

Supplementary data

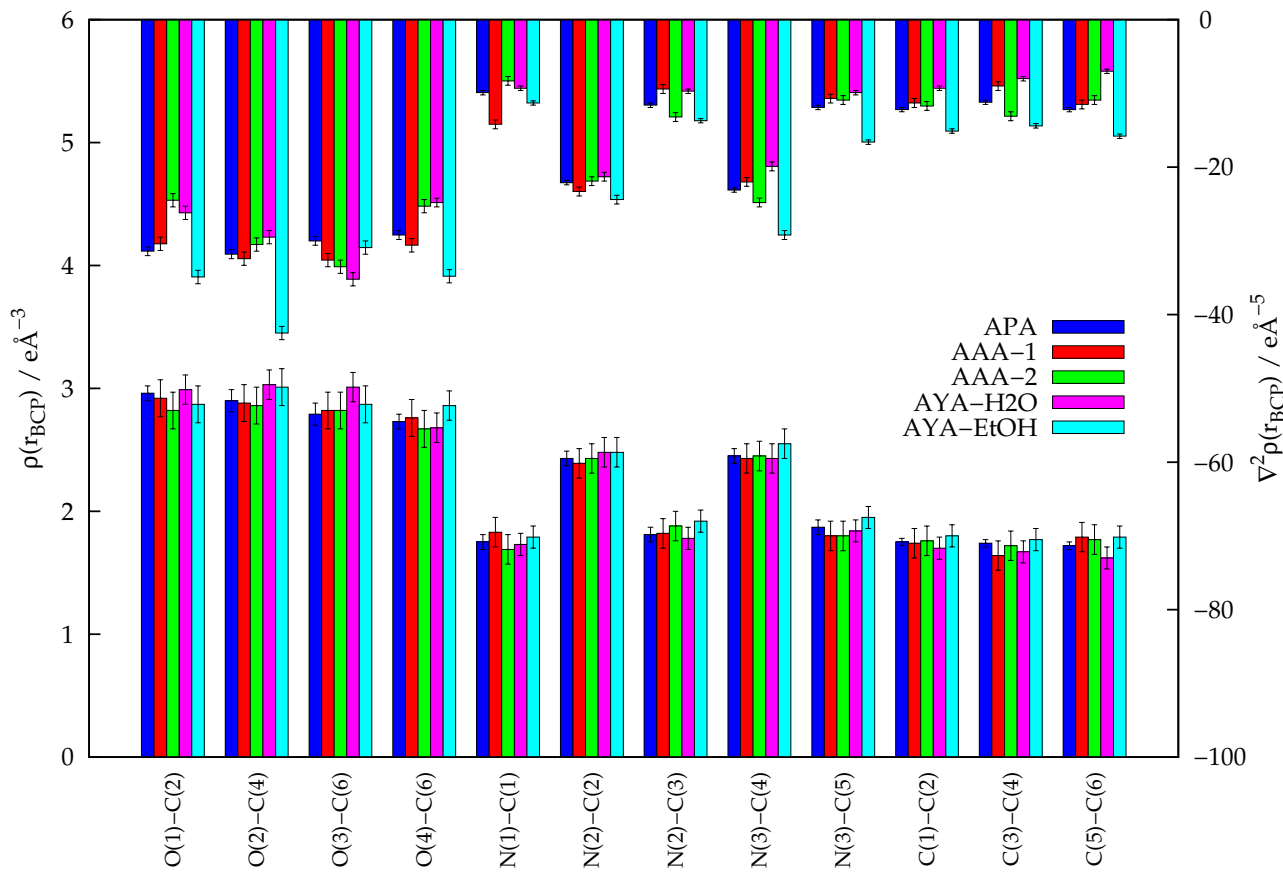


Figure 1: Comparison of bond topological parameters for several tripeptides, error bars $3 \times$ esd: Visualization of Table 4 of the paper.

Table 1: Comparison of refined multipole model with invariom approach: Data of Figure 3 of the paper.

Bond	<i>ref</i>		<i>inv</i>		<i>inv083</i>	
	$\rho(\mathbf{r})$	$\nabla^2\rho(\mathbf{r})$	$\rho(\mathbf{r})$	$\nabla^2\rho(\mathbf{r})$	$\rho(\mathbf{r})$	$\nabla^2\rho(\mathbf{r})$
O(1)–C(2)	2.96(2)	–31.4(2)	2.88	–33.8	2.88	–34.1
O(2)–C(4)	2.90(2)	–31.8(2)	2.60	–30.1	2.61	–29.9
O(3)–C(6)	2.79(3)	–30.0(2)	2.66	–31.3	2.67	–31.5
O(4)–C(6)	2.73(2)	–29.2(2)	2.66	–31.0	2.66	–31.0
N(1)–C(1)	1.75(2)	–9.9(1)	1.75	–9.6	1.74	–9.5
N(2)–C(2)	2.43(2)	–22.1(1)	2.23	–22.4	2.24	–22.6
N(2)–C(3)	1.81(2)	–11.6(1)	1.74	–8.4	1.74	–8.3
N(2)–C(22)	1.74(2)	–9.1(1)	1.72	–9.6	1.72	–9.7
N(3)–C(4)	2.45(2)	–23.1(1)	2.29	–22.6	2.30	–23.0
N(3)–C(5)	1.87(2)	–11.9(1)	1.80	–10.1	1.79	–10.0
C(1)–C(7)	1.66(2)	–9.4(1)	1.66	–10.8	1.66	–10.9
C(2)–C(1)	1.75(1)	–12.1(1)	1.71	–12.1	1.71	–12.1
C(3)–C(20)	1.65(2)	–10.6(1)	1.62	–10.3	1.62	–10.3
C(4)–C(3)	1.74(1)	–11.2(1)	1.77	–11.4	1.76	–11.2
C(5)–C(8)	1.63(1)	–9.4(1)	1.63	–10.2	1.62	–10.2
C(6)–C(5)	1.72(1)	–12.2(1)	1.69	–12.8	1.69	–12.8
C(20)–C(21)	1.62(2)	–8.8(1)	1.60	–9.9	1.61	–9.9
C(21)–C(22)	1.64(2)	–9.2(1)	1.65	–11.1	1.65	–11.1
N(1)–H(11A)	2.22(5)	–33.7(3)	2.22	–33.8	2.22	–33.7
N(1)–H(11B)	2.28(5)	–33.7(3)	2.22	–33.8	2.22	–33.8
N(1)–H(11C)	2.22(5)	–33.1(3)	2.22	–33.7	2.22	–33.7
N(3)–H(13)	2.30(6)	–30.0(4)	2.29	–33.2	2.29	–33.1
C(1)–H(1)	1.97(4)	–19.7(2)	1.88	–20.7	1.88	–20.7
C(3)–H(3)	1.94(4)	–18.7(2)	1.88	–20.7	1.88	–20.7
C(5)–H(5)	1.93(5)	–18.2(2)	1.88	–20.7	1.88	–20.7
C(7)–H(7A)	1.91(0)	–15.7(1)	1.95	–22.4	1.95	–22.4
C(7)–H(7B)	1.90(0)	–15.7(1)	1.95	–22.4	1.96	–22.4
C(7)–H(7C)	1.90(0)	–15.7(1)	1.95	–22.3	1.95	–22.3
C(8)–H(8A)	1.90(3)	–15.7(1)	1.96	–22.4	1.96	–22.4
C(8)–H(8B)	1.90(1)	–15.6(1)	1.95	–22.2	1.95	–22.3
C(8)–H(8C)	1.90(1)	–15.7(1)	1.95	–22.3	1.95	–22.3
C(20)–H(20A)	1.89(4)	–17.4(1)	1.88	–20.6	1.87	–20.5
C(20)–H(20B)	1.88(2)	–17.2(1)	1.87	–20.6	1.87	–20.6
C(21)–H(21A)	1.94(4)	–18.5(1)	1.87	–20.6	1.88	–20.7
C(21)–H(21B)	1.94(2)	–18.4(1)	1.88	–20.7	1.88	–20.7
C(22)–H(22A)	1.90(4)	–16.8(1)	1.90	–21.6	1.89	–21.6
C(22)–H(22B)	1.90(2)	–16.7(1)	1.92	–22.3	1.92	–22.4
O(100)–H(101)	2.37(7)	–38.0(5)	2.48	–48.4	2.48	–48.3
O(100)–H(102)	2.50(8)	–41.0(6)	2.48	–48.3	2.48	–48.4

Table 2: Topological Parameters of Bonds Formed by Non-Hydrogen-Atoms

Bindung	$\rho(r)$	$\nabla^2\rho(r)$	R_{ij}	d_1	d_2	ϵ
O(1)–C(2)	2.96	–31.4	1.240	0.740	0.500	0.09
	2.74	–17.4		0.809	0.431	0.12
	2.80	–28.4		0.740	0.500	0.12
O(2)–C(4)	2.90	–31.8	1.243	0.756	0.487	0.07
	2.70	–16.5		0.813	0.430	0.09
	2.74	–27.8		0.756	0.487	0.10
O(3)–C(6)	2.79	–30.0	1.266	0.768	0.498	0.08
	2.57	–18.2		0.826	0.440	0.09
	2.61	–26.8		0.767	0.499	0.11
O(4)–C(6)	2.73	–29.2	1.271	0.766	0.505	0.09
	2.56	–20.0		0.826	0.445	0.11
	2.60	–26.8		0.765	0.506	0.12
N(1)–C(1)	1.75	–9.9	1.495	0.821	0.674	0.05
	1.59	–13.6		0.939	0.556	0.01
	1.65	–11.6		0.821	0.674	0.00
N(2)–C(2)	2.43	–22.1	1.354	0.772	0.582	0.30
	2.26	–25.4		0.832	0.522	0.25
	2.28	–23.2		0.772	0.582	0.28
N(2)–C(3)	1.81	–11.6	1.475	0.820	0.655	0.10
	1.70	–15.5		0.899	0.577	0.03
	1.73	–13.1		0.820	0.655	0.05
N(2)–C(22)	1.74	–9.1	1.485	0.831	0.654	0.03
	1.68	–15.0		0.891	0.594	0.04
	1.70	–13.0		0.830	0.655	0.06
N(3)–C(4)	2.45	–23.1	1.346	0.757	0.590	0.23
	2.32	–26.6		0.826	0.520	0.25
	2.34	–23.9		0.757	0.590	0.28
N(3)–C(5)	1.87	–11.9	1.462	0.818	0.644	0.07
	1.72	–15.8		0.912	0.550	0.01
	1.75	–13.8		0.817	0.645	0.04
C(1)–C(7)	1.66	–9.4	1.534	0.779	0.755	0.03
	1.63	–13.2		0.810	0.724	0.01
	1.63	–13.0		0.779	0.755	0.02
C(2)–C(1)	1.75	–12.1	1.537	0.783	0.754	0.10
	1.70	–14.5		0.753	0.784	0.09
	1.70	–14.5		0.782	0.755	0.09
C(3)–C(20)	1.65	–10.6	1.547	0.793	0.754	0.05
	1.61	–12.8		0.791	0.757	0.02
	1.61	–12.8		0.794	0.753	0.02
C(4)–C(3)	1.74	–11.2	1.539	0.775	0.764	0.11
	1.69	–14.4		0.762	0.776	0.07
	1.69	–14.4		0.775	0.763	0.07
C(5)–C(8)	1.63	–9.4	1.546	0.783	0.763	0.07
	1.60	–12.7		0.784	0.762	0.04
	1.60	–12.7		0.782	0.764	0.04
C(6)–C(5)	1.72	–12.2	1.544	0.779	0.764	0.07
	1.68	–14.1		0.750	0.794	0.08
	1.68	–14.1		0.779	0.764	0.09
C(20)–C(21)	1.62	–8.8	1.540	0.771	0.769	0.07
	1.62	–12.8		0.763	0.777	0.00
	1.62	–12.8		0.772	0.769	0.00
C(21)–C(22)	1.64	–9.2	1.538	0.765	0.772	0.02
	1.64	–13.5		0.744	0.794	0.02
	1.64	–13.4		0.766	0.772	0.02

ρ in $\text{e}\text{\AA}^{-3}$, $\nabla^2\rho$ in $\text{e}\text{\AA}^{-5}$, d und R-l in \AA

The first entry for each bond refers to multipole model,

second to results of analyzing the theoretic density,

third to topological parameters of the theoretical density, obtained at the experimental location of the BCP

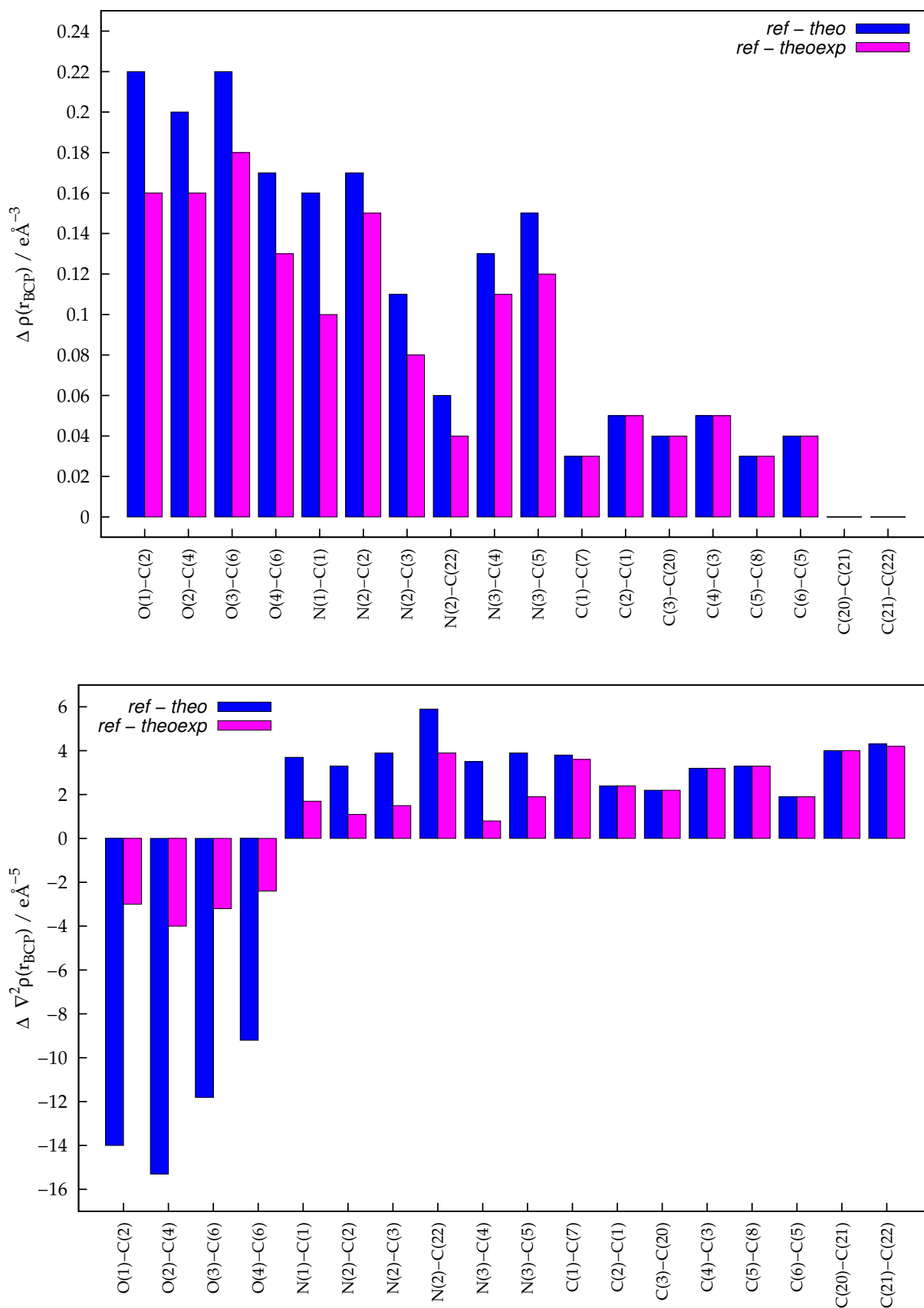


Figure 2: Differences between model *ref* and theory for topological properties of bonds formed by non-hydrogen-atoms (*theoexp*: theoretical density, obtained at the experimental location of the bcp); mean deviations in ρ : $0.10 \text{e}\text{\AA}^{-3}$ for *theo*, $0.08 \text{e}\text{\AA}^{-3}$ for *theoexp*, in $\nabla^2 \rho$: $5.53 \text{e}\text{\AA}^{-5}$ for *theo*, $2.68 \text{e}\text{\AA}^{-5}$ for *theoexp*.

Table 4: Bond topological properties: Additional data to Table 10 of the paper.

D-H...A	R_{ij}	ρ(r)	∇²ρ(r)	λ1	λ2	λ3	ε
O(100)-H(101)...O(2)	1.921	0.13(2)	2.12(4)	-0.83	-0.81	3.76	0.02
	1.921	0.16	2.29	-0.72	-0.70	3.71	0.02
	1.920	0.22(1)	2.34(1)	-1.03	-1.02	4.39	0.01
O(100)-H(102)...O(3)	1.972	0.10(1)	1.98(3)	-0.62	-0.57	3.16	0.09
	1.975	0.14	1.91	-0.63	-0.60	3.14	0.05
	1.972	0.19(1)	2.11(1)	-0.86	-0.84	3.80	0.03
N(1)-H(11A)...O(3)	1.874	0.16(1)	2.46(2)	-1.00	-0.81	4.27	0.24
	1.878	0.17	2.79	-0.88	-0.83	4.50	0.06
	1.873	0.25(1)	2.62(1)	-1.17	-1.11	4.90	0.05
N(1)-H(11B)...O(4)	1.818	0.23(1)	2.06(3)	-1.55	-1.49	5.09	0.04
	1.817	0.19	3.12	-1.06	-1.04	5.22	0.02
	1.816	0.28(1)	2.85(1)	-1.41	-1.39	5.65	0.01
N(1)-H(11C)...O(4)	1.816	0.22(2)	2.27(3)	-1.53	-1.45	5.25	0.06
	1.824	0.19	3.17	-1.10	-1.07	5.35	0.03
	1.814	0.29(1)	2.85(1)	-1.54	-1.47	5.86	0.05
C(7)-H(7B)...O(100)	2.579	0.04(1)	0.68(1)	-0.13	-0.12	0.92	0.09
	2.582	0.04	0.67	-0.16	-0.14	0.96	0.13
	2.578	0.06(1)	0.73(1)	-0.18	-0.17	1.07	0.06
C(7)-H(7C)...O(3)	2.485	0.04(1)	0.84(1)	-0.17	-0.15	1.16	0.10
	2.479	0.05	0.81	-0.20	-0.17	1.17	0.16
	2.481	0.07(1)	0.85(1)	-0.23	-0.21	1.29	0.10
C(8)-H(8A)...O(1)	2.594	0.03(2)	0.66(1)	-0.13	-0.12	0.91	0.07
	2.583	0.04	0.65	-0.14	-0.12	0.91	0.18
	2.589	0.06(1)	0.71(1)	-0.18	-0.18	1.07	0.04

Table 5: Mutual Penetration: Additional data to Table 10 of the paper.

D-H...A	R_{ij}	r_b(H)	Δr(H)	r_b(O)	Δr(O)	Δr(H) + Δr(O)	$\frac{\Delta r(H)}{\Delta r(H) + \Delta r(O)}$
H(101)-O(2)	1.921	0.664	-0.536	1.256	-0.264	-0.799	0.6700
H(102)-O(3)	1.972	0.692	-0.508	1.280	-0.239	-0.748	0.6797
H(11A)-O(3)	1.874	0.658	-0.542	1.216	-0.304	-0.846	0.6403
H(11B)-O(4)	1.818	0.641	-0.559	1.176	-0.344	-0.902	0.6191
H(11C)-O(4)	1.816	0.628	-0.572	1.188	-0.332	-0.904	0.6329
H(7B)-O(100)	2.579	1.059	-0.141	1.520	0.000	-0.141	1.0000
H(7C)-O(3)	2.485	1.021	-0.179	1.464	-0.057	-0.235	0.7599
H(8A)-O(1)	2.594	1.077	-0.123	1.517	-0.003	-0.126	0.9785
H(101)-O(2)	1.921	0.693	-0.507	1.228	-0.292	-0.799	0.6349
H(102)-O(3)	1.975	0.729	-0.471	1.246	-0.274	-0.745	0.6327
H(11A)-O(3)	1.877	0.684	-0.516	1.194	-0.326	-0.843	0.6129
H(11B)-O(4)	1.817	0.643	-0.557	1.175	-0.345	-0.903	0.6173
H(11C)-O(4)	1.824	0.641	-0.558	1.182	-0.338	-0.896	0.6230
H(7B)-O(100)	2.582	1.078	-0.122	1.504	-0.016	-0.138	0.8832
H(7C)-O(3)	2.479	1.039	-0.161	1.440	-0.080	-0.241	0.6682
H(8A)-O(1)	2.583	1.099	-0.101	1.484	-0.036	-0.137	0.7385
H(101)-O(2)	1.920	0.762	-0.438	1.159	-0.361	-0.800	0.5481
H(102)-O(3)	1.972	0.800	-0.400	1.172	-0.348	-0.748	0.5350
H(11A)-O(3)	1.873	0.740	-0.460	1.133	-0.387	-0.847	0.5433
H(11B)-O(4)	1.816	0.700	-0.500	1.116	-0.404	-0.904	0.5532
H(11C)-O(4)	1.814	0.691	-0.509	1.124	-0.396	-0.906	0.5623
H(7B)-O(100)	2.578	1.136	-0.064	1.442	-0.078	-0.142	0.4531
H(7C)-O(3)	2.481	1.096	-0.104	1.385	-0.135	-0.239	0.4351
H(8A)-O(1)	2.589	1.149	-0.051	1.440	-0.080	-0.131	0.3876

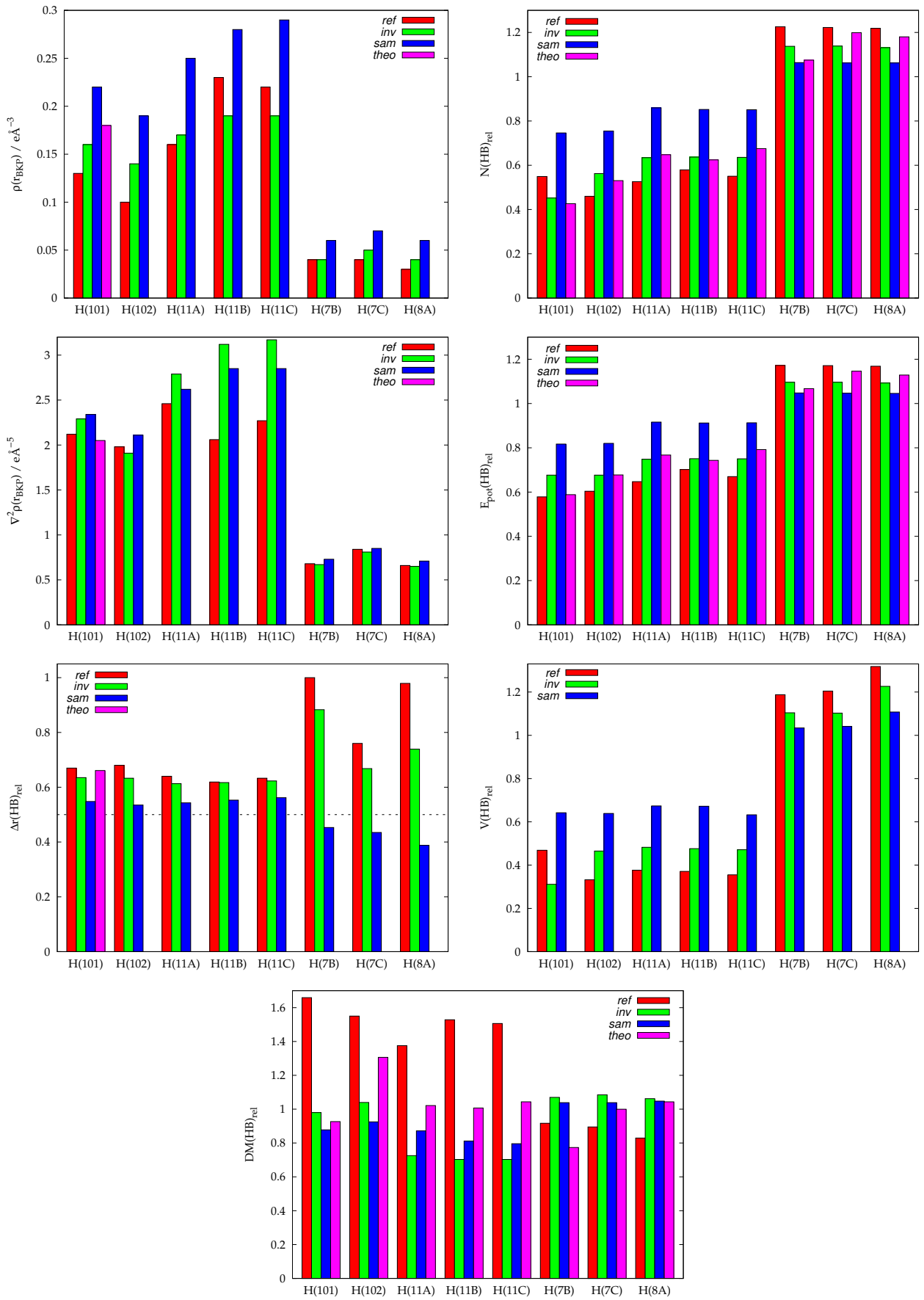


Figure 3: Visualization of the Koch and Popelier parameter from Table 10 of the paper.