

Supplementary Information

S1 Unit cell sizes for packings identified to be optimal by the sequential linear programming (SLP) method

SLP identifies the densest structures in the ranges $2.86\sigma \leq D \leq 2.98\sigma$ and $3.43\sigma \leq D \leq 4.00\sigma$ as well as for $D = 3.04\sigma$, 3.27σ and 3.40σ .

Supplementary Table S1: Structural parameters for different cylinder diameters. Quantities are rounded to the last digit. * denotes that the identified structure has a small enough period to give confidence that it is the truly optimal packing. Other entries indicate the densest structure for the N range we search. Recall that $\eta = [\frac{4}{3}\pi(\frac{\sigma}{2})^3 N] / [\pi(\frac{D}{2})^2] \lambda_z$.

D/σ	N	λ_z/σ	λ_θ	D/σ	N	λ_z/σ	λ_θ	D/σ	N	λ_z/σ	λ_θ
2.86	63	9.0393	2.9033	3.52	77	7.4307	0.6253	3.77	58	4.5814	0.8325
2.87	50	6.9948	2.8225	3.53	77	7.3873	5.6060	3.78	58	4.5496	0.8230
2.88	65	8.9876	5.2646	3.54	72	6.8727	3.7098	3.79	58	4.5220	0.8134
2.89	138	18.9765	0.1512	3.55	62	5.8876	2.8030	3.80	54	4.1833	1.3869
2.90	117	15.9913	0.8482	3.56	62	5.8565	3.4986	3.81	54	4.1563	1.4064
2.91	81	10.9944	2.6513	3.57	52	4.8802	3.2919	3.82	54	4.1322	1.4034
2.92	141	18.9795	1.8146	3.58	66	6.0746	0.0044	3.83	54	4.1166	4.8716
2.93	90	12.0053	0.3859	3.59	66	6.0000	0.0153	3.84	54	4.1063	1.3987
2.94	83	10.9975	0.9297	3.60	55	4.9973	0.0563	3.85	79	5.9917	0.0480
2.95	69	9.0499	0.1637	3.61	66	5.9896	0.1373	3.86	79	5.9805	0.0473
2.96	69	9.0133	4.3213	3.62	72	6.5186	0.3233	3.87	71	5.3601	1.8866
2.97	69	8.9801	1.7785	3.63	57	5.1245	3.0348	3.88	71	5.3448	1.9012
2.98	55	7.0602	2.4692	3.64	83	7.4014	0.0912	3.89	71	5.3314	1.9129
3.04	48	5.9376	3.6792	3.65	83	7.3474	6.2378	3.90*	12	0.8944	0.3191
3.27	50	5.4996	5.5196	3.66*	12	1.0527	0.1915	3.91*	12	0.8836	0.7146
3.40	78	8.0863	2.5233	3.67*	12	1.0396	0.1961	3.92*	12	0.8704	0.7083
3.43*	10	1.0192	0.0000	3.68*	12	1.0263	0.2005	3.93*	12	0.8609	0.9076
3.44*	10	1.0069	0.0000	3.69*	12	1.0127	0.2050	3.94*	12	0.8598	0.3492
3.45*	10	1.0000	0.0097	3.70*	12	0.9989	0.2094	3.95*	14	1.0002	0.1737
3.46	59	5.9567	3.3920	3.71*	12	0.9972	0.1993	3.96*	14	0.9927	0.1797
3.47	65	6.4690	1.1549	3.72*	12	0.9963	0.1953	3.97*	14	0.9890	0.1822
3.48	51	5.0314	2.1022	3.73*	12	0.9944	0.8389	3.98*	14	0.9859	1.3955
3.49	51	4.9989	4.1921	3.74	74	6.0863	2.1105	3.99*	14	0.9842	0.1769
3.50	51	4.9740	2.1083	3.75	50	4.0720	2.8097	4.00*	14	0.9826	0.8123
3.51	72	6.9849	2.6963	3.76	63	5.0371	3.8694				