wwPDB X-ray Structure Validation Summary Report (i)

Mar 8, 2026 – 01:56 PM UTC

PDB ID	:	5YHX / pdb_00005yhx
Title	:	Structure of Lactococcus lactis ZitR, wild type
Authors	:	Song, Y.; Liu, H.; Zhu, R.; Yi, C.; Chen, P.
Deposited on	:	2017-10-01
Resolution	:	2.40 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) 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 (1)) were used in the production of this report:

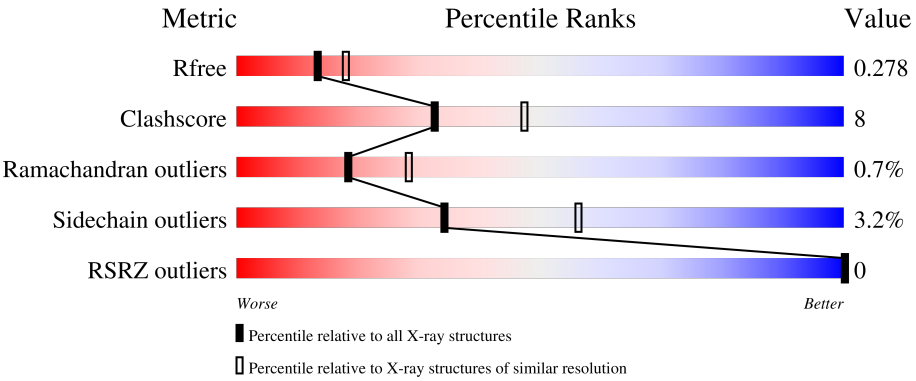
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

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 2.40 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}	180053	4912 (2.40-2.40)
Clashscore	190562	5391 (2.40-2.40)
Ramachandran outliers	187476	5320 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)
RSRZ outliers	180081	4916 (2.40-2.40)

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	146	81% 16%
1	B	146	77% 18%
1	G	146	78% 20%
1	H	146	66% 23% 8%
1	M	146	85% 14%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
1	N	146	80% 16%
1	S	146	79% 19%
1	T	146	84% 14%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 9078 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 Zinc transport transcriptional regulator.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	144	Total	C	N	O	S	0	0	0
			1131	715	190	223	3			
1	B	140	Total	C	N	O	S	0	0	0
			1099	695	183	217	4			
1	G	144	Total	C	N	O	S	0	0	0
			1129	713	190	223	3			
1	H	134	Total	C	N	O	S	0	0	0
			1046	666	172	204	4			
1	M	145	Total	C	N	O	S	0	0	0
			1144	722	192	226	4			
1	N	146	Total	C	N	O	S	0	0	0
			1137	717	191	225	4			
1	S	146	Total	C	N	O	S	0	0	0
			1128	713	188	223	4			
1	T	144	Total	C	N	O	S	0	0	0
			1140	719	191	227	3			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP Q9CDU5
B	1	GLY	-	expression tag	UNP Q9CDU5
G	1	GLY	-	expression tag	UNP Q9CDU5
H	1	GLY	-	expression tag	UNP Q9CDU5
M	1	GLY	-	expression tag	UNP Q9CDU5
N	1	GLY	-	expression tag	UNP Q9CDU5
S	1	GLY	-	expression tag	UNP Q9CDU5
T	1	GLY	-	expression tag	UNP Q9CDU5

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Zn 2 2	0	0
2	B	2	Total Zn 2 2	0	0
2	G	2	Total Zn 2 2	0	0
2	H	2	Total Zn 2 2	0	0
2	M	2	Total Zn 2 2	0	0
2	N	2	Total Zn 2 2	0	0
2	S	2	Total Zn 2 2	0	0
2	T	2	Total Zn 2 2	0	0

- Molecule 3 is water.

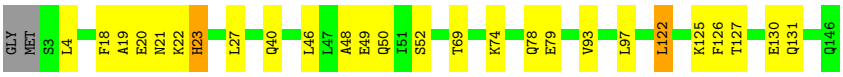
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	11	Total O 11 11	0	0
3	B	7	Total O 7 7	0	0
3	G	12	Total O 12 12	0	0
3	H	9	Total O 9 9	0	0
3	M	28	Total O 28 28	0	0
3	N	10	Total O 10 10	0	0
3	S	13	Total O 13 13	0	0
3	T	18	Total O 18 18	0	0

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.

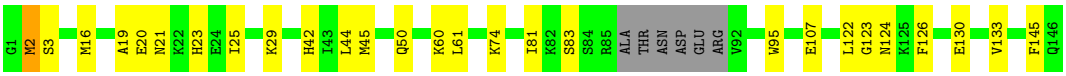
• Molecule 1: Zinc transport transcriptional regulator

Chain A:



• Molecule 1: Zinc transport transcriptional regulator

Chain B:

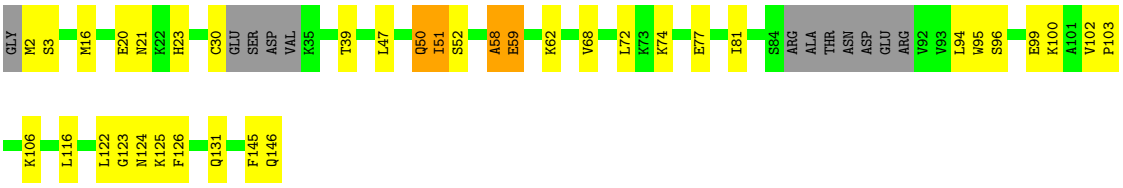


• Molecule 1: Zinc transport transcriptional regulator

Chain G:

• Molecule 1: Zinc transport transcriptional regulator

Chain H:

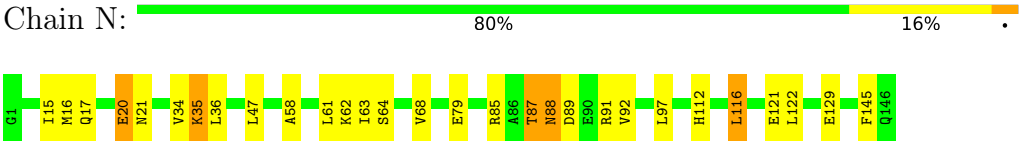


• Molecule 1: Zinc transport transcriptional regulator

Chain M:

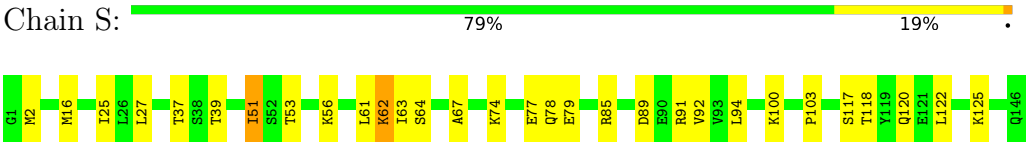
• Molecule 1: Zinc transport transcriptional regulator

Chain N:



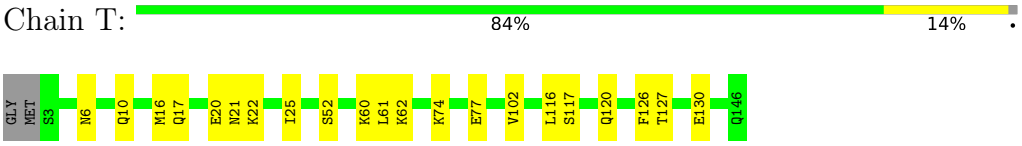
• Molecule 1: Zinc transport transcriptional regulator

Chain S:



• Molecule 1: Zinc transport transcriptional regulator

Chain T:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	34.75Å 125.79Å 153.66Å 90.00° 90.97° 90.00°	Depositor
Resolution (Å)	48.66 – 2.40 48.66 – 2.40	Depositor EDS
% Data completeness (in resolution range)	94.9 (48.66-2.40) 90.2 (48.66-2.40)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.37 (at 2.32Å)	Xtriage
Refinement program	PHENIX 1.6.2_432	Depositor
R, R_{free}	0.221 , 0.289 0.217 , 0.278	Depositor DCC
R_{free} test set	1998 reflections (3.49%)	wwPDB-VP
Wilson B-factor (Å^2)	54.3	Xtriage
Anisotropy	0.170	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 40.1	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.368 for h,-k,-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	9078	wwPDB-VP
Average B, all atoms (Å^2)	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.23% 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: ZN

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	0.57	0/1145	0.83	1/1542 (0.1%)
1	B	0.54	0/1112	0.82	0/1494
1	G	0.56	0/1143	0.82	0/1539
1	H	0.53	0/1058	0.88	2/1423 (0.1%)
1	M	0.63	0/1158	0.90	1/1559 (0.1%)
1	N	0.52	0/1151	0.87	0/1552
1	S	0.53	0/1142	0.83	0/1538
1	T	0.62	0/1154	0.90	3/1554 (0.2%)
All	All	0.56	0/9063	0.86	7/12201 (0.1%)

There are no bond length outliers.

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	T	52	SER	N-CA-C	6.35	118.42	108.96
1	H	52	SER	N-CA-C	6.33	116.22	107.73
1	H	58	ALA	N-CA-C	-6.31	102.16	110.43
1	T	102	VAL	CA-C-N	-6.16	113.42	119.64
1	T	102	VAL	C-N-CA	-6.16	113.42	119.64

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	1131	0	1149	19	0
1	B	1099	0	1119	19	0
1	G	1129	0	1142	25	0
1	H	1046	0	1060	24	0
1	M	1144	0	1167	15	0
1	N	1137	0	1149	24	0
1	S	1128	0	1136	24	0
1	T	1140	0	1162	11	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	G	2	0	0	0	0
2	H	2	0	0	0	0
2	M	2	0	0	0	0
2	N	2	0	0	0	0
2	S	2	0	0	0	0
2	T	2	0	0	0	0
3	A	11	0	0	0	0
3	B	7	0	0	0	0
3	G	12	0	0	0	0
3	H	9	0	0	0	0
3	M	28	0	0	0	0
3	N	10	0	0	0	0
3	S	13	0	0	0	0
3	T	18	0	0	0	0
All	All	9078	0	9084	142	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 8.

The worst 5 of 142 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:S:16:MET:HE3	1:T:25:ILE:HD11	1.65	0.79
1:M:25:ILE:HD11	1:N:16:MET:HE3	1.66	0.77
1:B:2:MET:HG3	1:B:3:SER:N	2.04	0.72
1:H:58:ALA:HB2	1:H:68:VAL:HG21	1.71	0.71
1:H:51:ILE:HG23	1:H:95:TRP:O	1.93	0.69

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	142/146 (97%)	140 (99%)	1 (1%)	1 (1%)	18 28
1	B	136/146 (93%)	131 (96%)	4 (3%)	1 (1%)	18 28
1	G	142/146 (97%)	137 (96%)	3 (2%)	2 (1%)	9 13
1	H	128/146 (88%)	120 (94%)	5 (4%)	3 (2%)	5 6
1	M	143/146 (98%)	140 (98%)	3 (2%)	0	100 100
1	N	144/146 (99%)	142 (99%)	2 (1%)	0	100 100
1	S	144/146 (99%)	131 (91%)	12 (8%)	1 (1%)	18 28
1	T	142/146 (97%)	139 (98%)	3 (2%)	0	100 100
All	All	1121/1168 (96%)	1080 (96%)	33 (3%)	8 (1%)	18 28

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	50	GLN
1	B	50	GLN
1	G	51	ILE
1	G	89	ASP
1	S	62	LYS

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	125/129 (97%)	121 (97%)	4 (3%)	34 56

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	B	122/129 (95%)	118 (97%)	4 (3%)	33 55
1	G	124/129 (96%)	122 (98%)	2 (2%)	55 76
1	H	115/129 (89%)	108 (94%)	7 (6%)	17 30
1	M	128/129 (99%)	126 (98%)	2 (2%)	55 76
1	N	125/129 (97%)	116 (93%)	9 (7%)	13 23
1	S	122/129 (95%)	121 (99%)	1 (1%)	73 86
1	T	128/129 (99%)	125 (98%)	3 (2%)	44 66
All	All	989/1032 (96%)	957 (97%)	32 (3%)	34 56

5 of 32 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	S	51	ILE
1	T	22	LYS
1	H	39	THR
1	H	30	CYS
1	T	60	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	T	17	GLN
1	S	7	GLN
1	M	120	GLN
1	M	21	ASN
1	N	17	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 16 ligands modelled in this entry, 16 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	144/146 (98%)	-1.04	0	100	100	46, 62, 96, 111	0
1	B	140/146 (95%)	-0.95	0	100	100	46, 71, 93, 111	0
1	G	144/146 (98%)	-1.01	0	100	100	48, 66, 95, 107	0
1	H	134/146 (91%)	-0.89	0	100	100	47, 76, 95, 103	0
1	M	145/146 (99%)	-1.15	0	100	100	39, 56, 78, 94	0
1	N	146/146 (100%)	-0.91	0	100	100	44, 75, 98, 117	0
1	S	146/146 (100%)	-0.90	0	100	100	45, 81, 106, 125	0
1	T	144/146 (98%)	-1.11	0	100	100	41, 59, 81, 96	0
All	All	1143/1168 (97%)	-1.00	0	100	100	39, 68, 96, 125	0

There are no RSRZ outliers to report.

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 oligosaccharides in this entry.

6.4 Ligands

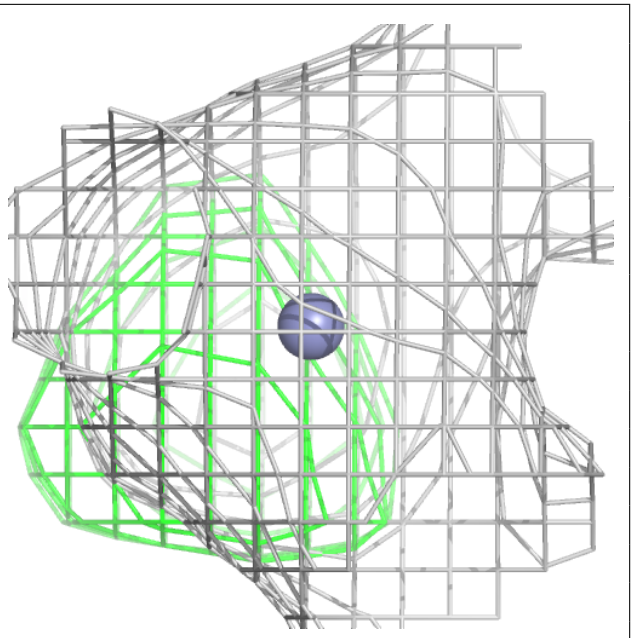
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

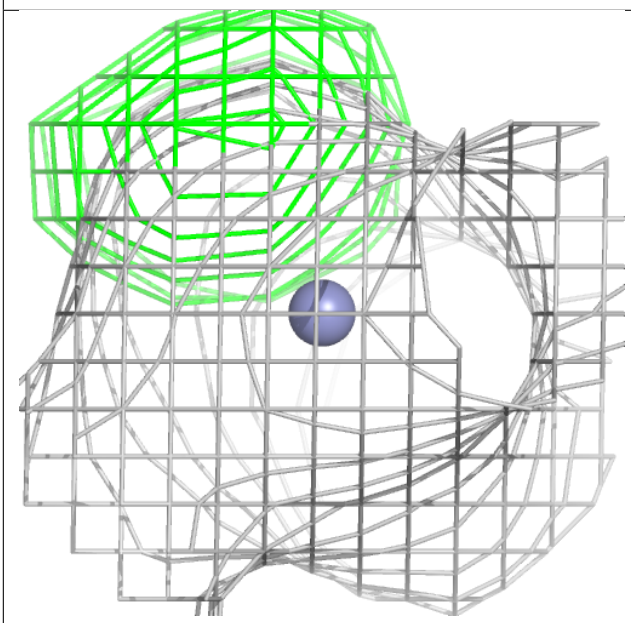
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	ZN	T	202	1/1	0.99	0.02	45,45,45,45	0
2	ZN	A	202	1/1	1.00	0.01	48,48,48,48	0
2	ZN	B	201	1/1	1.00	0.01	55,55,55,55	0
2	ZN	B	202	1/1	1.00	0.01	69,69,69,69	0
2	ZN	G	201	1/1	1.00	0.01	50,50,50,50	0
2	ZN	G	202	1/1	1.00	0.01	50,50,50,50	0
2	ZN	H	201	1/1	1.00	0.01	61,61,61,61	0
2	ZN	H	202	1/1	1.00	0.01	80,80,80,80	0
2	ZN	M	201	1/1	1.00	0.01	41,41,41,41	0
2	ZN	M	202	1/1	1.00	0.01	43,43,43,43	0
2	ZN	N	201	1/1	1.00	0.01	65,65,65,65	0
2	ZN	N	202	1/1	1.00	0.01	68,68,68,68	0
2	ZN	S	201	1/1	1.00	0.01	70,70,70,70	0
2	ZN	S	202	1/1	1.00	0.01	76,76,76,76	0
2	ZN	T	201	1/1	1.00	0.01	41,41,41,41	0
2	ZN	A	201	1/1	1.00	0.01	51,51,51,51	0

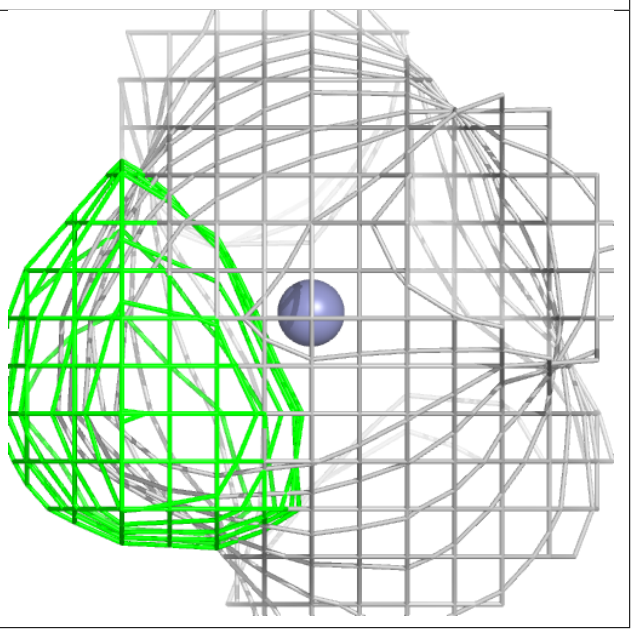
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around ZN T 202:

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

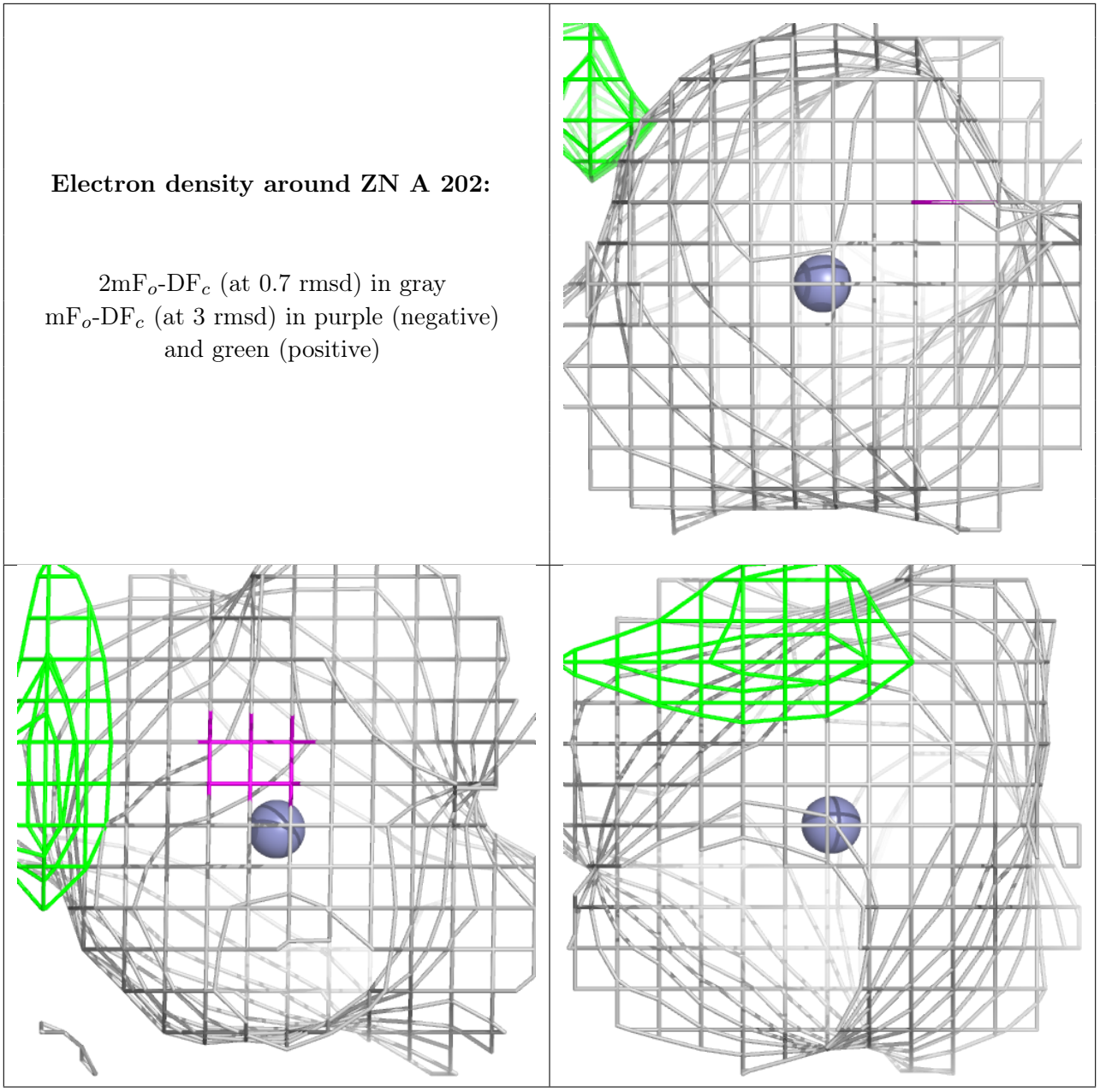






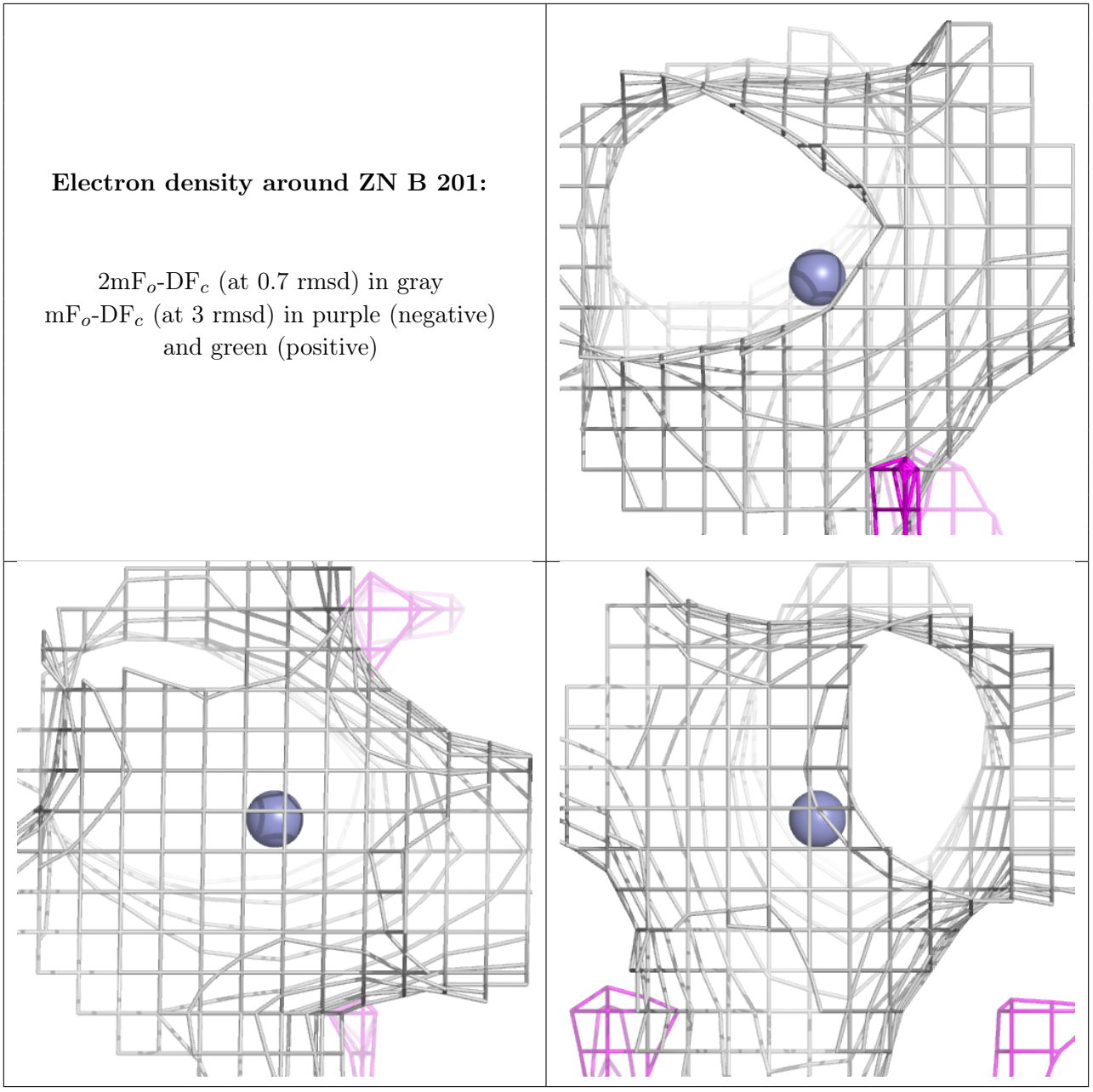
Electron density around ZN A 202:

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



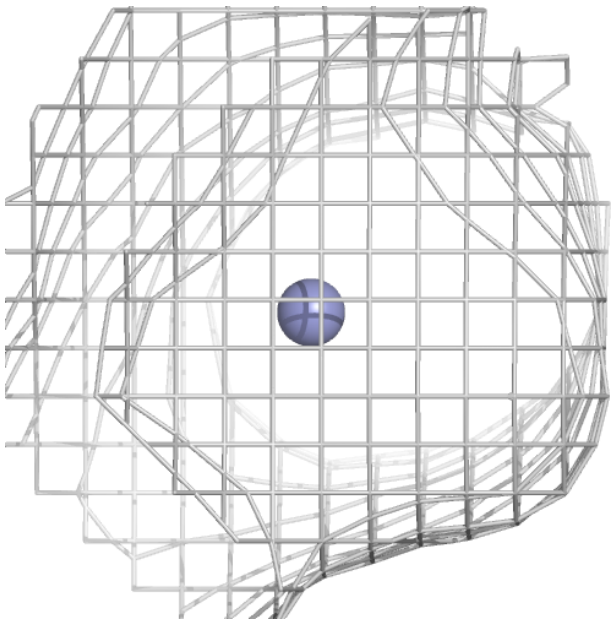
Electron density around ZN B 201:

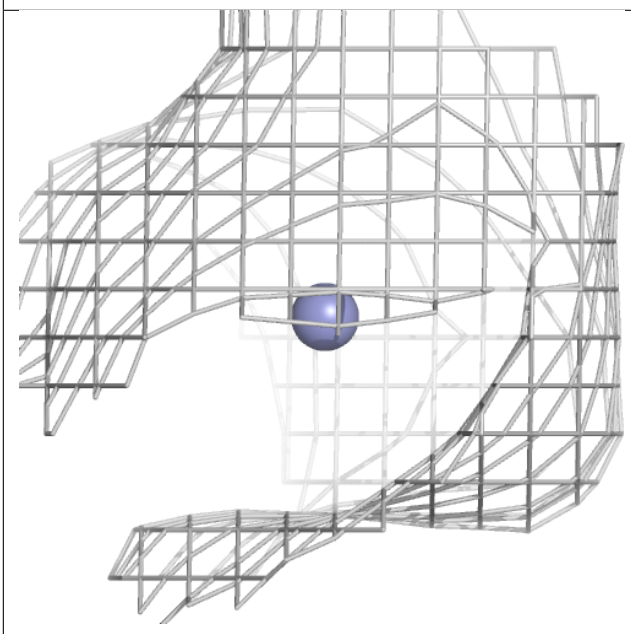
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

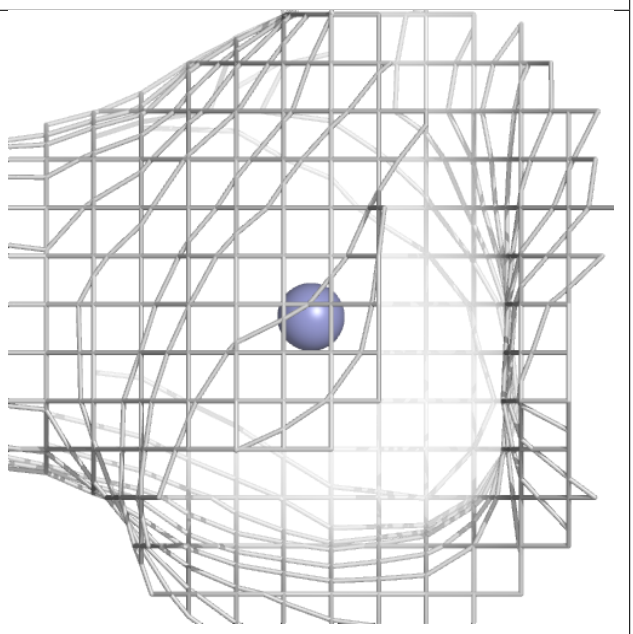


Electron density around ZN B 202:

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

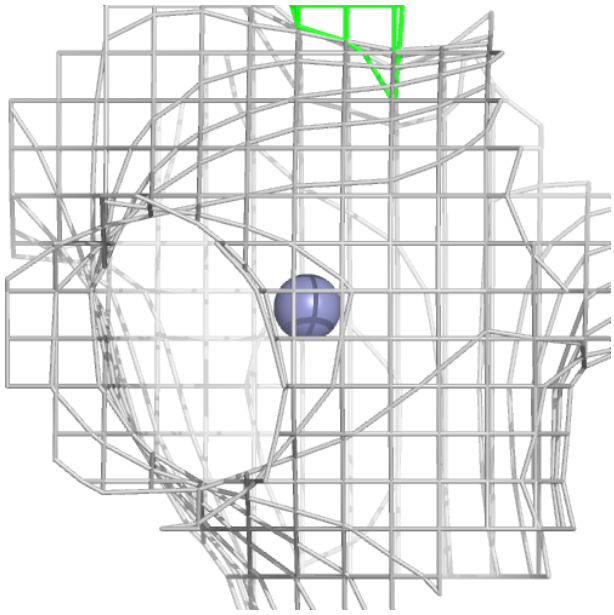


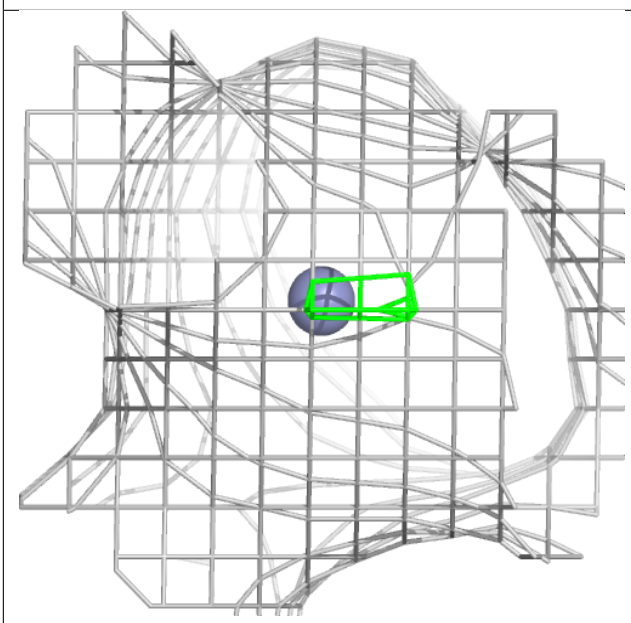


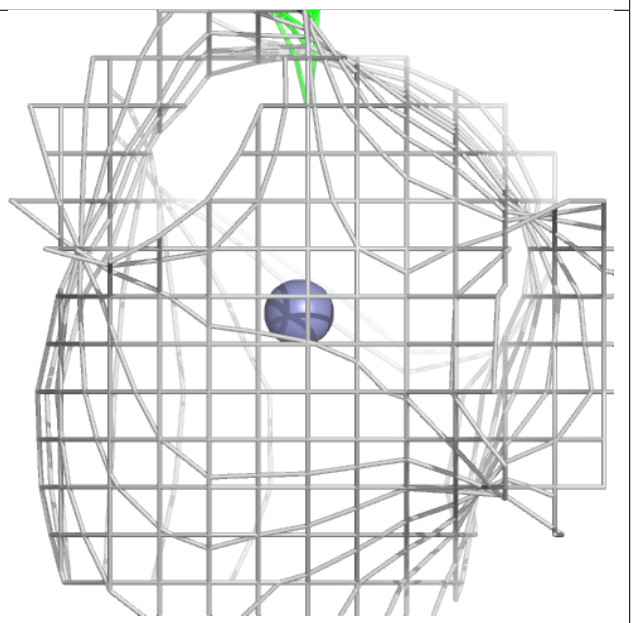


Electron density around ZN G 201:

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

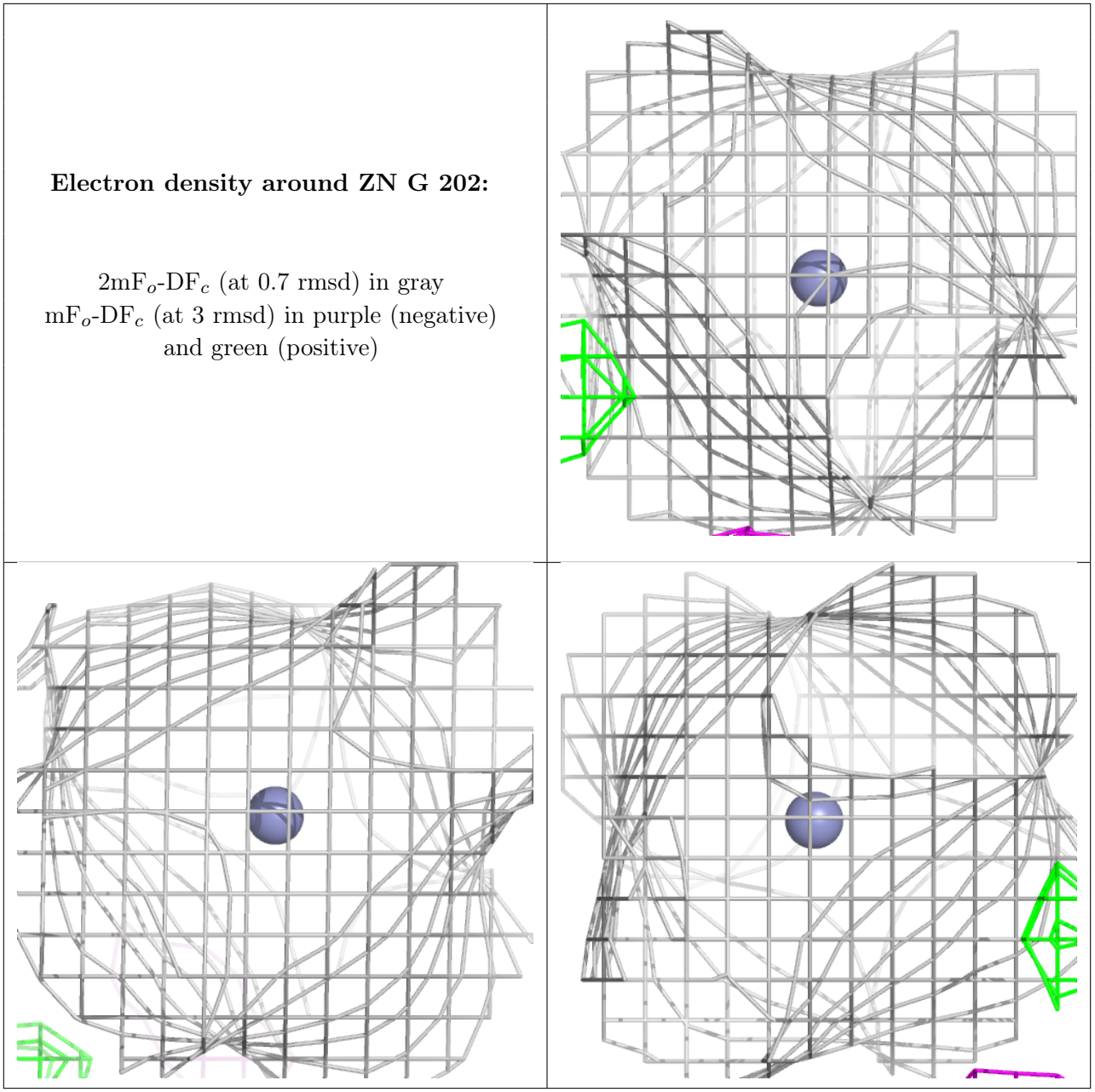






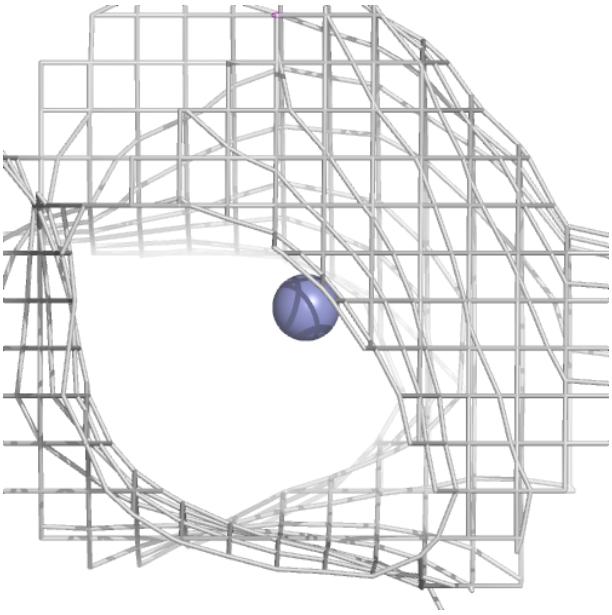
Electron density around ZN G 202:

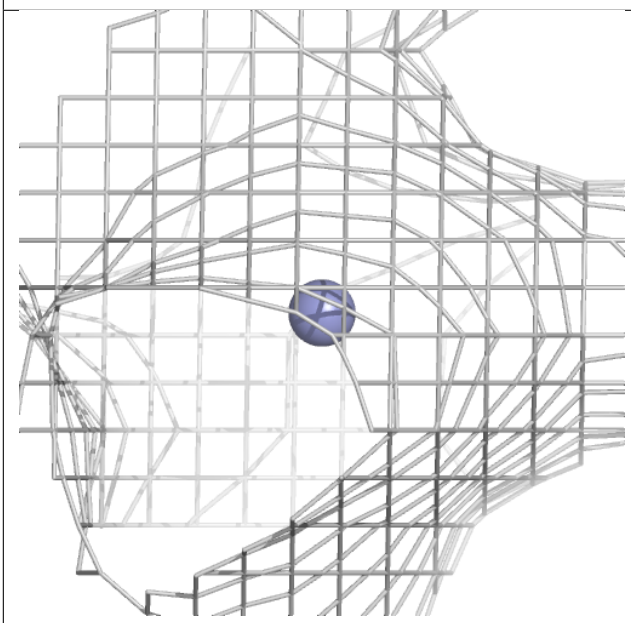
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

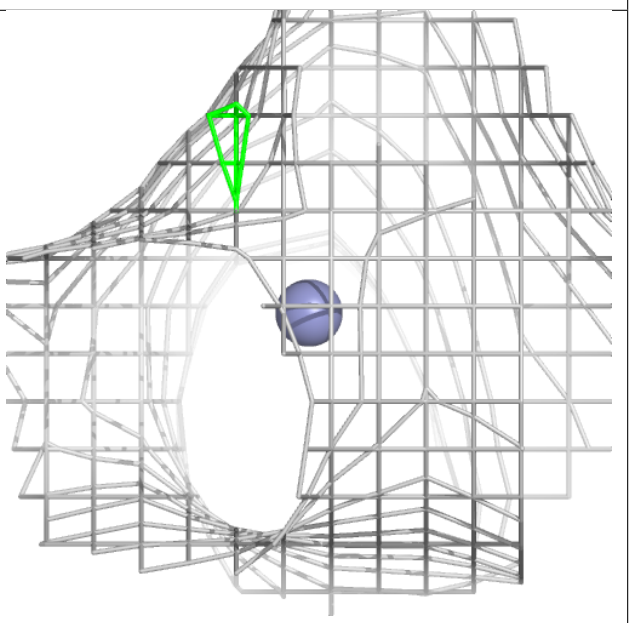


Electron density around ZN H 201:

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

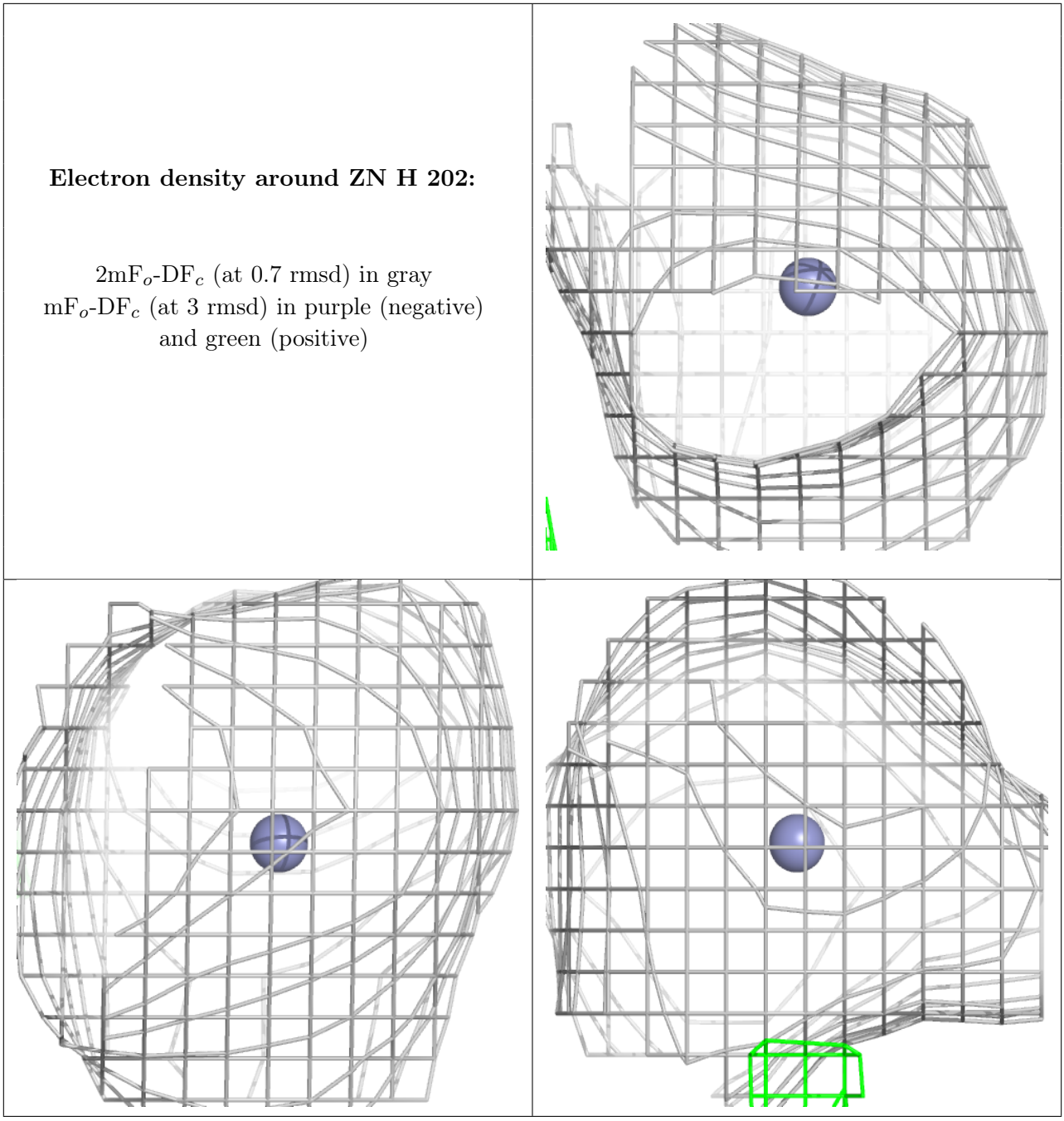






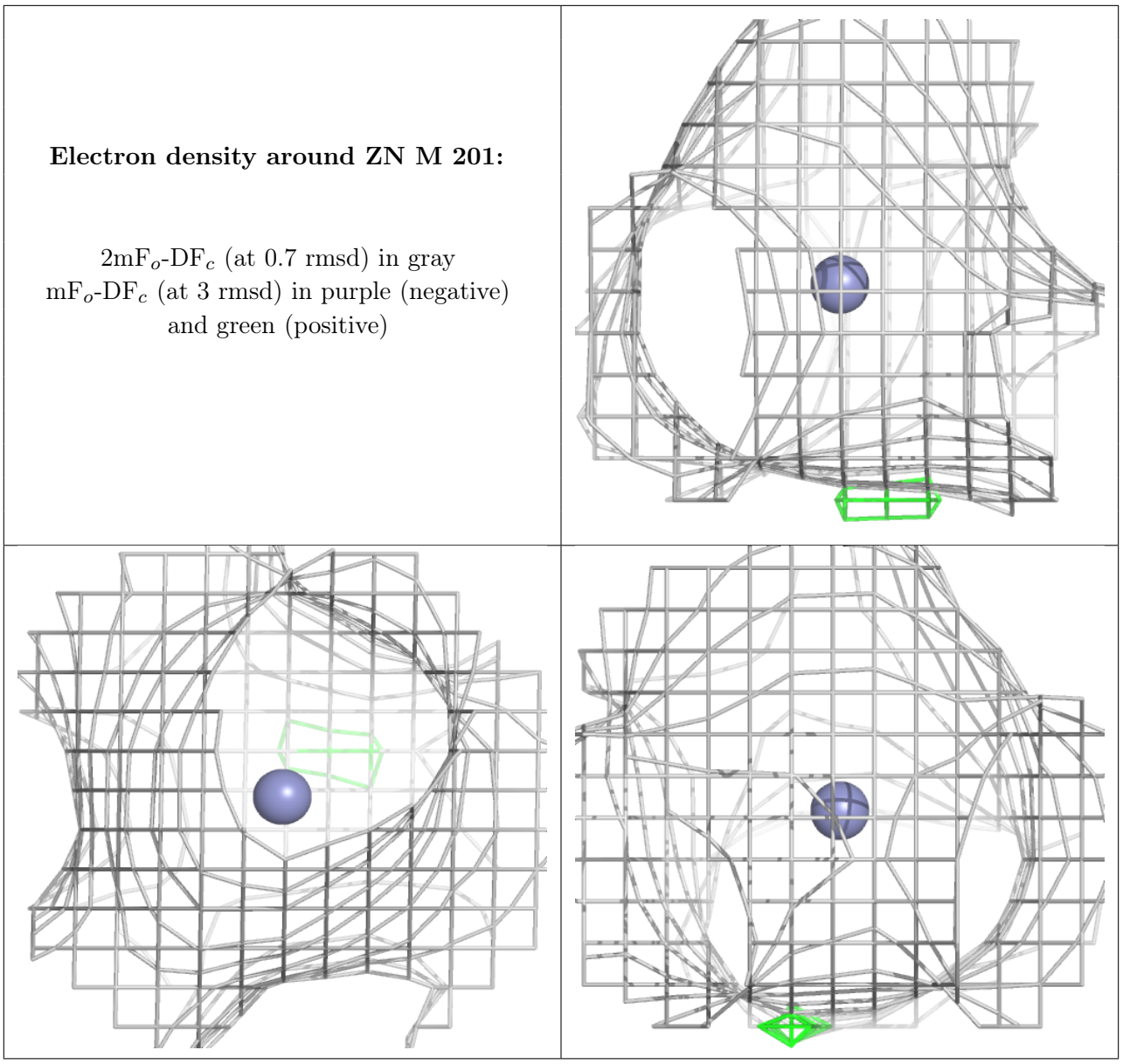
Electron density around ZN H 202:

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



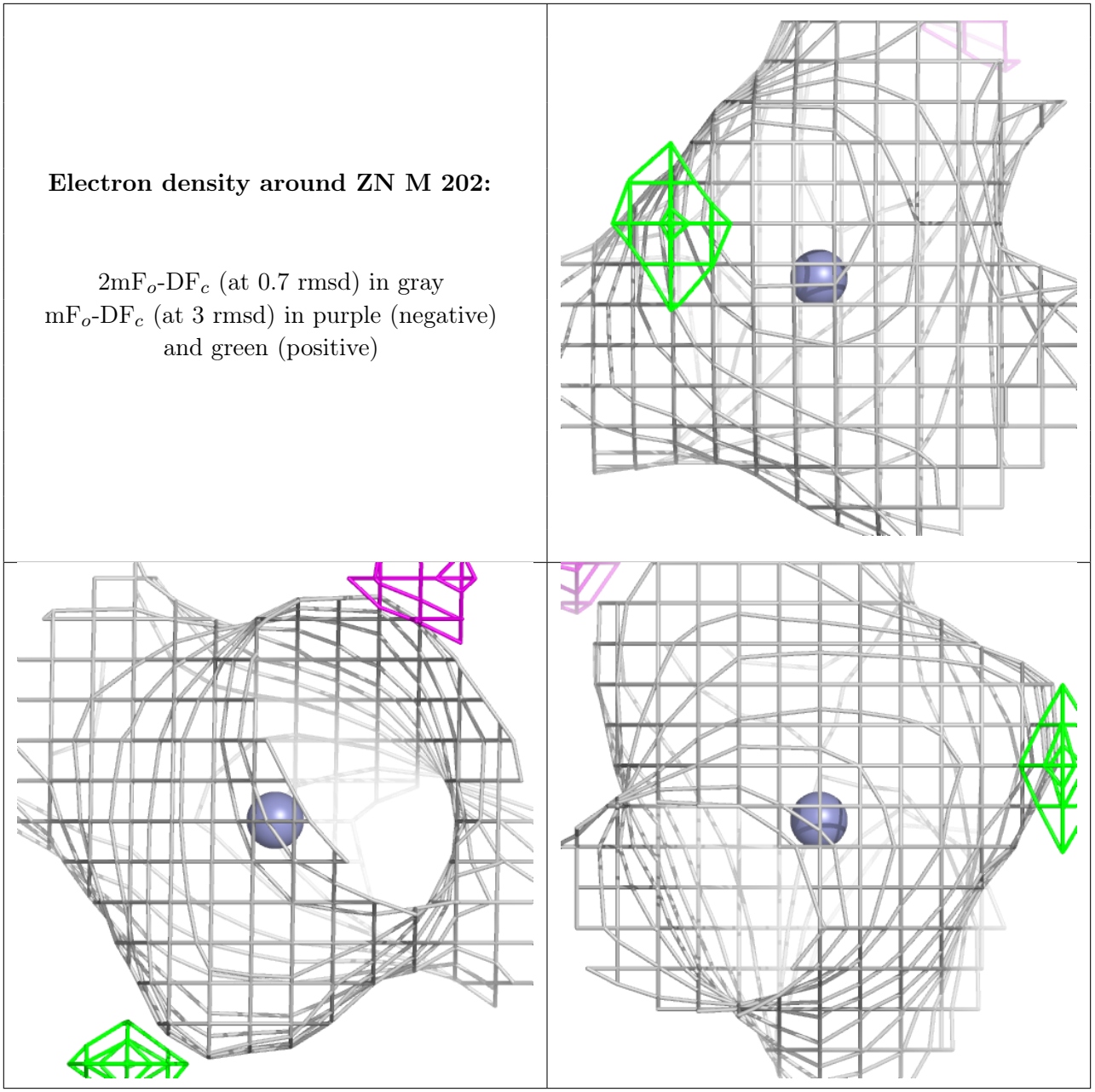
Electron density around ZN M 201:

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



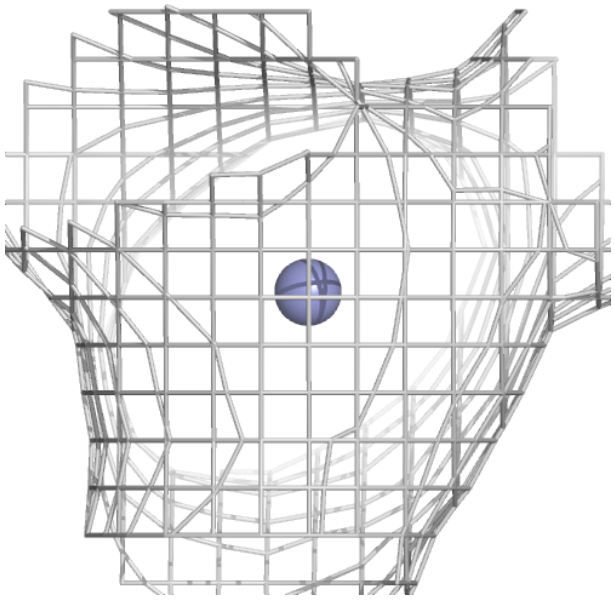
Electron density around ZN M 202:

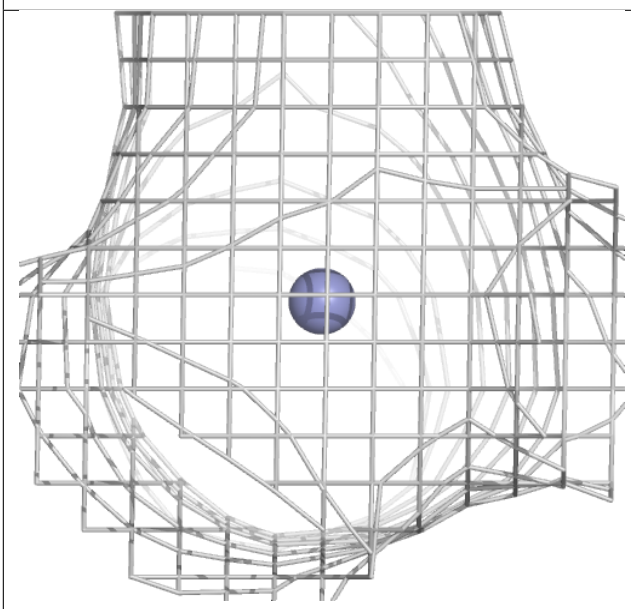
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

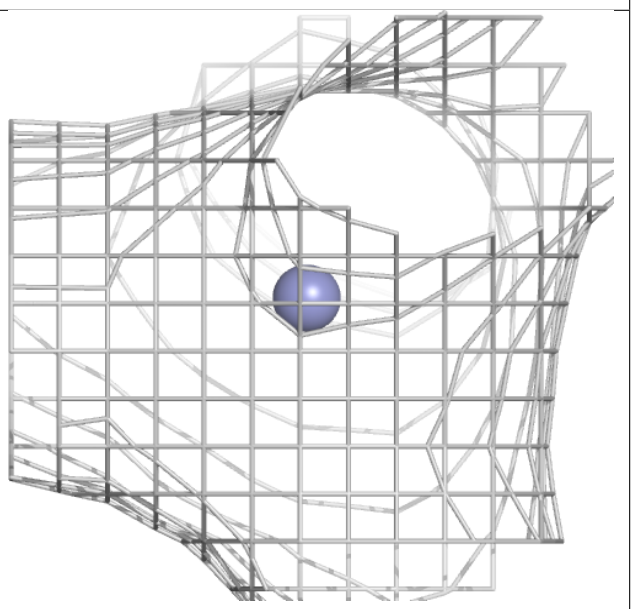


Electron density around ZN N 201:

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

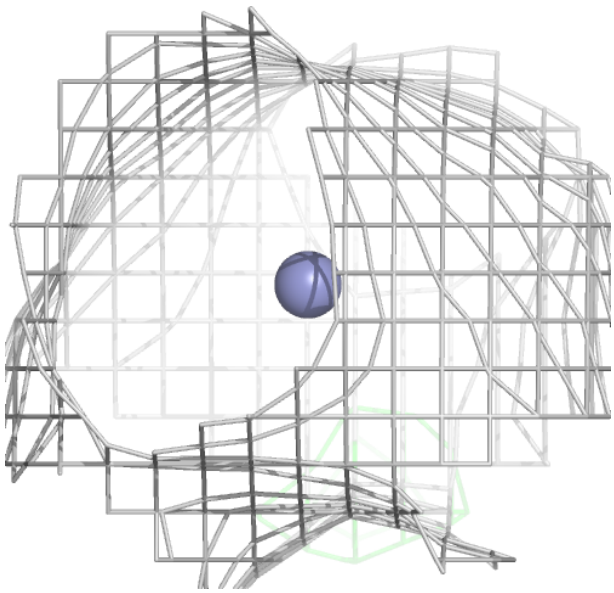


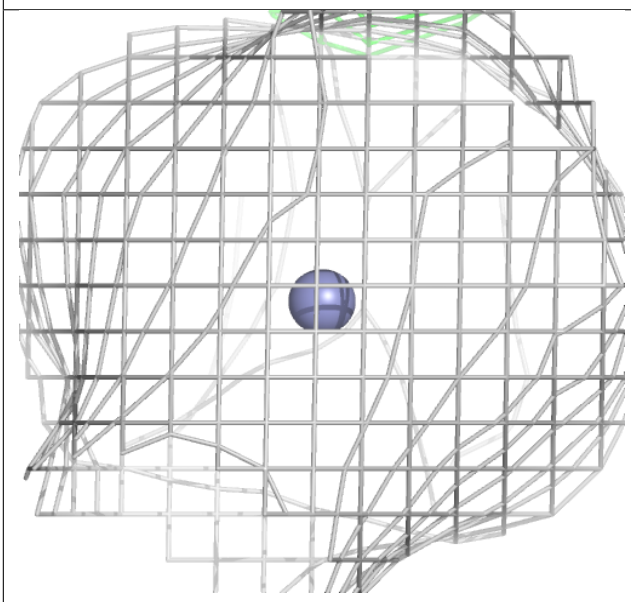


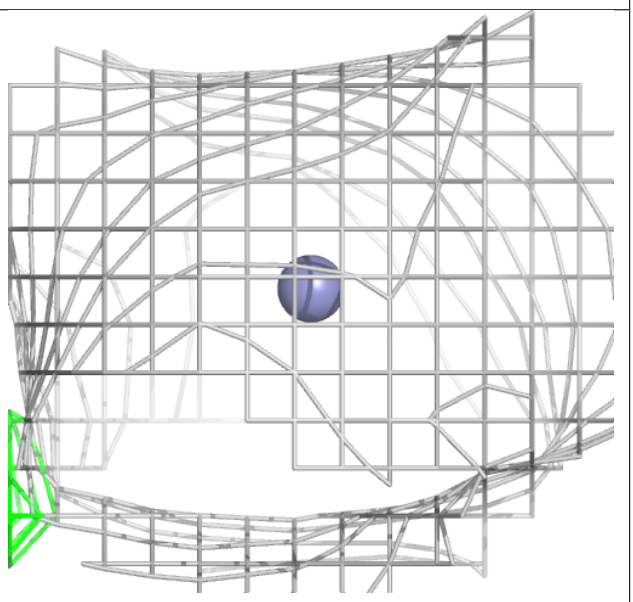


Electron density around ZN N 202:

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

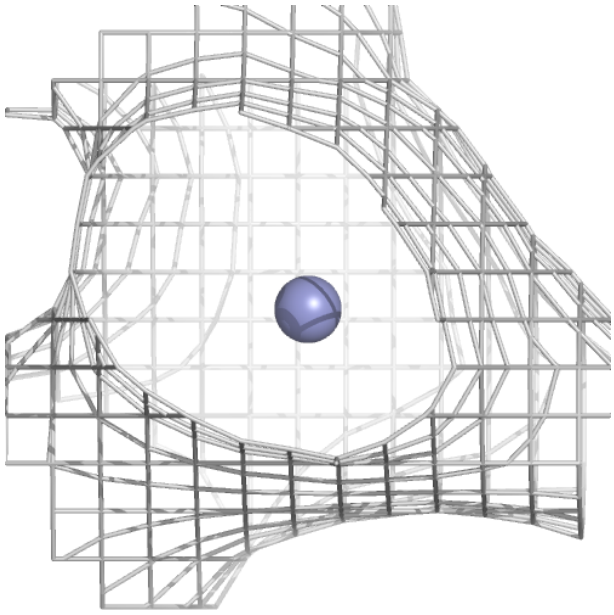


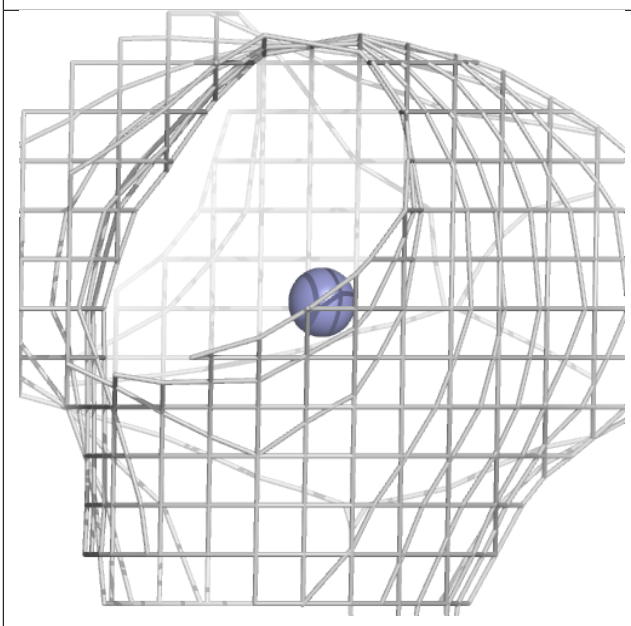


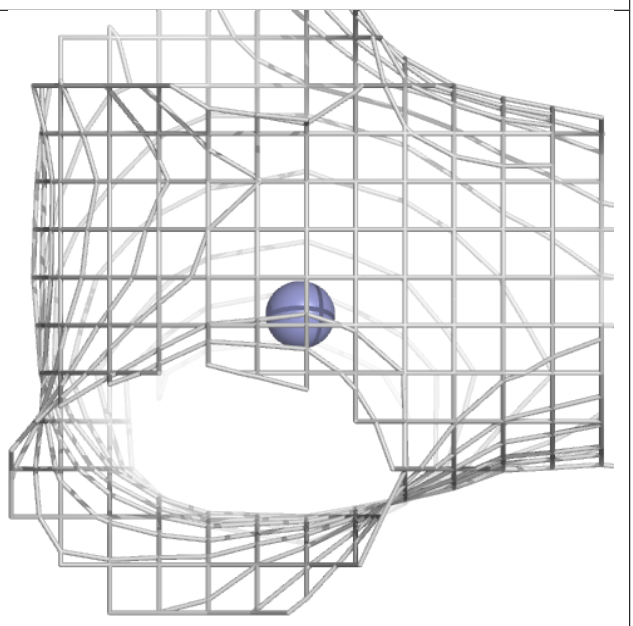


Electron density around ZN S 201:

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

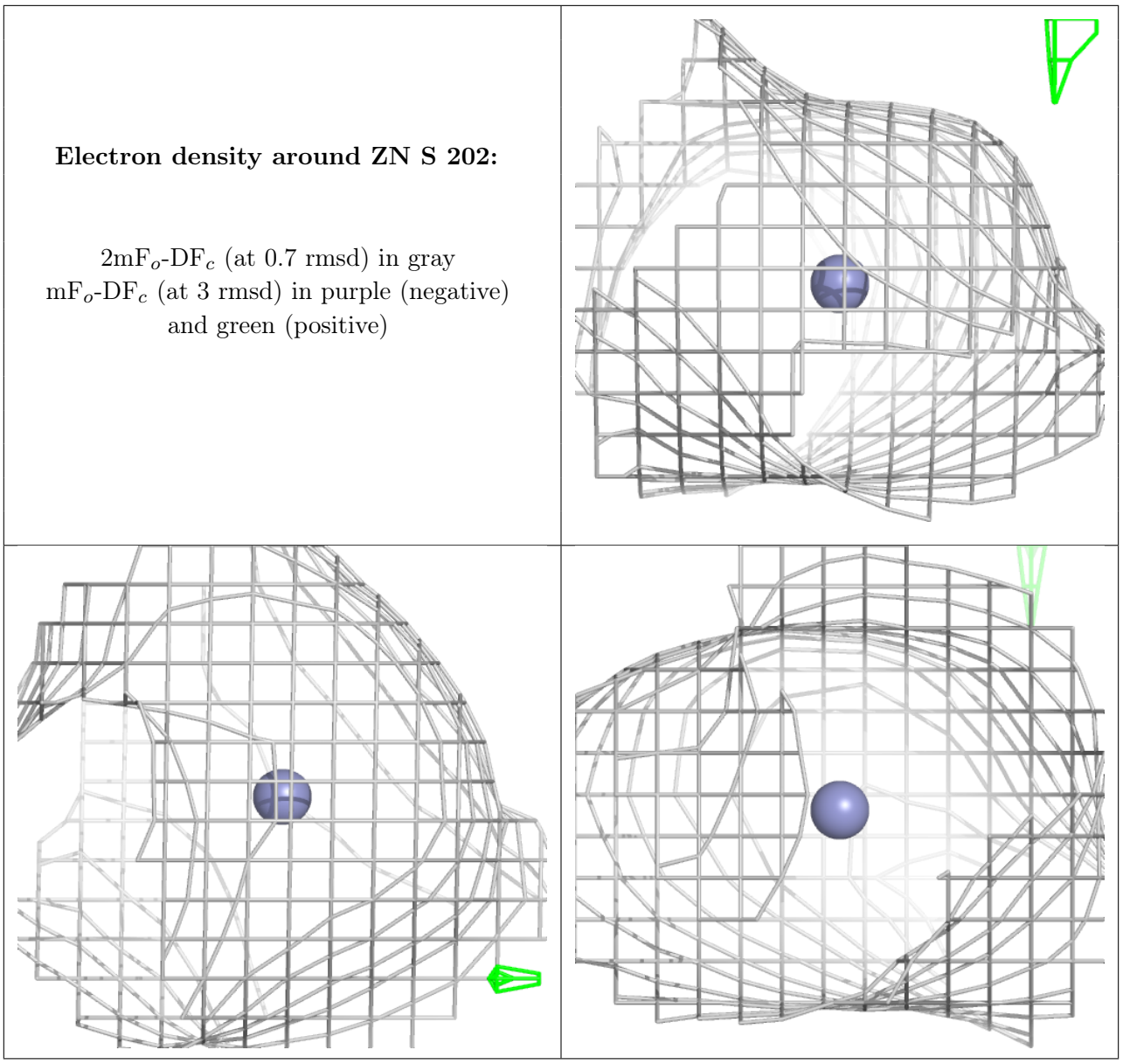






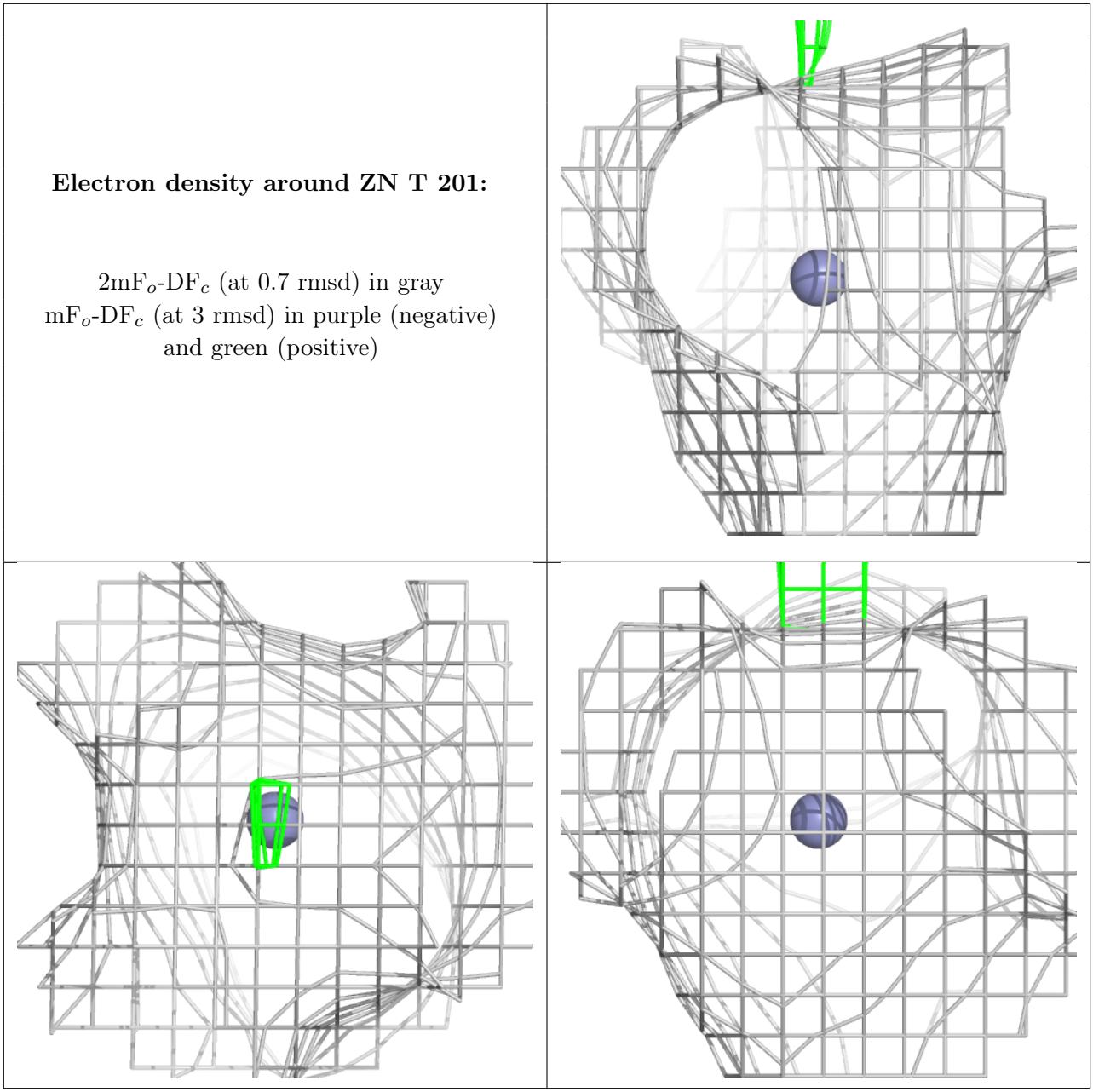
Electron density around ZN S 202:

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



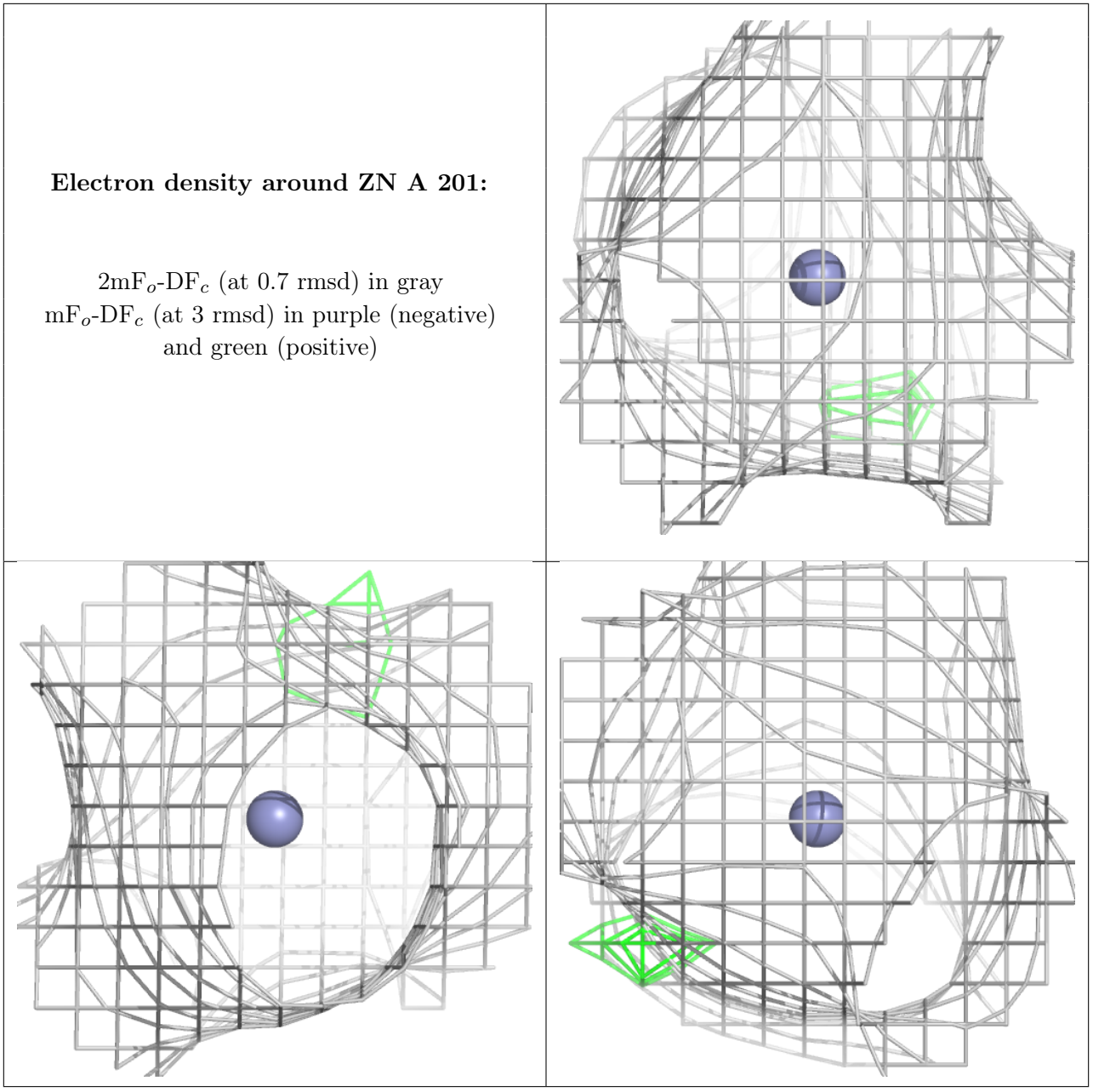
Electron density around ZN T 201:

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



Electron density around ZN A 201:

$2mF_o$-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.