

Supplementary Material

First-Principles Molecular Dynamics Simulations on Water–Solid Interface Behavior of H₂O-Based Atomic Layer Deposition of Zirconium Dioxide

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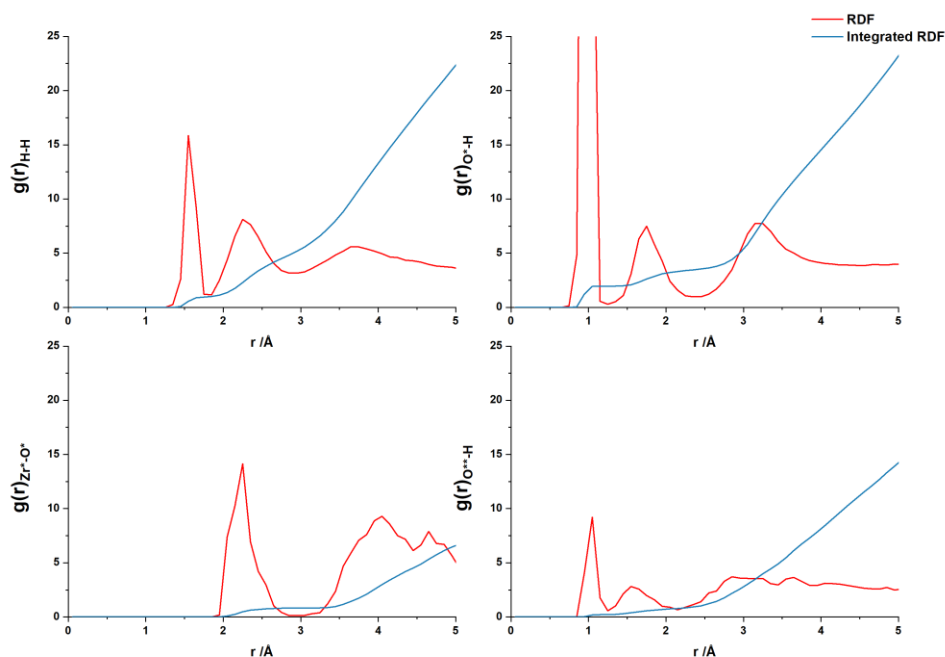


Figure S1 Radial distribution functions (RDFs) and their integrated RDFs of five-layer ZrO_2 model. $g(r)_{\text{H-H}}$ between H atoms in the water molecule (a), $g(r)_{\text{O}^*\text{-H}}$ between O atoms in the water molecule and H atoms in the water molecule (b),

$g(r)_{\text{Zr}^*-\text{O}^*}$ between Zr atoms on the surface of ZrO_2 and O atoms in the water molecule

(c) and $g(r)_{\text{O}^*-\text{H}}$ between O atoms on the surface of ZrO_2 and H atoms in the water molecule (d).

Table S1 Atomic coordinates of 2-layer ZrO₂ substrate

ZrO2_2			
1.0			
	13.3698997498	0.0000000000	0.0000000000
	0.7368347366	7.4012122236	0.0000000000
	0.0000000000	0.0000000000	25.2518005371
Zr	O		
16	32		
Cartesian			
	6.053911234	6.539044964	2.005498007
	3.096552434	3.010285094	4.919045587
	12.370443741	2.838438852	2.005498007
	10.149919655	6.710890985	4.919045587
	1.706319432	0.684094068	2.096152038
	8.759686471	4.384700125	2.096152038
	6.026418488	0.854646041	4.983791156
	13.079785742	4.555252263	4.983791156
	2.241506500	4.066891920	1.862825364
	8.558038826	0.366286001	1.862825364
	6.371726887	4.076581264	4.683281741
	12.688259363	0.375974849	4.683281741
	5.852137069	2.520704760	1.772171333

3.868424212	6.374288169	4.573114522
12.905504312	6.221310871	1.772171333
10.184956143	2.673682278	4.573114522
4.107730155	6.911160524	2.518243348
1.287448534	3.354980965	5.626581709
10.424263082	3.210554633	2.518243348
8.340815577	7.055587077	5.626581709
6.604547215	4.496015976	2.373695885
3.938707508	0.897409140	5.382616815
12.921079340	0.795410030	2.373695885
10.992074795	4.598015693	5.382616815
2.452574104	2.284845275	3.127773094
9.505941702	5.985450946	3.127773094
6.671597166	2.512946976	5.899967649
13.724963989	6.213552867	5.899967649
6.506656467	0.630672866	2.951299868
4.438999778	4.571057223	5.631052681
13.560023716	4.331279033	2.951299868
10.755532273	0.870451001	5.631052681
4.086715020	3.429277777	1.233550454
1.360709830	0.088043520	4.139301865
11.140082640	7.129883668	1.233550454

8.414077580	3.788649714	4.139301865
1.695480609	6.102817564	1.434302280
8.012013016	2.402211453	1.434302280
5.937466176	6.193024550	4.223421774
12.253998262	2.492418218	4.223421774
5.202830262	0.878967943	0.727756906
2.876785068	4.749263696	3.698377118
12.256197499	4.579573999	0.727756906
9.193317386	1.048657694	3.698377118
0.948947184	2.532324782	0.986840401
8.002314007	6.232930674	0.986840401
5.238656712	2.674876241	3.775167447
12.292024000	6.375482794	3.775167447

Table S2 Atomic coordinates of 3-layer ZrO₂ substrate

ZrO ₂ _3		
1.0		
13.3698997498	0.0000000000	0.0000000000
0.7368347366	7.4012122236	0.0000000000
0.0000000000	0.0000000000	28.0905990601
Zr	O	
24	48	

Cartesian

1.765640884	6.373775998	1.987128961
8.082172992	2.673169886	1.987128961
6.031256346	6.482460410	4.880540198
3.110545299	3.016356154	7.738651114
12.347788454	2.781854298	4.880540198
10.163912963	6.716962486	7.738651114
4.471550399	4.219431159	2.077861541
1.669172845	0.671688804	4.986156109
10.788082900	0.518824992	2.077861541
8.722539607	4.372295081	4.986156109
6.003352368	0.846997495	7.790594696
13.056719617	4.547603662	7.790594696
4.269768863	0.201016924	1.844709599
2.223774448	4.055170654	4.684262657
11.323136098	3.901622953	1.844709599
8.540306581	0.354564790	4.684262657
6.352721322	4.056400570	7.535910658
12.669253015	0.355794293	7.535910658
1.564000499	2.355435794	1.753696150
8.617367443	6.056041905	1.753696150
5.813455977	2.458469117	4.562973342

3.852796072	6.388742779	7.474131223
12.866823220	6.159075229	4.562973342
10.169328601	2.688136888	7.474131223
6.142545646	3.083359047	2.447554063
4.122488931	6.986168244	5.512046893
1.308331149	3.395897976	8.416951570
13.195912889	6.783965159	2.447554063
10.439022213	3.285561912	5.512046893
8.361698271	7.096503868	8.416951570
2.301238706	4.345528510	2.366958924
8.617771423	0.644922508	2.366958924
6.618483374	4.446725781	5.295693715
3.923722515	0.910921627	8.228526637
12.935015897	0.746119835	5.295693715
10.977089786	4.611528014	8.228526637
5.191962766	5.808395865	3.132608977
2.455323485	2.304018831	5.908833007
11.508494875	2.107789754	3.132608977
9.508690529	6.004624943	5.908833007
6.583127589	2.478678926	8.758032719
13.636494433	6.179285038	8.758032719
2.233092328	0.454498287	2.943793716

9.286459579	4.155104481	2.943793716
6.529637024	0.649096693	5.723015844
4.404096228	4.545164563	8.483525449
13.583003853	4.349702639	5.723015844
10.720629521	0.844558341	8.483525449
6.851945771	6.964614702	1.215199333
4.109452707	3.555745912	4.038023531
1.339700249	0.059917320	7.109912505
13.168478278	3.264008590	1.215199333
11.162820348	7.256352024	4.038023531
8.393068100	3.760523529	7.109912505
3.723876546	2.236942487	1.416047063
1.599627624	6.057151389	4.211030813
10.777244187	5.937548598	1.416047063
7.916160109	2.356545057	4.211030813
5.961208345	6.180087925	7.134455674
12.277740453	2.479481813	7.134455674
0.914559906	0.713698922	0.709287651
7.967927547	4.414305033	0.709287651
5.024953489	0.834997480	3.666380833
2.928349074	4.757210952	6.471500036
12.078321131	4.535603592	3.666380833

9.244881193	1.056604951	6.471500036
3.714044254	6.067661708	0.968563906
0.971345470	2.513473264	3.841023098
10.030576561	2.367055596	0.968563906
8.024712641	6.214079155	3.841023098
5.205057283	2.662667288	6.584494719
12.258424548	6.363273620	6.584494719

Table S3 Atomic coordinates of 4-layer ZrO₂ substrate.

ZrO2_4		
1.0		
13.3698997498	0.0000000000	0.0000000000
0.7368347366	7.4012122236	0.0000000000
0.0000000000	0.0000000000	30.9293994904
Zr	O	
32	64	
Direct		
0.265089989	0.338849992	0.065130003
0.081281401	0.858739555	0.158556074
0.765089989	0.838850021	0.065130003
0.581281364	0.358739555	0.158556074
0.401672155	0.876958013	0.251208812

0.208299726	0.408661872	0.344038367
0.901672184	0.376957983	0.251208812
0.708299696	0.908661842	0.344038367
0.483520001	0.047770001	0.068070002
0.300120145	0.569904685	0.160696134
0.117677435	0.089774728	0.254667014
0.983519971	0.547770023	0.068070002
0.800120115	0.069904670	0.160696134
0.617677391	0.589774728	0.254667014
0.440553159	0.116057396	0.345856994
0.940553188	0.616057396	0.345856994
0.498349994	0.504830003	0.060520001
0.315760911	0.024372872	0.152600586
0.135021374	0.545625091	0.245221913
0.998350024	0.004830000	0.060520001
0.815760911	0.524372876	0.152600586
0.635021389	0.045625135	0.245221913
0.443273097	0.549162984	0.337672293
0.943273067	0.049162939	0.337672293
0.279929996	0.795920014	0.057580002
0.097221680	0.312522948	0.150195941
0.779929996	0.295920014	0.057580002

0.597221673	0.812522948	0.150195941
0.415301174	0.332732171	0.241803318
0.239375845	0.863570452	0.335084498
0.915301204	0.832732141	0.241803318
0.739375830	0.363570452	0.335084498
0.117613547	0.399083465	0.081092745
0.617613554	0.899083495	0.081092745
0.437042534	0.432707906	0.177992851
0.255664051	0.947919488	0.271293253
0.070826821	0.461379290	0.366075248
0.937042534	0.932707906	0.177992851
0.755664051	0.447919518	0.271293253
0.570826828	0.961379230	0.366075248
0.320426673	0.065154560	0.077727646
0.139899984	0.583789587	0.171892449
0.820426643	0.565154552	0.077727646
0.639900029	0.083789580	0.171892449
0.459420592	0.602360964	0.265259653
0.284524441	0.123598337	0.359894753
0.959420562	0.102360994	0.265259653
0.784524441	0.623598397	0.359894753
0.023950234	0.764072001	0.102276556

0.523950279	0.264071971	0.102276556
0.342372090	0.788417697	0.193574309
0.161505893	0.310324073	0.285537183
0.842372060	0.288417697	0.193574309
0.661505878	0.810324013	0.285537183
0.472524375	0.336301833	0.377257884
0.972524345	0.836301804	0.377257884
0.344549149	0.539035082	0.095374949
0.164805099	0.066873610	0.186910331
0.844549119	0.039035074	0.095374949
0.664805055	0.566873610	0.186910331
0.481123894	0.087432139	0.278835684
0.293816805	0.616187394	0.368200660
0.981123865	0.587432146	0.278835684
0.793816805	0.116187401	0.368200660
0.141120002	0.918680012	0.040169999
0.641120017	0.418680012	0.040169999
0.460611045	0.954544604	0.131906807
0.277938187	0.469387949	0.225353017
0.097995251	0.005423663	0.322837710
0.960611045	0.454544604	0.131906807
0.777938187	0.969387949	0.225353017

0.597995281	0.505423665	0.322837710
0.442360014	0.779910028	0.046659999
0.255310744	0.295898587	0.137492880
0.076060325	0.818808079	0.231054395
0.942359984	0.279909998	0.046659999
0.755310774	0.795898557	0.137492880
0.576060295	0.318808079	0.231054395
0.398113191	0.836350739	0.324313402
0.898113191	0.336350739	0.324313402
0.243579999	0.574100018	0.023820000
0.053226847	0.094299652	0.118925810
0.743579984	0.074100003	0.023820000
0.553226888	0.594299674	0.118925810
0.373929530	0.112163015	0.210060567
0.183955207	0.642224967	0.302669376
0.873929560	0.612163007	0.210060567
0.683955193	0.142224997	0.302669376
0.413100004	0.297490001	0.032200001
0.235297740	0.818150938	0.124789290
0.050721988	0.337317616	0.217489138
0.913100004	0.797490001	0.032200001
0.735297740	0.318150938	0.124789290

0.550721943	0.837317586	0.217489138
0.367773026	0.360264391	0.307359070
0.867772996	0.860264421	0.307359070

Table S4 Atomic coordinates of 5-layer ZrO₂ substrate.

ZrO2_5		
1.0		
13.3698997498	0.0000000000	0.0000000000
0.7368347366	7.4012122236	0.0000000000
0.0000000000	0.0000000000	33.7681999207
Zr	O	
40	80	
Direct		
0.445589989	0.816519976	0.037840001
0.265089989	0.338849992	0.121909998
0.084600002	0.861180007	0.205970004
0.945590019	0.316520005	0.037840001
0.765089989	0.838850021	0.121909998
0.584599972	0.361180007	0.205970004
0.404110014	0.883509994	0.290039986
0.223619998	0.405849993	0.374110013
0.904110014	0.383509994	0.290039986

0.723619998	0.905849993	0.374110013
0.164010003	0.025440000	0.040530000
0.664009988	0.525439978	0.040530000
0.483520001	0.047770001	0.124600001
0.303030014	0.570100009	0.208660007
0.122529998	0.092430003	0.292730004
0.983519971	0.547770023	0.124600001
0.803030014	0.070100002	0.208660007
0.622529984	0.592429996	0.292730004
0.442039996	0.114759997	0.376800001
0.942040026	0.614759982	0.376800001
0.178849995	0.482499987	0.033620000
0.678849995	0.982500017	0.033620000
0.498349994	0.504830003	0.117689997
0.317860007	0.027160000	0.201749995
0.137370005	0.549489975	0.285820007
0.998350024	0.004830000	0.117689997
0.817860007	0.527159989	0.201749995
0.637369990	0.049490001	0.285820007
0.456880003	0.571820021	0.369890004
0.956879973	0.071819998	0.369890004
0.460420012	0.273589998	0.030929999

0.279929996	0.795920014	0.115000002
0.099440001	0.318250000	0.199059993
0.960420012	0.773590028	0.030929999
0.779929996	0.295920014	0.115000002
0.599439979	0.818250000	0.199059993
0.418940008	0.340579987	0.283129990
0.238450006	0.862909973	0.367199987
0.918940008	0.840579987	0.283129990
0.738449991	0.362910002	0.367199987
0.302819997	0.902670026	0.056480002
0.122330002	0.425000012	0.140540004
0.802820027	0.402669996	0.056480002
0.622330010	0.925000012	0.140540004
0.441839993	0.447329998	0.224610001
0.261339992	0.969669998	0.308679998
0.080849998	0.492000014	0.392749995
0.941839993	0.947329998	0.224610001
0.761340022	0.469669998	0.308679998
0.580850005	0.991999984	0.392749995
0.001580000	0.041439999	0.050530002
0.501580000	0.541440010	0.050530002
0.321090013	0.063770004	0.134599999

0.140599996	0.586109996	0.218669996
0.821089983	0.563769996	0.134599999
0.640600026	0.086110003	0.218669996
0.460099995	0.608439982	0.302740008
0.279610008	0.130769998	0.386799991
0.960099995	0.108439997	0.302740008
0.779609978	0.630770028	0.386799991
0.200360000	0.247250006	0.071460001
0.019859999	0.769580007	0.155520007
0.700360000	0.747250021	0.071460001
0.519860029	0.269580007	0.155520007
0.339370012	0.791909993	0.239590004
0.158879995	0.314240009	0.323659986
0.839370012	0.291909993	0.239590004
0.658879995	0.814239979	0.323659986
0.478390008	0.336580008	0.407730013
0.978389978	0.836579978	0.407730013
0.030840000	0.523859978	0.063780002
0.530839980	0.023860000	0.063780002
0.350340009	0.546190023	0.147850007
0.169850007	0.068520002	0.231920004
0.850340009	0.046190001	0.147850007

0.669849992	0.568520010	0.231920004
0.489360005	0.090860002	0.315979987
0.308869988	0.613189995	0.400050014
0.989359975	0.590860009	0.315979987
0.808870018	0.113190003	0.400050014
0.321610004	0.396349996	0.014980000
0.141120002	0.918680012	0.099050000
0.821609974	0.896350026	0.014980000
0.641120017	0.418680012	0.099050000
0.460630000	0.941009998	0.183119997
0.280129999	0.463340014	0.267179996
0.099639997	0.985669971	0.351249993
0.960630000	0.441009998	0.183119997
0.780130029	0.963339984	0.267179996
0.599640012	0.485670000	0.351249993
0.122850001	0.757579982	0.020919999
0.622850001	0.257580012	0.020919999
0.442360014	0.779910028	0.104989998
0.261869997	0.302240014	0.189060003
0.081370004	0.824570000	0.273130000
0.942359984	0.279909998	0.104989998
0.761870027	0.802240014	0.189060003

0.581369996	0.324570000	0.273130000
0.400880009	0.846899986	0.357190013
0.900879979	0.346899986	0.357190013
0.424080014	0.051770002	0.000000000
0.243579999	0.574100018	0.084069997
0.063089997	0.096430004	0.168139994
0.924080014	0.551769972	0.000000000
0.743579984	0.074100003	0.084069997
0.563090026	0.596430004	0.168139994
0.382600009	0.118759997	0.252200007
0.202110007	0.641089976	0.336270005
0.882600009	0.618759990	0.252200007
0.702109993	0.141090006	0.336270005
0.093599997	0.275160015	0.007680000
0.593599975	0.775160015	0.007680000
0.413100004	0.297490001	0.091739997
0.232610002	0.819819987	0.175809994
0.052120000	0.342150003	0.259880006
0.913100004	0.797490001	0.091739997
0.732609987	0.319819987	0.175809994
0.552119970	0.842149973	0.259880006
0.371630013	0.364479989	0.343950003

0.871630013	0.864480019	0.343950003
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Table S5 Atomic coordinates of 3-layer ZrO₂ substrate 55 waters.

ZrO2_3_H2O			
1.0			
	13.3849000931	0.0000000000	0.0000000000
	0.3679334631	7.4097707366	0.0000000000
	0.0000000000	0.0000000000	29.3668003082
O	H	Zr	
103	110	24	
Direct			
	0.269927055	0.249232650	0.147246912
	0.575825512	0.477526098	0.503127337
	0.526521206	0.738670707	0.437544078
	0.980632067	0.719191074	0.118247636
	0.113621846	0.813443482	0.422109663
	0.621419907	0.096191898	0.589543521
	0.695391536	0.596496582	0.107669577
	0.599495173	0.579717517	0.206534564
	0.384490699	0.939312696	0.583393335
	0.164949924	0.023006292	0.198039785
	0.606706679	0.962872386	0.163158953

0.260983795	0.747459888	0.237141311
0.874694765	0.580532610	0.493748695
0.564058006	0.689767957	0.346103460
0.874921501	0.214320123	0.508036435
0.065945826	0.362076819	0.142482489
0.851144016	0.294450909	0.238863379
0.552332699	0.946769834	0.270393789
0.201030359	0.254914939	0.266140103
0.392943203	0.184508204	0.284445882
0.945271313	0.279057860	0.322249770
0.291288853	0.531355977	0.554732144
0.693829715	0.649717271	0.566670775
0.323916644	0.866639495	0.319780201
0.985788345	0.513978660	0.417426407
0.548580110	0.776864290	0.622021317
0.382330418	0.538095951	0.183631465
0.739869893	0.881065667	0.028500812
0.442848265	0.042747293	0.113463528
0.101161666	0.548304915	0.225744933
0.831039190	0.842400789	0.240890205
0.915922046	0.255281776	0.062340252
0.060298737	0.583289146	0.314350843

0.517997921	0.001574615	0.506330311
0.250526428	0.882603168	0.500046790
0.427831411	0.285391659	0.598716855
0.035166282	0.173593611	0.565871298
0.193017289	0.239394635	0.515910625
0.179474100	0.755340517	0.611307085
0.214778587	0.481116831	0.373444647
0.725579917	0.138559803	0.104590066
0.834165871	0.165477097	0.419135064
0.112360269	0.228882983	0.431920469
0.808745205	0.960566044	0.565632701
0.394136995	0.506777287	0.333230317
0.832512856	0.482830226	0.621314228
0.724566281	0.101359069	0.289821506
0.969254196	0.698529422	0.579547107
0.381120205	0.693103552	0.095216714
0.523349702	0.445007503	0.084474631
0.967168808	0.983071864	0.186177447
0.012998209	0.926356316	0.341063380
0.326287806	0.830970883	0.412753254
0.816101789	0.892054617	0.357297152
0.746417224	0.595487833	0.317837596

0.437314957	0.437445581	0.766051352
0.257683724	0.979646444	0.872204602
0.071901515	0.505962133	0.969227791
0.937946081	0.940918922	0.766866744
0.758771181	0.476100922	0.871039689
0.565810919	0.002886477	0.969389737
0.133346736	0.594106317	0.763573527
0.633022785	0.093548141	0.763306379
0.457538873	0.609882116	0.863204777
0.280356050	0.129758984	0.963602483
0.958613276	0.111578815	0.863564670
0.784696817	0.624612093	0.962228954
0.332936972	0.789538383	0.792100251
0.146460906	0.330309302	0.887791574
0.836864114	0.291799784	0.791589320
0.648081958	0.828685701	0.888577521
0.457780033	0.359480619	0.982963383
0.949378490	0.859735608	0.985812902
0.166819811	0.076216996	0.784422100
0.665485740	0.577271044	0.784216523
0.479824364	0.102793008	0.877569735
0.290079653	0.632174373	0.973226368

0.982282221	0.604304433	0.877169132
0.791856885	0.140015602	0.970598459
0.462104321	0.940535545	0.722162068
0.273796052	0.460728347	0.818445563
0.093286484	0.997488201	0.925237060
0.963588953	0.443551660	0.721037507
0.773914993	0.966481745	0.819444060
0.594383538	0.503398776	0.924292862
0.249186516	0.312099636	0.726949215
0.074927077	0.831537545	0.827678084
0.751326144	0.811824679	0.728099525
0.573786795	0.330130696	0.826952696
0.398014635	0.847777128	0.927107871
0.901787817	0.350172013	0.926289499
0.072389327	0.082680151	0.707659304
0.571430862	0.588018715	0.707175434
0.384198487	0.110485360	0.803403914
0.200554788	0.650514901	0.897992969
0.884801447	0.614075720	0.803070724
0.692609966	0.152300477	0.899538159
0.240944758	0.810110331	0.717070937
0.051749285	0.338997483	0.812985539

0.741209507	0.312543303	0.718626976
0.550836504	0.839594483	0.813736320
0.364388704	0.366396934	0.906201363
0.867656052	0.867187977	0.906703591
0.307105571	0.333959699	0.166083083
0.240090698	0.160193697	0.168178916
0.588475704	0.347671360	0.500608087
0.624380350	0.523718059	0.525173485
0.543388903	0.630716562	0.456614733
0.532744825	0.841041684	0.459051907
0.000864288	0.594414532	0.126405895
0.937722564	0.709037840	0.091779090
0.072891735	0.705550790	0.421731710
0.180640638	0.768311620	0.411966473
0.693430901	0.064580649	0.585446358
0.598501384	0.997707307	0.608966827
0.675357103	0.670558274	0.134086639
0.712622225	0.681260467	0.083699368
0.654337466	0.511901557	0.221625283
0.598544061	0.699418783	0.220512047
0.314223766	0.912530839	0.587091982
0.390595496	0.071333565	0.589849591

0.092827156	0.993880749	0.195796803
0.203316748	0.914672971	0.210526049
0.597382486	0.981041253	0.195871741
0.540252507	0.995425701	0.148479953
0.316830754	0.676120162	0.222078204
0.279288679	0.781861067	0.268747717
0.906563461	0.563928723	0.463238657
0.809046924	0.639493346	0.488571137
0.562120795	0.727463424	0.378675699
0.509781420	0.603146434	0.344297856
0.865250766	0.347856104	0.507762849
0.865110278	0.179039672	0.475369930
0.138591304	0.329555035	0.138457090
0.038685858	0.255451113	0.156428695
0.797841668	0.222319797	0.252035528
0.882052898	0.218476191	0.214970544
0.546051562	0.862716496	0.296324342
0.493079156	0.033425659	0.272703260
0.181031331	0.164752066	0.243247420
0.170537949	0.368321627	0.253590614
0.322888196	0.215276152	0.273054004
0.407188058	0.294357210	0.302113742

0.990007520	0.381275594	0.320708334
0.914723516	0.281262606	0.291117847
0.303755581	0.631702840	0.534071207
0.252031416	0.593203068	0.579477727
0.635583162	0.691861808	0.586346209
0.729879975	0.760449827	0.560528815
0.314340413	0.868691504	0.353344887
0.351352870	0.984592259	0.311862826
0.027563527	0.398426920	0.422058374
0.964760303	0.513608217	0.385617107
0.542604268	0.702444494	0.649657369
0.480472952	0.816044629	0.610701621
0.454108685	0.524375021	0.190946683
0.378498822	0.600053072	0.153665274
0.723107338	0.991187453	0.046690326
0.813297868	0.880820155	0.024232833
0.421362936	0.923215985	0.103481412
0.381550699	0.108979374	0.124466062
0.083629720	0.501310825	0.195554957
0.159375161	0.626318455	0.223619685
0.791262627	0.936055422	0.258341640
0.824907720	0.731088400	0.258133978

0.966910660	0.284588188	0.084588237
0.863115489	0.201270431	0.080234610
0.067198299	0.567922533	0.280844033
0.042406108	0.713708639	0.318696111
0.456121266	0.969116211	0.521612644
0.561843514	0.026904928	0.532455325
0.187063217	0.851270556	0.486280978
0.239281878	0.010383335	0.509854436
0.392857581	0.380103499	0.580160141
0.498200029	0.277989239	0.589469790
0.978748918	0.188939661	0.543808639
0.016385637	0.248002231	0.592060089
0.230358541	0.342502117	0.527127385
0.135603920	0.225368619	0.537527204
0.178727955	0.781845272	0.643929243
0.109087065	0.750607252	0.601711512
0.191586211	0.371120989	0.387656450
0.165263310	0.512703776	0.349189758
0.689993024	0.074220225	0.129325986
0.713779986	0.266492605	0.111473665
0.818211973	0.054546591	0.402461410
0.866279840	0.238550350	0.396271229

0.100040980	0.100334741	0.429061443
0.144282058	0.241104648	0.462724566
0.870421648	0.892989278	0.575363934
0.830189586	0.054326482	0.543859005
0.333890736	0.482759088	0.352340668
0.374646276	0.626099467	0.320116282
0.822464943	0.355408728	0.626228929
0.775107920	0.528677642	0.601887345
0.752744675	0.039521705	0.317464858
0.656680286	0.054130726	0.284184366
0.930326939	0.609129548	0.596268833
0.957994998	0.666782439	0.547508359
0.325359493	0.674737632	0.074715339
0.433160454	0.593762636	0.087635212
0.589976609	0.485224158	0.093840763
0.523084342	0.313946843	0.083074532
0.964162886	0.900217533	0.159800276
0.924433410	0.923953116	0.209371567
0.053861734	0.914571464	0.369048446
0.006412951	0.055627346	0.331826329
0.306951672	0.879520774	0.443099529
0.393694341	0.774140596	0.418454468

0.889166355	0.892786622	0.350487918
0.794818521	0.771083593	0.347343951
0.675200522	0.613601863	0.328948915
0.765750468	0.468342155	0.322020710
0.092075042	0.879552424	0.752866864
0.592658699	0.380290836	0.751721740
0.399645329	0.883744478	0.850381732
0.204078212	0.429316700	0.947021902
0.901593626	0.384870350	0.849885702
0.700042248	0.932367086	0.949630439
0.295509994	0.562106073	0.752752364
0.118204147	0.101606742	0.853855789
0.795309365	0.066164173	0.753843307
0.618635833	0.602246642	0.854060709
0.433737040	0.137555867	0.947558522
0.936665714	0.635679245	0.947500467
0.329120547	0.011211901	0.743853867
0.132706285	0.558031738	0.840509653
0.830273926	0.515113652	0.742794454
0.632086694	0.057926230	0.841936171
0.440312803	0.562227190	0.938551486
0.938710988	0.064494662	0.940100133

0.096256152	0.305469930	0.743159950
0.597720504	0.809032440	0.744357884
0.413747638	0.339140296	0.837144434
0.236358479	0.876348913	0.938130856
0.914188206	0.841014981	0.837629914
0.739043057	0.379238099	0.937455773