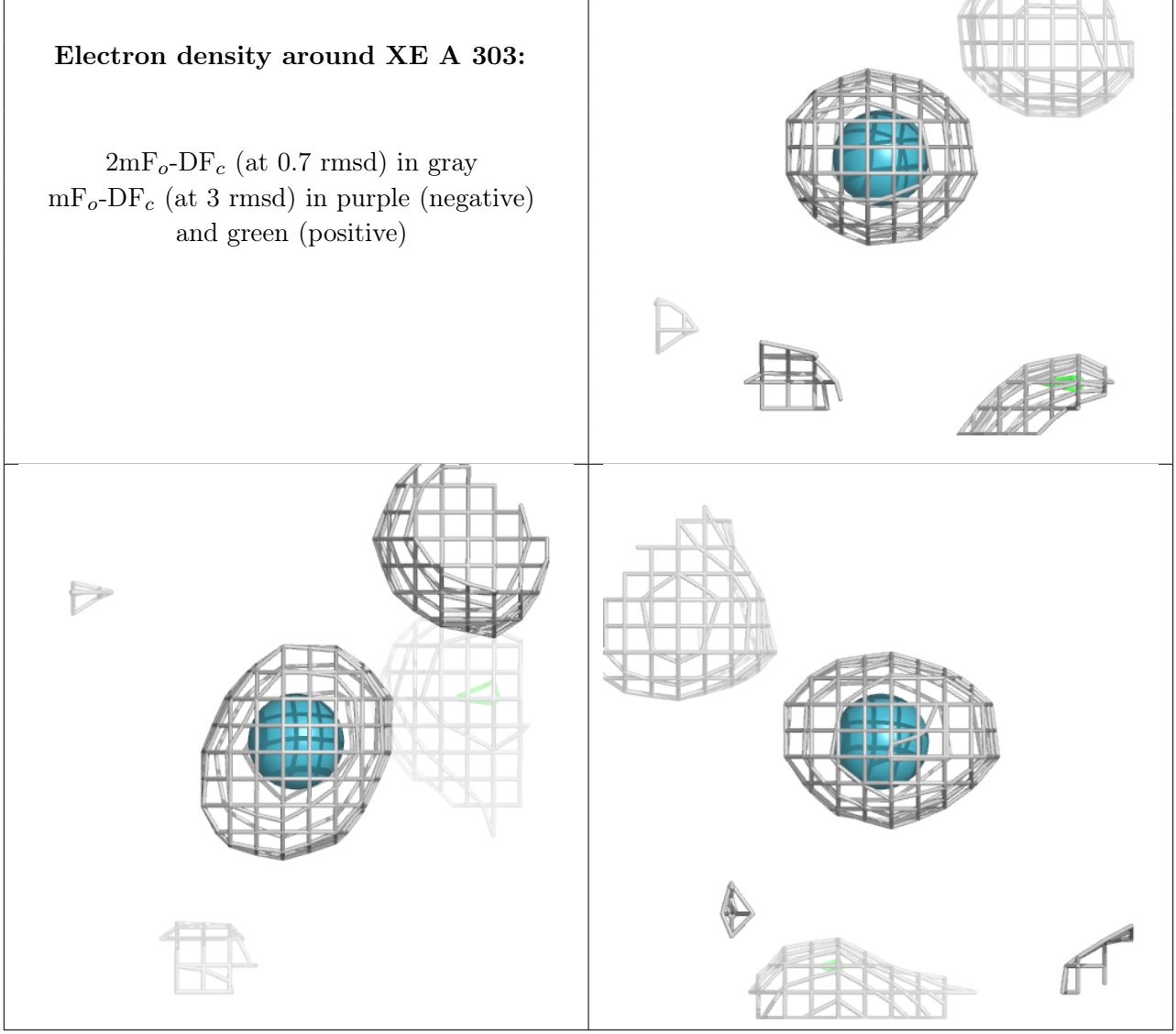
Electron density around XE C 303:

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



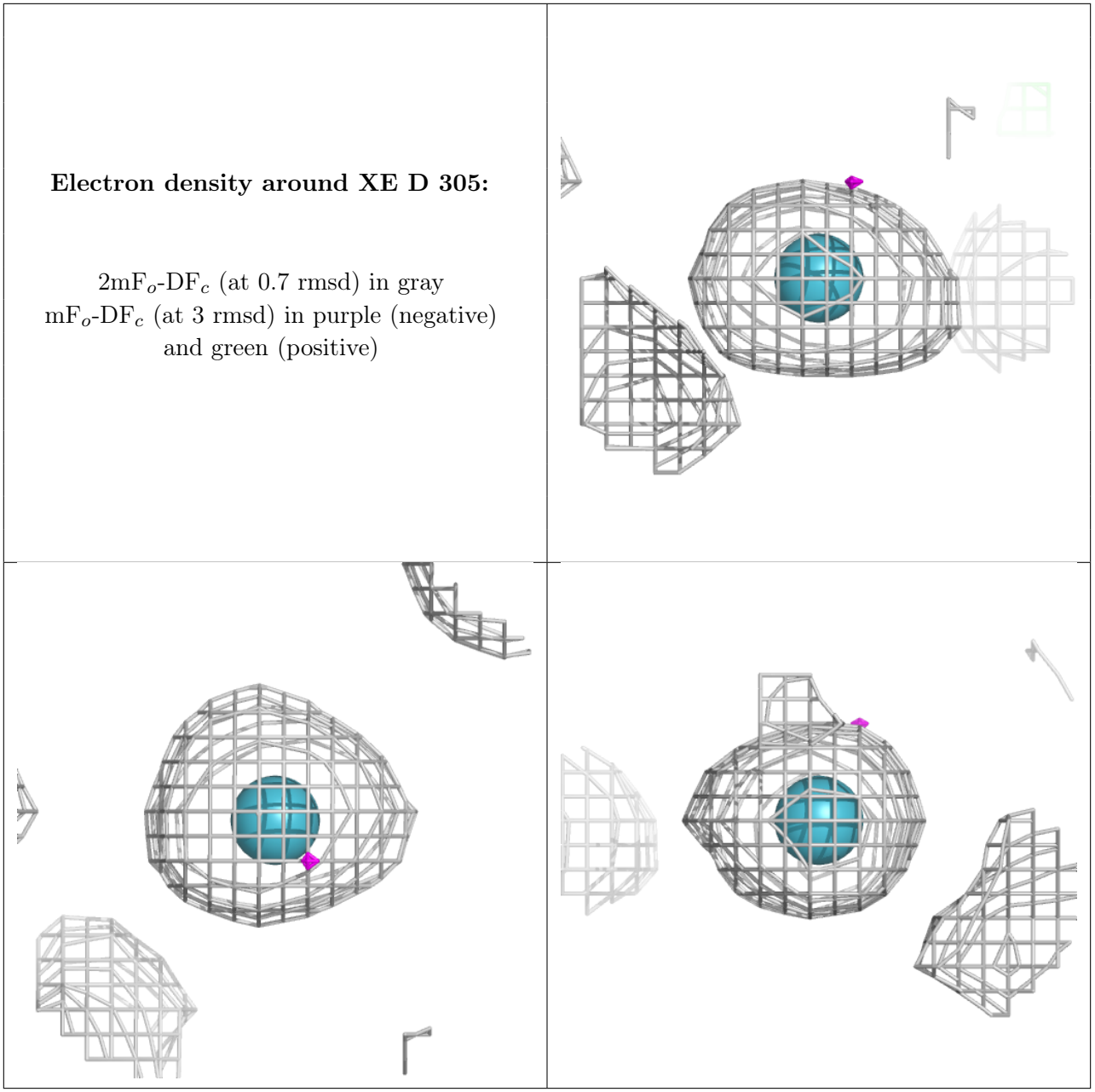
Electron density around XE A 303:

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



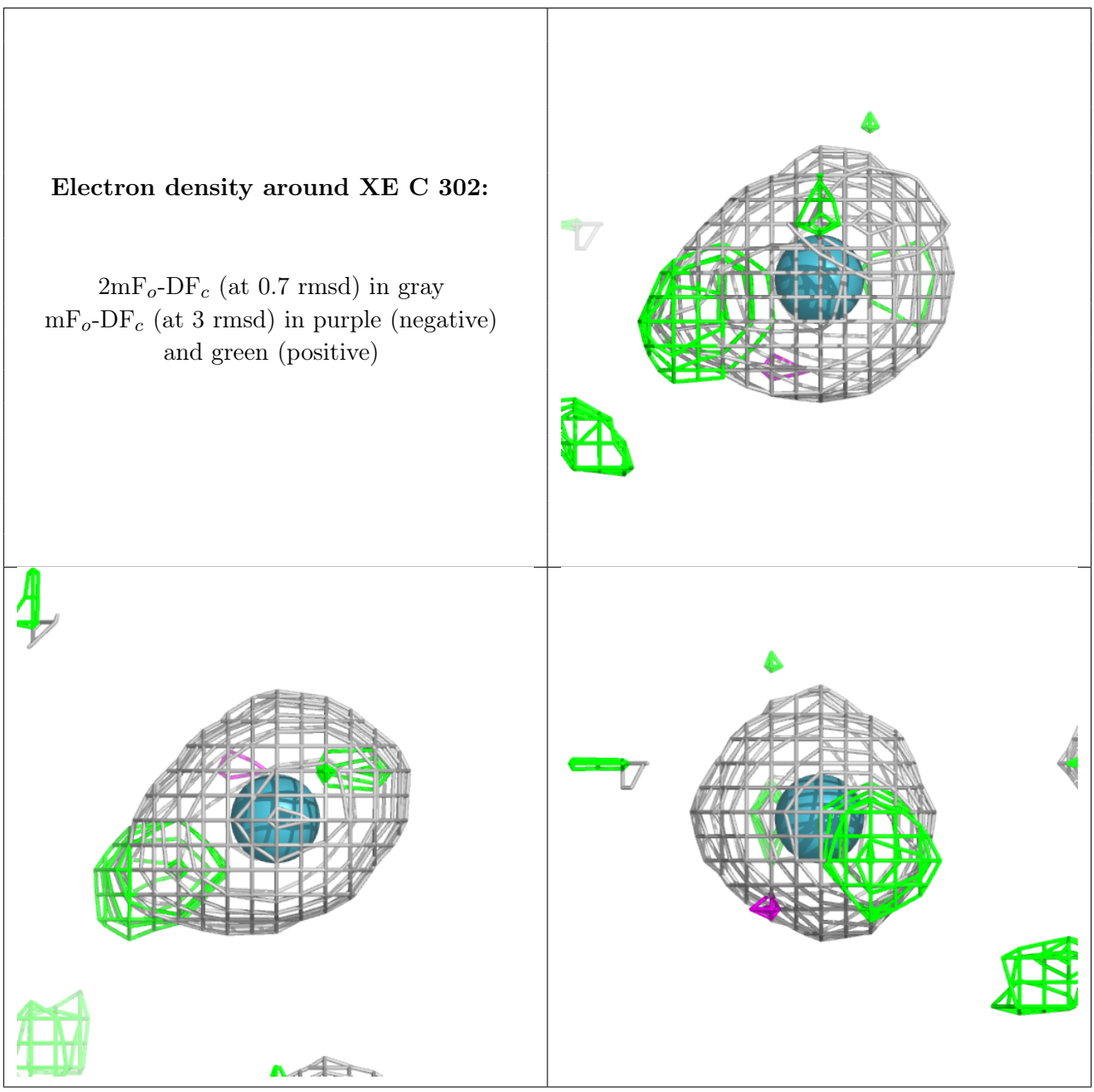
Electron density around XE D 305:

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



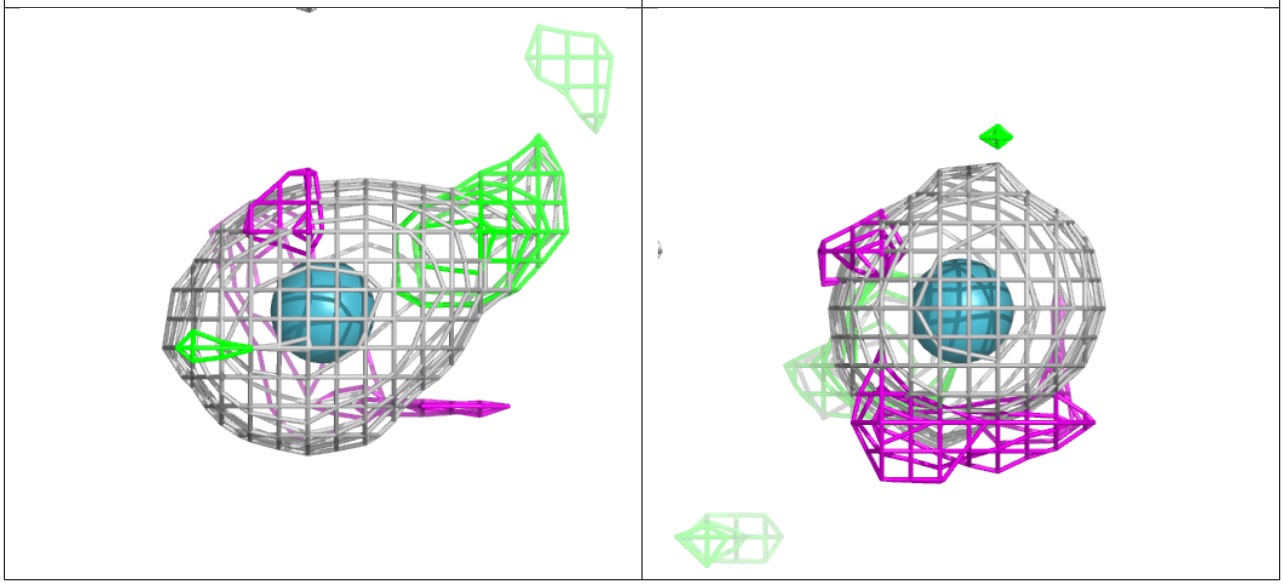
Electron density around XE C 302:

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



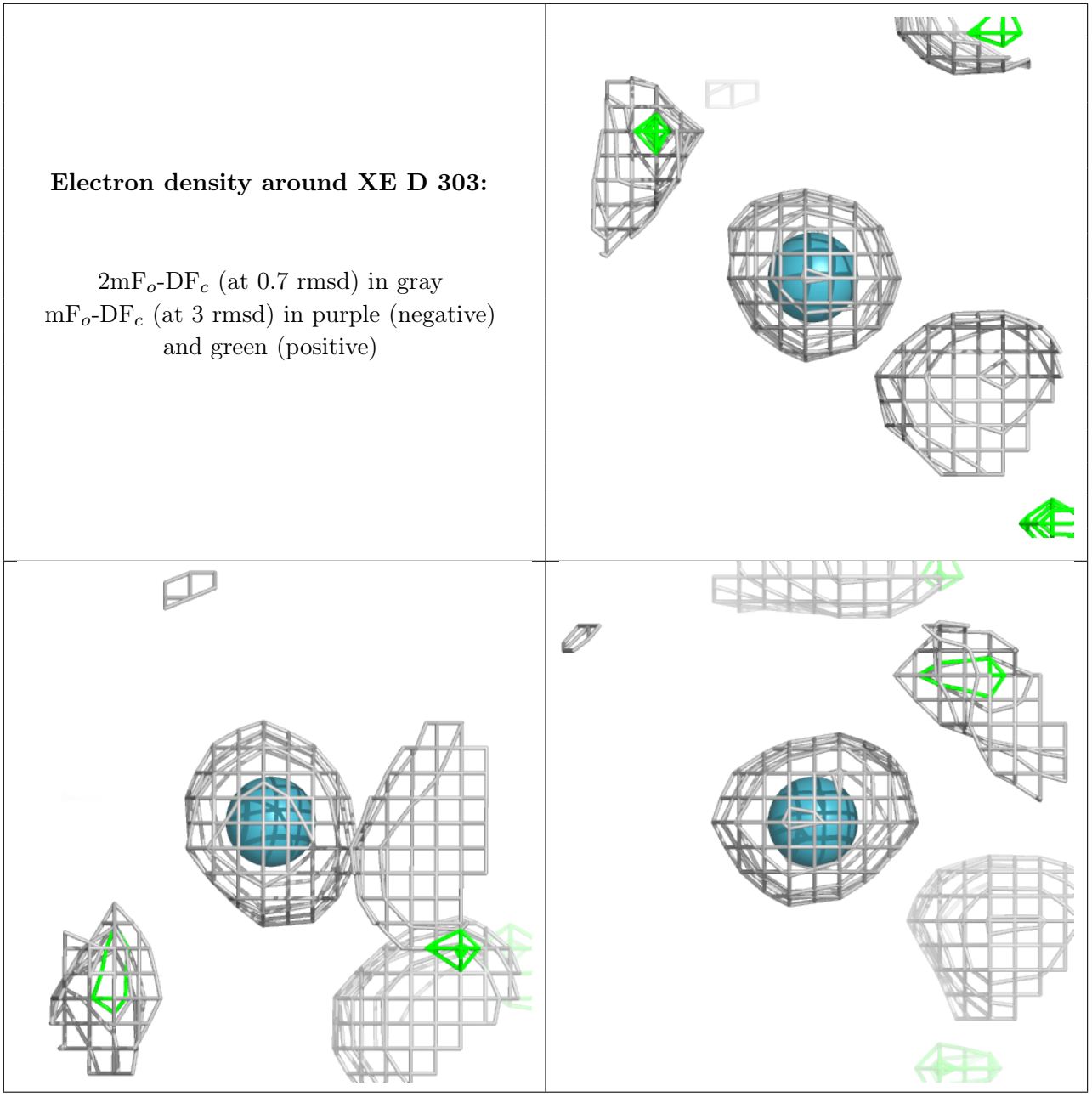
Electron density around XE D 302:

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



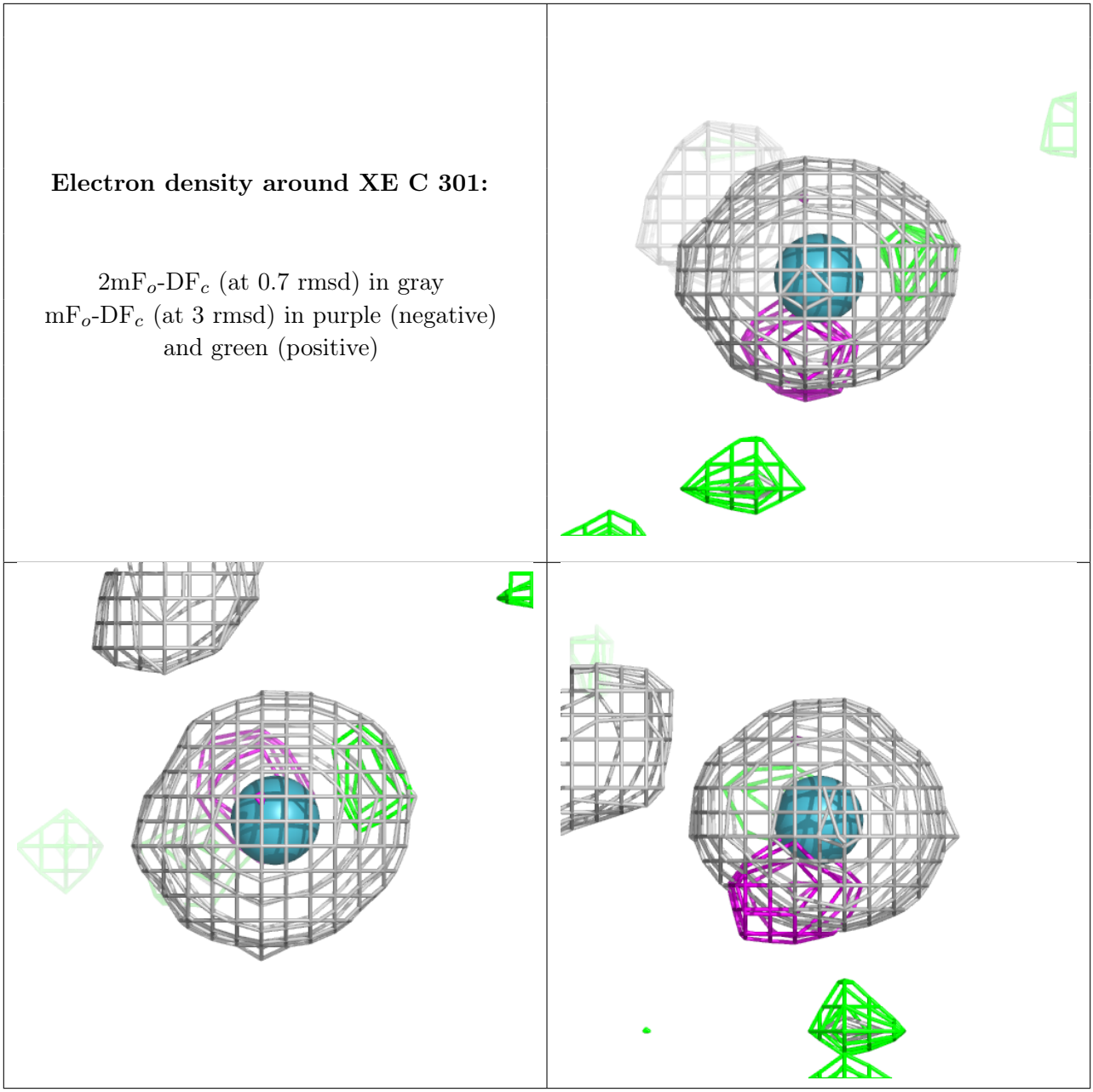
Electron density around XE D 303:

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



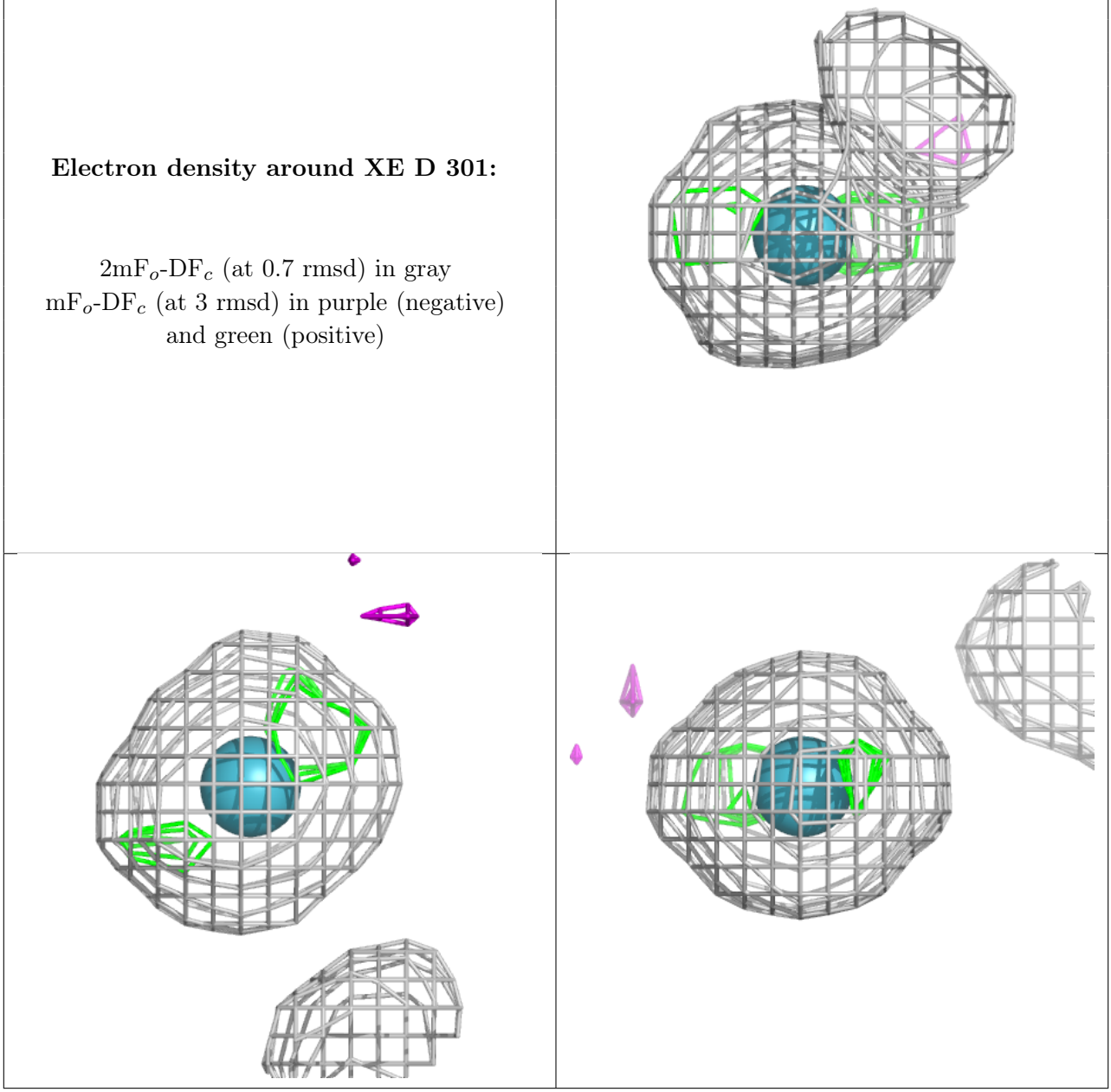
Electron density around XE C 301:

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



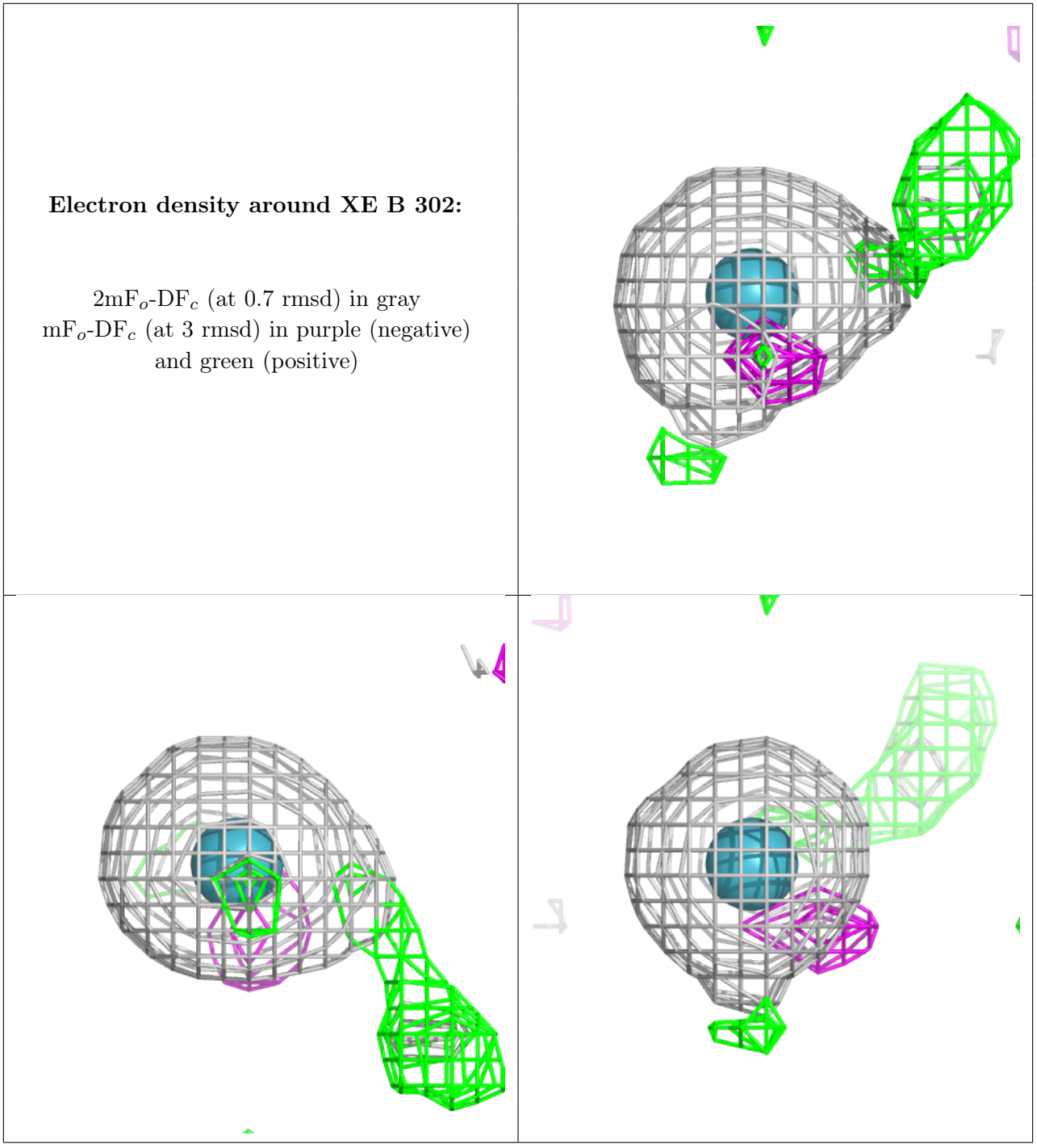
Electron density around XE D 301:

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



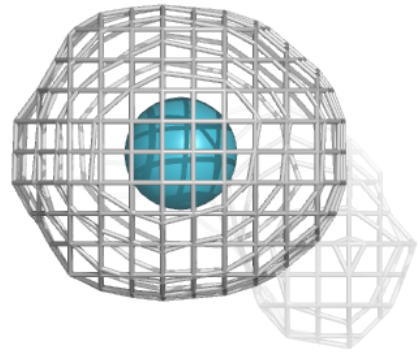
Electron density around XE B 302:

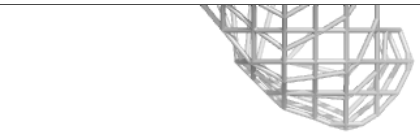
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

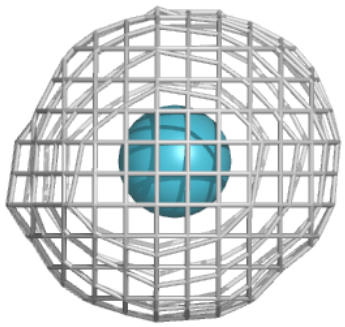


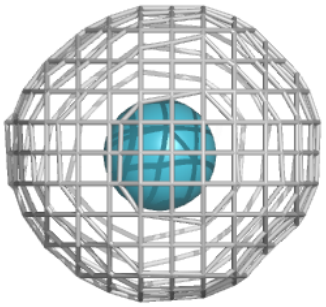
Electron density around XE A 301:

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



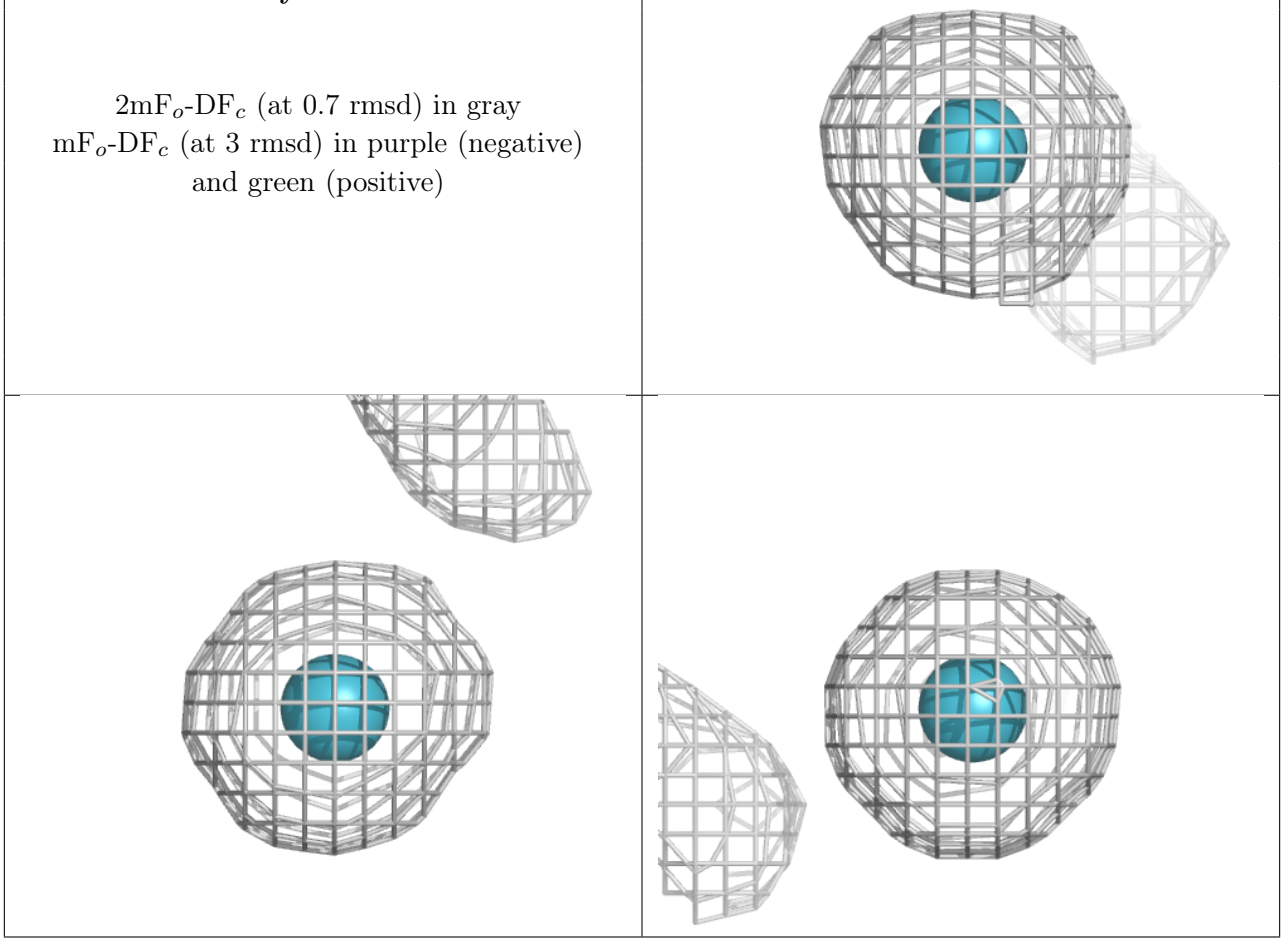






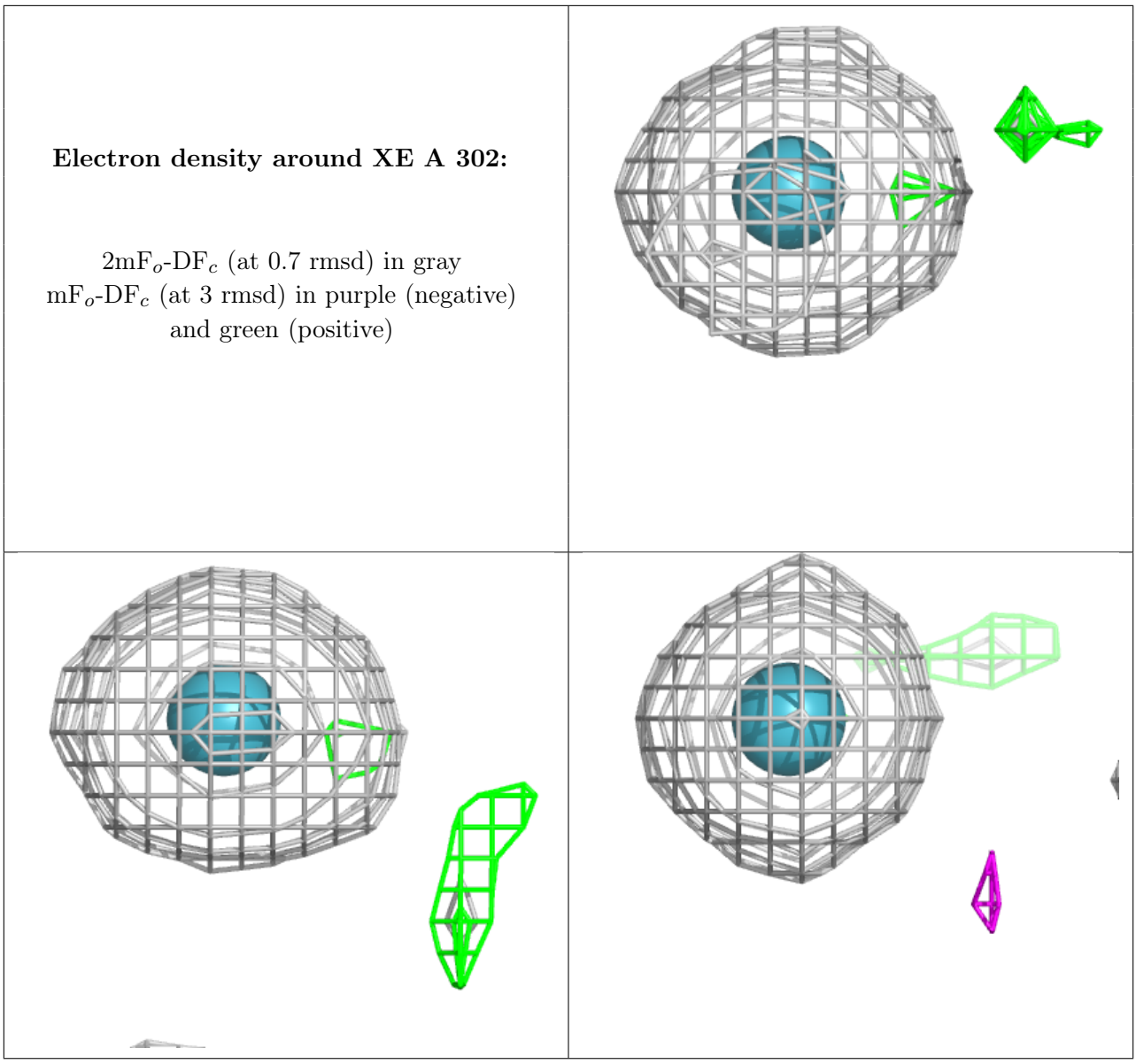
Electron density around XE B 301:

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



Electron density around XE A 302:

$2mF_o$-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.