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HYPERBOLIC INVARIANTS OF KNOTS AND LINKS

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ABSTRACT. Tables of values for the hyperbolic volume, number of symmetries, cusp volume and conformal invariants of the cusps are given for hyperbolic knots through ten crossings and hyperbolic links of 2, 3 and 4 components through 9 crossings. The horoball patterns and the canonical triangulations are displayed for knots through eight crossings and for particularly interesting additional examples of knots and links.

1. INTRODUCTION

In 1978, copies of notes from a course Thurston had taught at Princeton first began to circulate. These notes were the basis for a revolution in 3-manifold theory. Thurston's Geometrization Conjecture, now proven for Haken 3-manifolds and manifolds with symmetry, asserts that the interior of every compact 3-manifold may be canonically decomposed into pieces which admit certain geometric structures. (For an overview, see [14].) Of the eight geometries which occur, seven are well understood and the manifolds admitting them have been classified. The last and richest geometry is that of hyperbolic 3-space. Empirically, a "typical" 3-manifold can be expected to admit a hyperbolic structure, with no decomposition required. Mostow's Rigidity Theorem tells us that a finite volume hyperbolic 3-manifold has a unique hyperbolic structure. In particular, the hyperbolic volume can be used as a topological invariant.

In his notes Thurston displays the hyperbolic structure on the figure-eight knot complement as a pair of ideal (vertices missing) hyperbolic tetrahedra with all dihedral angles $\pi/3$ such that faces are identified in pairs. A similar description for the hyperbolic structure on any hyperbolic knot or link complement in S^3 is possible.

In this paper we present tables of hyperbolic link invariants. The computer program which calculates the hyperbolic structures decomposes a link complement into ideal tetrahedra according to the algorithm in [15], represents the

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shape of each ideal tetrahedron by a complex number, sets up the gluing and cusp equations as in [13], and solves the equations using the Newton-Raphson method. From this, the invariants can be calculated.

§2 briefly describes each of the tabulated invariants, §3 gives some applications, and the tables themselves appear as Tables 1 and 2. In Table 1, a link denoted *Lmnnppp* is an m-component link with nn crossings and with number ppp in the standard tables for nn-crossing links (cf. [11]).

The Dehn surgery spaces for these manifolds have also been calculated (cf. [15]). Recently, C. Hodgson, R. Meyerhoff and W. Neumann have extended the program to also calculate the Chern-Simons invariant for certain manifolds, an invariant which is not discussed in this paper.

A version of the program which generates these results and runs on a Macintosh computer is available from Jeffrey Weeks.

2. Invariants

Mostow's Rigidity Theorem (cf. Chapter 5 of [13]) implies that the hyperbolic structure on a finite volume hyperbolic 3-manifold is unique up to isometry. In particular, any invariants which are defined in terms of the hyperbolic structure of such a manifold are topological invariants of the 3-manifold.

The first such invariant that one would like to look at is the hyperbolic volume of the manifold. If the manifold has been decomposed into ideal hyperbolic tetrahedra, the volume will simply be the sum of the volumes of the tetrahedra. Once the dihedral angles on the set of ideal tetrahedra are known, their volumes may be computed using the formula which appears in [9].

Another invariant of the hyperbolic structure that we compute is the maximal cusp volume. In the case of a 1-cusped hyperbolic 3-manifold, this is simply the volume of the largest possible cusp in the manifold. That is, every noncompact orientable finite volume hyperbolic 3-manifold decomposes along a disjoint set of tori to yield a compact piece and a finite set of cusps, each of which is topologically $T^2 \times [0, 1)$. Geometrically, each cusp is covered by an infinite set of disjoint horoballs in H^3, all of which are identified by the covering transformations. We expand the horoballs equivariantly until two first become tangent. The projection of these expanded horoballs down to M is called the maximal cusp and its volume is the maximal cusp volume. Note that we still call it a cusp even though it touches itself on the boundary. In the case M has more than one cusp, we define the maximal disjoint cusp volume to be the largest total volume of a set of cusps which have pairwise disjoint interiors, but which can touch each other or themselves on their boundaries.

The computer program currently can compute the maximal cusp volume of a single cusp in a multi-cusped manifold and the disjoint maximal cusp volume in a 2-cusped manifold. Table 1 lists the maximal cusp volume for each of the cusps in a given link.

A related invariant which is not listed in Table 1 is the cusp density of M. It is the ratio of the disjoint maximal cusp volume to the total volume. In [7], Meyerhoff utilized results of Boroczky [4] in order to prove that cusp density is at most $.853\ldots$, a cusp density which is realized by the figure-eight knot complement. This upper bound on the cusp density can be used in conjunction with lower bounds on disjoint maximal cusp volume in order to obtain lower bounds for the volumes of manifolds as in [2] and [3].

Additional invariants of hyperbolic knot and link complements are obtainable from the cusps. Let M be such a manifold, and let C be a maximal cusp in M. Let H be a horoball in H^3 which is centered at ∞ in the upper-half-space model of H^3 and which covers C. Normalize so that the boundary of H is at height 1 above the x-y plane. Then let T be the parabolic isometry fixing ∞ which is the shortest translation. The column labelled "min trans" in Table 1 gives the length of that translation. This number can be thought of as the length of the shortest nontrivial parabolic loop in the boundary of the maximal cusp.

Continuing to let ∞ be the center of a horoball covering the cusp C, where we no longer assume C is necessarily maximal, let T_1 and T_2 be the two covering transformations which fix ∞ and which are lifts of the meridian and longitude of the link component corresponding to C. Representing the x-y plane as the complex plane, T_1 and T_2 are each translation by the complex numbers a and b respectively. Let r be the ratio a/b. Then r describes the parallelogram which is a fundamental domain for the action on the x-y plane of the subgroup of isometries of $\pi_1(M)$ which fix ∞, the argument giving the angle between two of the sides and the magnitude giving the ratio of the lengths of two adjacent sides. We call this the homological cusp shape.

If instead, we choose T_1 to be the parabolic isometry which is the shortest translation among all the isometries of $\pi_1(M)$ which fix ∞, and T_2 to be the parabolic isometry which is the shortest translation linearly independent from T_1, then the ratio of the corresponding complex numbers is called the geometrical cusp shape. If $\mathrm{PGL}(2, \mathbf{Z})$ acts on either the homological or geometrical cusp shape as a fractional linear transformation, the single resulting equivalence class of complex numbers is called the conformal invariant of the cusp.

The next invariant that we examine is the horoball pattern itself. That is, for a one-cusped manifold, the maximal cusp is covered by horoballs, all of which have disjoint interiors and some of which are tangent to each other. Centering one of these horoballs at ∞, so that its boundary becomes a horizonal plane at Euclidean height 1, there will exist horoballs touching this plane, and hence having Euclidean diameter 1, as well as horoballs of smaller Euclidean diameter. The pattern of these horoballs is an invariant of the manifold. In practice the computer draws only the horoballs of Euclidean diameter greater than some constant α, $0 < \alpha < 1$. In Table 2, α is 0.1.

The computer locates the horoballs by the following procedure. A horoball is centered at each vertex of each of the tetrahedra in the finite set of tetrahedra that the manifold decomposes into. The computer determines the largest hyperbolic distance that any horoball reaches beyond the opposite face of a tetrahedron it is centered at the vertex of. Call this number β. By tiling the upper-half-space model of H^3 with lifts of the ideal tetradehdra from the previously computed triangulation of the manifold down to a level β hyperbolic units below the Euclidean height α, the computer will include all of the vertices corresponding to the centers of horoballs of Euclidean diameter greater than α.

A similar pattern of horoballs is generated for multi-cusped manifolds by first maximizing one cusp and then maximizing the remaining cusps one at a time relative to the cusps which have already been expanded. Note that the result does not in general correspond to the maximal disjoint cusp volume, since there may be a choice of cusps containing the largest possible volume such that none of the cusps are themselves maximal.

Finally, the last invariant that the computer produces is the canonical triangulation. This triangulation can be thought of as dual to the Ford domain (cf. [6] or [10]). In the case we are dealing with a one-cusped manifold, we add in geodesic edges through the points of tangency of the maximal cusp and perpendicular to the cusp boundary. Then, we continue to expand the cusp through itself until a new point of tangency occurs. Again, we add in edges through points of tangency and perpendicular to the cusp boundary. Eventually, a canonical ideal cell division results. In most but not all cases, it is a triangulation. In unusually symmetric situations, some of the cells may not be tetrahedra. In principle, one could work with the cell division instead of a triangulation, but the current program is not set up to do so.

When a triangulation results, the computer checks it for symmetries. This yields the order of the isometry group of the manifold, given in the column labelled "num sym" in Table 1. In the case that the canonical cell division is not a triangulation, a question mark appears in this column.

The total hyperbolic volumes were calculated to an accuracy of 10^{-15}. The other invariants were computed using the hyperbolic structures which gave the volumes to this accuracy.

3. Applications

The most useful application of these invariants is to tell hyperbolic 3-manifolds apart. Although volume tells the vast majority of hyperbolic manifolds apart, there are examples of arbitrarily large finite sets of distinct manifolds, all with the same volume (cf. [16]). Each of the other invariants mentioned can sometimes be used to distinguish between manifolds of the same volume. For example, the 5_2 knot and a certain 12-crossing knot both have the same volume (cf. [15]), but their maximal cusp volumes are $1.973463\ldots$ and $2.012733\ldots$ respectively. More astonishing is the fact that the figure-eight knot complement has a "sibling" manifold which has the same volume, maximal cusp volume and horoball pattern. However the conformal invariants of the cusps differ.

There are several operations which we can perform on hyperbolic manifolds containing certain incompressible surfaces in order to obtain new hyperbolic manifolds with the same volume (cf. [1] and [12]). In certain of these situations, the resultant manifold will also have the same maximal cusp volume and cusp shape. Moreover, it can also have the same Chern-Simons invariant (cf. [8]). However, such manifolds can still often be distinguished by their horoball patterns. An example is the mutant knots displayed at the end of Table 2. Although none of the other invariants will distinguish between them, the horoball patterns tell them apart.

Cusp diagrams can also be used to obtain information about the isometries of a hyperbolic 3-manifold. For example, if a given cusp of a finite volume noncompact hyperbolic 3-manifold is preserved by an orientation-reversing isometry, there must be a fundamental domain for the action of the cusp subgroup which is either a rectangle or a rhombus. Thus Table 2 shows that relatively few of these knot complements double cover nonorientable manifolds.

Additionally, since an isometry of a 1-cusped hyperbolic 3-manifold must preserve the maximal cusp, such an isometry must lift to either a parabolic or elliptic isometry fixing ∞ in the upper-half-space model of H^3, where ∞ is chosen to be the center of a horoball covering the cusp. If the original isometry is fixed point free on the interior of the maximal cusp, then it must lift to a parabolic isometry which permutes the largest horoballs in the cusp diagram. Hence, for instance, since the cusp diagram for the knot 8_{10} admits no parabolic isometries other than those corresponding to its fundamental group, its complement has no fixed-point free isometries.

Define the periods of a knot as in Section 14D of [5]. Then the numbers of symmetries listed for 10-crossing knots in Table 1 of this paper imply that the only 10-crossing knots which could have odd periods are 10_{75}, 10_{123} and 10_{124}. This contradicts the results in Table 1 of [5]. By examining the cusp diagrams themselves, one can show that some of the knots which appear with period 2 in that table in fact have no such period.

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L103001	(2,3) torus knot					
L104001	2.029883212819307	8	1.732051	1.000000	0.000000 + 0.288675 i	0.000000 + 0.288675 i
L105001	(2,5) torus knot					
L105002	2.828122088330783	4	1.973464	1.150964	0.165153 + 0.197597 i	0.053770 + 0.326785 i
L106001	3.163963228883144	4	1.995452	1.247409	-0.184237 + 0.258674 i	0.026219 + 0.388123 i
L106002	4.400832516123046	4	2.882878	1.283754	0.116833 + 0.060607 i	-0.020778 + 0.284311 i
L106003	5.693021091281301	8	4.038067	1.210608	0.000000 + 0.181469 i	0.000000 + 0.181469 i
L107001	(2,7) torus knot					
L107002	3.331744231641115	4	1.998818	1.300876	0.209974 + 0.238325 i	0.014545 + 0.422820 i
L107003	4.592125697027063	4	2.878339	1.340245	-0.102270 + 0.038195 i	0.040097 + 0.306790 i
L107004	5.137941201873418	8	3.538856	1.485116	-0.063371 + 0.298152 i	0.030574 + 0.308593 i
L107005	6.443537380850573	4	3.955453	1.222402	0.080637 + 0.045279 i	0.015187 + 0.187658 i
L107006	7.084925953510830	4	4.447335	1.226445	0.084410 + 0.089503 i	-0.012041 + 0.168247 i
L107007	7.643375172359955	8	5.065555	1.247409	0.038884 + 0.143017 i	-0.005414 + 0.153398 i
L108001	3.427205246274016	4	1.999601	1.332538	-0.219796 + 0.253214 i	0.008867 + 0.443826 i
L108002	4.935242678280654	4	2.761873	1.358235	0.084741 + 0.023099 i	-0.001737 + 0.333968 i
L108003	5.238684100798440	8	3.546273	1.526793	0.000000 + 0.328669 i	0.000000 + 0.328669 i
L108004	5.500486416347235	4	3.387435	1.509575	0.115347 + 0.045788 i	0.053907 + 0.327490 i
L108005	6.997189147792215	4	4.570602	1.605393	-0.081510 + 0.025954 i	-0.011036 + 0.281509 i
L108006	7.475237429505243	4	4.337089	1.249648	0.086770 + 0.113967 i	0.007412 + 0.179725 i
L108007	7.022196589095253	4	3.830256	1.252114	-0.101616 + 0.090266 i	0.020703 + 0.202542 i
L108008	7.801341224440063	4	4.551729	1.270490	0.063255 + 0.150773 i	0.011462 + 0.176567 i
L108009	7.588180223641627	8	5.181939	1.420609	0.000000 + 0.194727 i	0.000000 + 0.194727 i
L108010	8.651148558017082	2	4.948575	1.331926	-0.089564 + 0.086363 i	0.006875 + 0.178982 i
L108011	8.286316817806593	4	5.006547	1.276111	0.075585 + 0.111304 i	0.004641 + 0.162500 i
L108012	8.935856927486689	8	5.515651	1.232599	0.000000 + 0.137726 i	0.000000 + 0.137726 i
L108013	8.531232201460416	4	4.958060	1.266677	0.059708 + 0.135493 i	-0.007225 + 0.161481 i
L108014	9.217800316021929	4	5.634795	1.234788	0.057722 + 0.102920 i	0.002660 + 0.135241 i
L108015	9.930648293796183	4	6.219559	1.302105	0.067465 + 0.058505 i	0.008518 + 0.135768 i
L108016	10.579021916899270	2	7.177619	1.500953	0.078459 + 0.079682 i	0.006741 + 0.156646 i
L108017	10.985907606284820	2	7.250950	1.429835	0.000000 + 0.140977 i	0.000000 + 0.140977 i
L108018	12.350906209158200	?	9.447478	1.553774	0.000000 + 0.127770 i	0.000000 + 0.127770 i
L108019	(3,4) torus knot					
L108020	4.124903251807676	2	2.677040	1.576435	-0.188586 + 0.367343 i	-0.022791 + 0.463038 i
L108021	6.783713519835127	4	4.447881	1.372299	0.100739 + 0.138337 i	0.019545 + 0.209877 i
L109001	(2,9) torus knot					
L109002	3.486660146295044	4	1.999840	1.352656	0.228083 + 0.245891 i	0.005793 + 0.457383 i
L109003	4.994856404125714	4	2.748613	1.374883	-0.073945 + 0.016714 i	0.015779 + 0.343139 i
L109004	5.556518816346559	4	3.376158	1.530728	0.112896 + 0.041754 i	-0.024929 + 0.345211 i
L109005	5.698441750940058	4	3.287842	1.522771	-0.055188 + 0.343778 i	-0.055188 + 0.343778 i
L109006	7.203600761623165	4	3.737575	1.258917	0.063830 + 0.021371 i	0.003932 + 0.211946 i

TABLE 1

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L109007	8.014861457829954	4	4.474973	1.290478	0.087593 + 0.061681 i	-0.012680 + 0.185204 i
L109008	8.192347962434356	4	4.584343	1.308048	0.091040 + 0.072869 i	-0.010586 + 0.186010 i
L109009	8.016815565678016	4	4.894707	1.413912	0.060112 + 0.019570 i	0.001723 + 0.204201 i
L109010	8.773457282055681	8	5.556538	1.372324	-0.084412 + 0.077372 i	-0.012505 + 0.168537 i
L109011	8.288589042858491	4	4.165777	1.257194	-0.075734 + 0.037744 i	0.015123 + 0.188492 i
L109012	8.836642343885842	4	4.816076	1.280850	0.076149 + 0.123290 i	-0.010797 + 0.169636 i
L109013	9.135094037937277	4	5.596681	1.381511	-0.083965 + 0.070479 i	0.000379 + 0.170509 i
L109014	8.954989262002549	4	4.768950	1.277111	0.069773 + 0.134921 i	0.000706 + 0.171000 i
L109015	9.885498660334439	4	5.673391	1.245774	-0.046418 + 0.118609 i	0.002594 + 0.136726 i
L109016	9.883006960018827	4	5.901833	1.394529	-0.056519 + 0.022447 i	-0.007652 + 0.164399 i
L109017	9.474580453499224	8	5.524448	1.332953	0.078960 + 0.065229 i	-0.012148 + 0.159886 i
L109018	10.057729635581000	4	5.583841	1.239739	0.068594 + 0.074297 i	-0.005515 + 0.137404 i
L109019	10.032547447836697	4	5.729656	1.254470	-0.015467 + 0.135564 i	0.003189 + 0.137255 i
L109020	9.644304073800876	4	5.305039	1.307595	0.066851 + 0.035594 i	-0.008940 + 0.160652 i
L109021	10.183265535681087	4	5.555841	1.241176	-0.046101 + 0.121087 i	0.004873 + 0.138468 i
L109022	10.620727021239473	2	5.609470	1.318188	-0.077165 + 0.070908 i	-0.000630 + 0.154880 i
L109023	10.611348294052509	8	6.102773	1.246574	0.062954 + 0.073095 i	-0.003809 + 0.127201 i
L109024	10.833729108945260	2	6.354064	1.309349	-0.016033 + 0.132972 i	0.001933 + 0.134878 i
L109025	11.390305147773655	2	6.303897	1.274099	0.046242 + 0.109168 i	0.004798 + 0.128577 i
L109026	10.595840514999372	4	5.911153	1.257366	-0.061935 + 0.092059 i	-0.000553 + 0.133725 i
L109027	10.999980958287120	4	6.322088	1.253057	-0.019798 + 0.120939 i	-0.004900 + 0.123986 i
L109028	11.563177016265123	4	7.113471	1.312282	0.056909 + 0.081119 i	-0.002990 + 0.120970 i
L109029	12.205856165114720	2	7.371437	1.495816	0.075704 + 0.070678 i	0.001328 + 0.151754 i
L109030	11.954526968232034	2	6.919684	1.289552	-0.014801 + 0.118309 i	-0.000594 + 0.120158 i
L109031	11.686312207878105	8	7.023806	1.260231	0.051490 + 0.079858 i	-0.003791 + 0.112930 i
L109032	13.099899845892527	1	6.996783	1.312592	-0.055049 + 0.089116 i	-0.000261 + 0.123120 i
L109033	13.280455636254788	1	7.245596	1.315237	-0.018742 + 0.116353 i	-0.004970 + 0.119165 i
L109034	14.344581387788963	2	8.681728	1.437423	-0.016411 + 0.116688 i	-0.002574 + 0.118940 i
L109035	7.940579247781311	?	4.899511	1.664119	0.053241 + 0.272195 i	-0.024405 + 0.280486 i
L109036	9.884578653127015	2	4.907323	1.303496	-0.073550 + 0.040920 i	-0.011414 + 0.172363 i
L109037	10.989449592576541	4	6.361299	1.334147	-0.009179 + 0.139300 i	-0.009179 + 0.139300 i
L109038	12.932858702252828	2	7.847565	1.417582	0.063316 + 0.073471 i	-0.004407 + 0.127884 i
L109039	12.810310003311115	2	7.598768	1.430371	-0.046696 + 0.115794 i	0.000082 + 0.134625 i
L109040	15.018342857865118	?	10.810100	1.582347	0.051063 + 0.085209 i	0.002341 + 0.115762 i
L109041	12.098936025990787	?	8.351373	1.618034	-0.057417 + 0.131713 i	0.005370 + 0.156559 i
L109042	4.056860224236820	2	2.363032	1.553898	-0.193265 + 0.088404 i	-0.071362 + 0.500741 i
L109043	5.904085858508103	2	3.152720	1.492733	-0.094798 + 0.027583 i	0.033972 + 0.350089 i
L109044	7.406767572367503	2	4.099116	1.363396	-0.037156 + 0.220476 i	0.013154 + 0.225972 i
L109045	8.602031166401501	2	5.000386	1.370048	0.070566 + 0.155709 i	0.014517 + 0.186559 i
L109046	4.751701965517900	4	3.274382	1.806879	-0.170121 + 0.431462 i	0.051414 + 0.493179 i
L109047	10.049957861274370	?	6.687008	1.556030	-0.090501 + 0.092349 i	-0.013466 + 0.180033 i
L109048	9.531879835800978	12	6.153201	1.356203	-0.060034 + 0.119230 i	-0.008216 + 0.149005 i

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L109049	9.427073627769277	?	6.518814	1.524703	-0.084996 + 0.062245 i	0.010828 + 0.177648 i
L110001	3.526195990735376	4	1.999927	1.366191	-0.232606 + 0.251540 i	0.003988 + 0.466603 i
L110002	5.114841460302401	4	2.709582	1.383682	0.064342 + 0.012135 i	0.001006 + 0.353295 i
L110003	5.732104786782051	4	3.277220	1.534846	-0.037854 + 0.355381 i	-0.037854 + 0.355381 i
L110004	5.817129692825429	4	3.225693	1.530559	0.116717 + 0.042488 i	-0.055930 + 0.354288 i
L110005	7.373935134274568	4	3.678635	1.269457	-0.084501 + 0.039848 i	0.015218 + 0.217976 i
L110006	8.390937606724454	4	4.098807	1.262998	0.083567 + 0.047468 i	0.001793 + 0.194572 i
L110007	9.115906395629991	4	4.679422	1.284710	0.078054 + 0.129200 i	0.013165 + 0.175367 i
L110008	6.083234837064977	4	3.648369	1.658011	0.081024 + 0.018316 i	-0.036275 + 0.373218 i
L110009	8.294099675229289	4	4.749776	1.427084	-0.107153 + 0.110100 i	0.020955 + 0.212318 i
L110010	9.180573644138948	4	4.651176	1.282900	0.074937 + 0.135476 i	0.003954 + 0.176838 i
L110011	9.370442441399365	4	5.381980	1.380226	0.088210 + 0.081448 i	0.003739 + 0.176903 i
L110012	9.817495190695846	4	5.183588	1.316652	-0.073184 + 0.124038 i	0.013105 + 0.166184 i
L110013	10.578480190464718	4	5.379859	1.244713	-0.034302 + 0.135295 i	0.004955 + 0.143821 i
L110014	10.937689414417554	4	5.708017	1.258695	0.065800 + 0.047361 i	0.000214 + 0.138779 i
L110015	8.973449326001361	4	4.272186	1.288936	-0.092010 + 0.065822 i	-0.007145 + 0.194176 i
L110016	9.546642305028446	4	5.353217	1.385303	-0.089493 + 0.094427 i	-0.009212 + 0.178769 i
L110017	8.536755599193235	8	5.814171	1.594111	0.000000 + 0.218534 i	0.000000 + 0.218534 i
L110018	10.639844271257633	4	5.353108	1.245553	0.070988 + 0.086953 i	-0.007665 + 0.144500 i
L110019	9.844771302667735	4	5.973447	1.461467	0.084374 + 0.059867 i	-0.003731 + 0.178704 i
L110020	8.317378718415007	4	4.536287	1.322309	0.087925 + 0.135794 i	0.013295 + 0.191802 i
L110021	9.675141144155306	4	5.411596	1.345687	0.075385 + 0.047387 i	-0.013674 + 0.166189 i
L110022	9.981866517896332	4	5.576825	1.373750	0.045652 + 0.155824 i	-0.007670 + 0.168851 i
L110023	11.393224634885061	4	6.113160	1.256462	-0.048585 + 0.107078 i	0.008072 + 0.128616 i
L110024	10.977454736821756	4	5.840201	1.267379	0.030295 + 0.130483 i	-0.005883 + 0.137265 i
L110025	11.875779603652080	4	6.671023	1.291795	0.059845 + 0.044388 i	-0.003446 + 0.124978 i
L110026	11.352017557987837	4	7.095615	1.393020	0.042556 + 0.121881 i	-0.008319 + 0.136232 i
L110027	12.384131966128570	4	6.874558	1.266194	0.043509 + 0.097114 i	-0.002146 + 0.116568 i
L110028	10.264674946506445	4	5.363038	1.338558	0.078106 + 0.113112 i	0.003729 + 0.166962 i
L110029	11.602905246667982	4	5.983160	1.246061	0.063678 + 0.077291 i	0.005872 + 0.129487 i
L110030	11.828757569503651	4	6.123354	1.256795	0.030237 + 0.121448 i	-0.001158 + 0.128966 i
L110031	11.044264031043386	4	5.822226	1.271210	0.005454 + 0.138562 i	0.005454 + 0.138562 i
L110032	12.090936871931918	4	6.305727	1.246572	-0.033924 + 0.113035 i	-0.006596 + 0.122862 i
L110033	11.535673932282333	8	7.563921	1.442536	0.000000 + 0.137555 i	0.000000 + 0.137555 i
L110034	8.422266667868570	4	4.599796	1.334665	0.081734 + 0.148709 i	-0.006049 + 0.193442 i
L110035	10.394496785605322	4	5.589742	1.257273	0.031839 + 0.133821 i	-0.006331 + 0.141112 i
L110036	10.476185540305242	4	5.602790	1.262661	0.047931 + 0.123708 i	-0.005595 + 0.142058 i
L110037	10.965810532424644	8	6.056148	1.261300	0.000000 + 0.131344 i	0.000000 + 0.131344 i
L110038	11.349313547236827	4	6.049709	1.255786	0.031772 + 0.122067 i	-0.000051 + 0.130337 i
L110039	11.589518727368463	4	6.189753	1.251882	0.060987 + 0.046348 i	0.006297 + 0.126283 i
L110040	12.888740330276486	4	7.277055	1.243302	-0.037393 + 0.090814 i	0.001390 + 0.106192 i
L110041	12.376615498635041	4	6.648861	1.251505	0.057066 + 0.073446 i	-0.005584 + 0.117519 i

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L110042	13.239848366795648	4	7.457133	1.244272	0.002122 + 0.103764 i	0.002122 + 0.103764 i
L110043	12.602596114262077	8	7.306366	1.287780	0.000000 + 0.113489 i	0.000000 + 0.113489 i
L110044	12.968994205032500	4	7.300230	1.270313	0.053331 + 0.069743 i	-0.000993 + 0.110515 i
L110045	13.716075984752730	8	7.965675	1.261389	0.000000 + 0.099872 i	0.000000 + 0.099872 i
L110046	7.716999809324510	2	4.465802	1.649660	-0.062557 + 0.013436 i	-0.025860 + 0.302480 i
L110047	9.385194156727692	2	4.803283	1.372157	-0.078798 + 0.039737 i	-0.004519 + 0.195888 i
L110048	10.378901449017832	2	5.984340	1.453071	-0.007241 + 0.176114 i	-0.007241 + 0.176114 i
L110049	11.453193366219928	2	6.133251	1.321760	0.057143 + 0.028717 i	-0.000580 + 0.142422 i
L110050	11.198889792082566	2	6.098304	1.405292	-0.074955 + 0.050364 i	-0.005017 + 0.161762 i
L110051	12.631379519944109	2	7.128129	1.332301	-0.044892 + 0.105386 i	-0.006512 + 0.124167 i
L110052	11.537548182498972	2	6.859008	1.481106	-0.078057 + 0.062632 i	0.005276 + 0.159738 i
L110053	12.886847420183464	2	7.124076	1.327996	0.059399 + 0.079262 i	0.000834 + 0.123770 i
L110054	10.591311133639090	2	4.919714	1.315102	-0.086507 + 0.072377 i	0.006175 + 0.175555 i
L110055	12.185540627039736	2	6.390616	1.293867	0.064754 + 0.075282 i	-0.007403 + 0.130561 i
L110056	12.398802155808716	2	6.172514	1.265472	-0.062955 + 0.049253 i	0.002467 + 0.129675 i
L110057	13.588558502226049	2	7.346979	1.257089	-0.036573 + 0.093193 i	0.004052 + 0.107393 i
L110058	12.721330698537600	4	6.730189	1.297969	-0.022702 + 0.120899 i	0.007798 + 0.124674 i
L110059	13.389944141432721	2	7.150058	1.285353	-0.054167 + 0.077840 i	-0.000309 + 0.115532 i
L110060	13.980041535708047	4	7.828635	1.299728	-0.026599 + 0.100878 i	-0.005155 + 0.107645 i
L110061	8.458580267591309	4	4.951932	1.695038	-0.080414 + 0.024331 i	-0.032622 + 0.286389 i
L110062	10.141469036303512	2	5.150368	1.411840	-0.076523 + 0.037546 i	0.017366 + 0.191938 i
L110063	11.511691291838952	4	6.265340	1.353470	0.073014 + 0.069636 i	0.003676 + 0.146099 i
L110064	10.868092713050994	4	6.213795	1.471382	-0.086896 + 0.093107 i	-0.010804 + 0.173534 i
L110065	12.076461434489462	2	6.488605	1.340261	-0.053564 + 0.113037 i	-0.008084 + 0.137946 i
L110066	13.029268870834496	4	7.331201	1.325702	0.050934 + 0.028347 i	-0.000141 + 0.119863 i
L110067	12.421630505421152	2	6.319028	1.294082	0.041211 + 0.118131 i	-0.006433 + 0.132195 i
L110068	11.637035229302697	4	5.688419	1.342518	-0.066506 + 0.122240 i	-0.010847 + 0.157677 i
L110069	14.126505170670148	4	7.948534	1.286461	-0.033846 + 0.091600 i	0.004875 + 0.103877 i
L110070	12.510887730420802	2	6.537062	1.265762	-0.058744 + 0.078690 i	-0.001380 + 0.122528 i
L110071	13.385228746039955	2	7.407702	1.258159	0.004794 + 0.106630 i	0.004794 + 0.106630 i
L110072	12.929594687049697	2	7.013903	1.278858	-0.057219 + 0.047151 i	-0.005543 + 0.116324 i
L110073	13.706880842371525	2	7.733839	1.269930	0.038306 + 0.087493 i	0.002164 + 0.104219 i
L110074	12.006036998378074	4	6.522540	1.328413	0.035361 + 0.125296 i	0.001578 + 0.135257 i
L110075	13.430748784284765	12	7.916875	1.326253	0.035010 + 0.098665 i	0.002395 + 0.111037 i
L110076	11.512860414469814	4	6.517227	1.323589	-0.063521 + 0.045266 i	-0.007935 + 0.133934 i
L110077	12.074711681444690	2	6.937139	1.311588	-0.048007 + 0.101220 i	0.002686 + 0.123931 i
L110078	12.502099196987689	4	7.194156	1.311687	0.057943 + 0.045046 i	-0.003472 + 0.119477 i
L110079	12.540295218484353	2	7.869607	1.491719	0.000000 + 0.141381 i	0.000000 + 0.141381 i
L110080	13.394044471515975	1	7.326246	1.362101	0.053897 + 0.030094 i	0.002311 + 0.126579 i
L110081	14.492667031583342	2	8.410048	1.347480	0.000000 + 0.107948 i	0.000000 + 0.107948 i
L110082	12.431479531326187	1	7.253723	1.465493	0.071436 + 0.093406 i	0.003639 + 0.147950 i

TABLE 1 (continued)

link	volume	num sym	cusp vol	min trans	homological cusp shape	geometrical cusp shape
L110083	14.258051849186285	1	8.527786	1.439222	-0.046765 + 0.099459 i	0.001893 + 0.121418 i
L110084	14.709898781554164	1	7.442273	1.283946	-0.042292 + 0.091125 i	-0.002336 + 0.110704 i
L110085	11.797773659928865	1	7.030088	1.542717	0.070858 + 0.038351 i	-0.002427 + 0.169236 i
L110086	14.341256139500095	1	8.801783	1.457273	0.031768 + 0.111594 i	0.005226 + 0.120410 i
L110087	14.273644598070369	1	7.007689	1.297011	0.026124 + 0.114044 i	-0.001318 + 0.120013 i
L110088	15.646649171780129	2	8.543811	1.321543	0.000000 + 0.102207 i	0.000000 + 0.102207 i
L110089	15.566058923120140	2	8.452853	1.320269	0.034430 + 0.089926 i	-0.003045 + 0.103018 i
L110090	13.866149863271102	1	7.669042	1.413810	0.032377 + 0.121707 i	0.000701 + 0.130316 i
L110091	13.487022420297793	1	7.946395	1.480310	-0.004578 + 0.137729 i	-0.004578 + 0.137729 i
L110092	14.855350171596801	1	7.452590	1.317140	-0.057257 + 0.047781 i	-0.003998 + 0.116255 i
L110093	13.016467164907686	1	7.133014	1.492392	0.077095 + 0.065822 i	-0.012058 + 0.155185 i
L110094	13.311566524967591	1	7.375691	1.446023	-0.068917 + 0.087415 i	0.008769 + 0.141204 i
L110095	15.047852884581213	1	7.668547	1.305733	-0.039669 + 0.094515 i	0.002772 + 0.111095 i
L110096	15.177851427724612	2	8.017805	1.342982	0.029023 + 0.104407 i	0.005948 + 0.112159 i
L110097	14.852746708375895	2	7.584367	1.340583	-0.026763 + 0.112088 i	-0.000215 + 0.118478 i
L110098	14.412919023550258	2	8.552706	1.478910	0.062031 + 0.048455 i	0.000194 + 0.127864 i
L110099	14.334344519045008	4	8.783716	1.496764	0.000000 + 0.127526 i	0.000000 + 0.127526 i
L110100	12.810882566465487	2	7.889772	1.601846	0.068043 + 0.036800 i	0.009766 + 0.162021 i
L110101	14.687506837621710	2	7.226123	1.327944	-0.058467 + 0.078436 i	-0.001624 + 0.121997 i
L110102	13.727343297136715	1	7.550002	1.440825	0.028929 + 0.131098 i	-0.007443 + 0.137078 i
L110103	13.874789569933135	2	8.598367	1.522555	0.057087 + 0.103235 i	0.001855 + 0.134778 i
L110104	14.107126687552346	2	8.910944	1.514165	-0.003479 + 0.128551 i	-0.003479 + 0.128551 i
L110105	15.181695504612627	2	7.951634	1.354326	-0.054875 + 0.075396 i	-0.004125 + 0.115187 i
L110106	13.933018994314387	1	8.525792	1.508283	-0.064719 + 0.082871 i	0.002604 + 0.133363 i
L110107	15.352852697019813	1	8.070344	1.337830	0.001627 + 0.110863 i	0.001627 + 0.110863 i
L110108	12.904623952906521	2	8.014762	1.606905	-0.079840 + 0.069919 i	-0.002299 + 0.161054 i
L110109	14.900208603026842	2	9.380628	1.499964	0.000000 + 0.119922 i	0.000000 + 0.119922 i
L110110	14.777462665072863	1	8.688655	1.475189	0.060157 + 0.079989 i	0.000086 + 0.125231 i
L110111	14.265023013493206	2	7.774540	1.443814	-0.064932 + 0.050383 i	0.006936 + 0.133706 i
L110112	14.755884075953190	2	9.478197	1.550750	0.060305 + 0.083095 i	-0.004489 + 0.126702 i
L110113	16.473473661468838	2	8.410847	1.316549	-0.037011 + 0.087359 i	-0.001185 + 0.103026 i
L110114	15.304904343443041	2	9.805784	1.543165	-0.026777 + 0.115203 i	0.001265 + 0.121413 i
L110115	16.638038056436637	2	9.955525	1.457190	0.000000 + 0.106644 i	0.000000 + 0.106644 i
L110116	15.423866507314436	2	9.936883	1.555128	0.058076 + 0.078990 i	0.000620 + 0.121686 i
L110117	16.125443523976963	1	9.151656	1.428597	-0.041858 + 0.092578 i	-0.000683 + 0.111500 i
L110118	15.545214905676717	2	9.660452	1.510168	0.000000 + 0.118038 i	0.000000 + 0.118038 i
L110119	15.938694126282648	1	8.960135	1.438336	0.027716 + 0.108356 i	0.002872 + 0.115374 i
L110120	16.271368282159341	4	9.469486	1.462641	0.051500 + 0.079667 i	-0.003534 + 0.112848 i
L110121	16.974877032190903	2	9.985171	1.461929	0.038244 + 0.090937 i	-0.000806 + 0.107014 i
L110122	16.410823158610278	4	10.811343	1.578235	0.025070 + 0.109453 i	-0.000154 + 0.115195 i
L110123	17.085709482982861	?	12.449491	1.618034	0.000000 + 0.105146 i	0.000000 + 0.105146 i
L110124	(3,5) torus knot					

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L110125	4.611961374497319	2	2.972315	1.755316	-0.173433 + 0.066588 i	-0.006753 + 0.518217 i
L110126	6.904256123806481	2	4.072219	1.583497	0.149777 + 0.118393 i	0.010330 + 0.307527 i
L110127	8.896816759631431	2	4.903064	1.370967	0.082090 + 0.046382 i	0.008574 + 0.191287 i
L110128	5.860539301740002	2	2.991092	1.482839	-0.082274 + 0.019445 i	0.063930 + 0.356082 i
L110129	8.901516637278769	2	5.001494	1.411076	0.014702 + 0.197962 i	0.014702 + 0.197962 i
L110130	6.778198890046892	2	3.552387	1.589214	-0.171990 + 0.222583 i	-0.021864 + 0.354130 i
L110131	9.465021657265468	2	5.515099	1.466427	0.061008 + 0.173505 i	-0.007454 + 0.194671 i
L110132	4.056860224236820	2	2.277288	1.553898	0.076367 + 0.518909 i	0.076367 + 0.518909 i
L110133	7.798300232166506	2	3.948709	1.367836	0.113754 + 0.151493 i	0.009499 + 0.236528 i
L110134	8.392922508336978	2	4.043108	1.327505	-0.066800 + 0.022876 i	-0.018797 + 0.216302 i
L110135	10.687174968339628	2	5.683605	1.277845	-0.011619 + 0.142703 i	0.008904 + 0.143095 i
L110136	7.746274546233128	4	4.502435	1.492545	-0.123563 + 0.118015 i	-0.014170 + 0.246573 i
L110137	9.250556262699874	2	4.954651	1.403511	-0.052791 + 0.183609 i	-0.017501 + 0.197234 i
L110138	10.467246242670898	4	5.841000	1.398657	-0.083474 + 0.077202 i	-0.012735 + 0.166484 i
L110139	4.851170757332738	4	3.713631	1.805415	-0.074205 + 0.012928 i	-0.015253 + 0.438328 i
L110140	5.212566822320545	2	3.782483	1.977430	-0.147125 + 0.470922 i	0.101445 + 0.496144 i
L110141	7.936474229212679	4	4.890544	1.549476	-0.050244 + 0.234705 i	0.007697 + 0.245219 i
L110142	6.770816780739823	4	3.800882	1.601960	-0.076374 + 0.018267 i	-0.043140 + 0.331984 i
L110143	9.070899270019318	2	5.292677	1.451587	0.097816 + 0.117919 i	0.006617 + 0.198838 i
L110144	10.796594984133836	4	6.425854	1.357589	0.070609 + 0.084191 i	-0.003122 + 0.143341 i
L110145	5.044899162918904	4	3.213554	1.887268	0.177948 + 0.064691 i	-0.011170 + 0.553956 i
L110146	10.561016754914699	4	5.823670	1.332078	-0.001697 + 0.152328 i	-0.001697 + 0.152328 i
L110147	9.417590916016745	2	5.050486	1.421542	-0.099336 + 0.088275 i	0.014930 + 0.198938 i
L110148	10.260243436313672	1	6.209885	1.475377	0.078243 + 0.127096 i	-0.014865 + 0.173994 i
L110149	11.442726778861969	1	7.196160	1.431585	0.068245 + 0.050903 i	0.008387 + 0.141902 i
L110150	10.081362856560818	1	5.729521	1.494518	-0.079304 + 0.040810 i	0.001155 + 0.194912 i
L110151	11.843044751681145	1	6.997312	1.390498	-0.064011 + 0.095053 i	0.002399 + 0.138117 i
L110152	8.536065347205609	2	5.923815	1.684018	0.069818 + 0.022474 i	-0.001247 + 0.239359 i
L110153	7.374343889306712	1	5.148124	2.051201	0.192559 + 0.272635 i	-0.044800 + 0.403665 i
L110154	9.249887443861750	2	5.974363	1.733570	-0.097213 + 0.045980 i	-0.025425 + 0.248917 i
L110155	9.250541613012099	4	6.488128	1.722084	0.078158 + 0.197629 i	-0.014024 + 0.227674 i
L110156	11.163390642176326	2	6.143681	1.393974	0.073972 + 0.107007 i	0.009253 + 0.157600 i
L110157	12.665333284998503	8	8.394391	1.465571	-0.062854 + 0.052079 i	-0.007074 + 0.127544 i
L110158	12.271236358446972	2	7.264142	1.418844	0.024714 + 0.134008 i	0.006341 + 0.138275 i
L110159	11.740641037913916	2	7.778262	1.527173	0.059055 + 0.121130 i	0.005655 + 0.149708 i
L110160	9.203916606090773	2	5.482489	1.600169	-0.089574 + 0.041864 i	-0.008853 + 0.233184 i
L110161	5.638772948853054	2	3.438912	1.849792	0.110036 + 0.025661 i	-0.090983 + 0.480266 i
L110162	10.693360546719855	2	6.894367	1.549460	0.086573 + 0.096228 i	0.005061 + 0.173968 i
L110163	13.290003068598358	2	7.887024	1.444501	-0.059495 + 0.095033 i	0.004670 + 0.132114 i
L110164	12.506687930892361	2	7.768581	1.512790	-0.011278 + 0.146426 i	0.010300 + 0.146570 i
L110165	11.603084649769077	2	6.566099	1.512756	-0.049227 + 0.159023 i	0.006780 + 0.173997 i

TABLE 1 (continued)

link	volume	num sym	cusp vol	min trans	homological cusp shape	geometrical cusp shape
L200001	(2,0) torus link					
L202001	(2,2) torus link					
L204001	(2,4) torus link					
L205001	3.663862376708876	8	2.000000	1.414214	0.250000 + 0.250000 i	0.000000 + 0.500000 i
			2.000000	1.414214	0.250000 + 0.250000 i	0.000000 + 0.500000 i
L206001	(2,6) torus link					
L206002	4.059766425638614	8	2.598076	1.732051	0.000000 + 0.577350 i	0.000000 + 0.577350 i
			2.598076	1.732051	0.000000 + 0.577350 i	0.000000 + 0.577350 i
L206003	5.333489566898120	8	2.645751	1.414214	0.125000 + 0.330719 i	0.000000 + 0.377964 i
			2.645751	1.414214	0.125000 + 0.330719 i	0.000000 + 0.377964 i
L207001	4.749499981874439	4	2.494874	1.774232	0.238631 + 0.109146 i	0.170582 + 0.580771 i
			2.494874	1.774232	0.238631 + 0.109146 i	0.170582 + 0.580771 i
L207002	6.598951539438494	4	3.038735	1.524703	-0.079596 + 0.365165 i	0.061281 + 0.372431 i
			3.038735	1.524703	-0.079596 + 0.365165 i	0.061281 + 0.372431 i
L207003	6.138138789085247	8	3.058171	1.550544	0.064266 + 0.382271 i	0.064266 + 0.382271 i
			3.058171	1.550544	0.064266 + 0.382271 i	0.064266 + 0.382271 i
L207004	6.138138789085247	4	3.058171	1.550544	-0.118666 + 0.039868 i	0.064266 + 0.382271 i
			3.058171	2.318603	-0.435734 + 0.382271 i	-0.214709 + 0.822924 i
L207005	7.706911802810127	4	3.538856	1.288009	0.096663 + 0.183464 i	0.013570 + 0.233605 i
			2.935423	1.912843	-0.306675 + 0.366928 i	-0.126743 + 0.596305 i
L207006	8.997351943606996	4	4.645751	1.414214	0.098094 + 0.151906 i	0.000000 + 0.215250 i
			4.645751	2.376079	0.125000 + 0.580719 i	0.125000 + 0.580719 i
L207007	same complement as (2,4) torus link					
L207008	3.663862376708876	8	2.000000	1.414214	0.250000 + 0.250000 i	0.000000 + 0.500000 i
			2.000000	1.414214	-0.750000 + 0.250000 i	0.000000 + 0.500000 i
L208001	(2,8) torus link					
L208002	4.851170757332738	4	2.588550	1.852210	-0.330221 + 0.358443 i	-0.160625 + 0.621127 i
			2.588550	1.852210	-0.330221 + 0.358443 i	-0.160625 + 0.621127 i
L208003	6.947555448592513	4	2.970785	1.550949	0.199155 + 0.166187 i	-0.006544 + 0.404744 i
			2.970785	1.550949	0.199155 + 0.166187 i	-0.006544 + 0.404744 i
L208004	7.517689896474569	8	3.971262	1.744351	0.190172 + 0.214468 i	0.045510 + 0.377612 i
			3.971262	1.744351	0.190172 + 0.214468 i	0.045510 + 0.377612 i
L208005	7.894594487233149	4	3.356610	1.553018	-0.128300 + 0.305365 i	-0.021792 + 0.357944 i
			3.356610	1.553018	-0.128300 + 0.305365 i	-0.021792 + 0.357944 i
L208006	6.551743287887868	8	3.332295	1.672221	0.035597 + 0.416537 i	0.035597 + 0.416537 i
			3.332295	1.672221	0.035597 + 0.416537 i	0.035597 + 0.416537 i
L208007	8.830664954907732	8	4.608220	1.682610	0.153258 + 0.143448 i	0.044151 + 0.300705 i
			4.608220	1.682610	0.153258 + 0.143448 i	0.044151 + 0.300705 i
L208008	9.672807730794686	8	4.760018	1.569379	0.000000 + 0.258712 i	0.000000 + 0.258712 i
			4.760018	1.569379	0.000000 + 0.258712 i	0.000000 + 0.258712 i

TABLE 1 (continued)

link	volume	num sym	cusp vol	min trans	homological cusp shape	geometrical cusp shape
L208009	8.967360848788455	4	3.151133	2.226017	-0.393124 + 0.393892 i	-0.159379 + 0.752492 i
			3.860417	1.277707	-0.091327 + 0.158983 i	0.012618 + 0.210690 i
L208010	9.659498544958967	4	4.397646	1.295233	-0.084911 + 0.138796 i	-0.007531 + 0.190444 i
			3.110366	2.052618	-0.334911 + 0.388796 i	-0.120611 + 0.655084 i
L208011	8.793345603864991	4	3.104984	1.792059	-0.223781 + 0.388123 i	-0.030623 + 0.515329 i
			4.412896	1.436625	-0.101957 + 0.059688 i	-0.016573 + 0.232667 i
L208012	9.659498544958967	4	3.110366	1.689575	-0.165089 + 0.388796 i	0.015712 + 0.458357 i
			4.397646	1.295233	0.084911 + 0.138796 i	0.007531 + 0.190444 i
L208013	11.370774179519003	4	5.197823	1.288009	0.041386 + 0.148011 i	-0.006302 + 0.159334 i
			4.935423	2.478103	0.056675 + 0.616928 i	0.056675 + 0.616928 i
L208014	10.666979133796239	8	5.291503	1.414214	0.000000 + 0.188982 i	0.000000 + 0.188982 i
			5.291503	2.828427	0.250000 + 0.661438 i	-0.250000 + 0.661438 i
L208015	3.663862376708876	8	2.000000	1.414214	-0.250000 + 0.250000 i	0.000000 + 0.500000 i
			2.000000	1.414214	-1.250000 + 0.250000 i	0.000000 + 0.500000 i
L208016	5.333489566898120	8	2.645751	1.414214	-0.875000 + 0.330719 i	0.000000 + 0.377964 i
			2.645751	1.414214	-0.187500 + 0.165359 i	0.000000 + 0.377964 i
L209001	5.044899162918904	4	2.576252	1.887268	0.201372 + 0.064721 i	-0.213097 + 0.617764 i
			2.576252	1.887268	0.201372 + 0.064721 i	-0.213097 + 0.617764 i
L209002	7.244320350873284	4	2.977959	1.594613	-0.206668 + 0.266916 i	0.033766 + 0.424247 i
			2.977959	1.594613	-0.206668 + 0.266916 i	0.033766 + 0.424247 i
L209003	8.085586605502178	4	3.328190	1.580517	0.186729 + 0.206129 i	0.056915 + 0.366444 i
			3.328190	1.580517	0.186729 + 0.206129 i	0.056915 + 0.366444 i
L209004	5.875918082667625	8	3.387794	2.209586	0.190996 + 0.054792 i	-0.083185 + 0.710833 i
			3.387794	2.209586	0.190996 + 0.054792 i	-0.083185 + 0.710833 i
L209005	8.051684058915048	4	3.718663	1.751819	-0.163893 + 0.331636 i	-0.033434 + 0.409904 i
			3.718663	1.751819	-0.163893 + 0.331636 i	-0.033434 + 0.409904 i
L209006	9.181187330616343	4	4.632118	1.733540	0.129336 + 0.260060 i	-0.048022 + 0.317111 i
			4.632118	1.733540	0.129336 + 0.260060 i	-0.048022 + 0.317111 i
L209007	10.394372662399081	4	4.639143	1.571823	0.101890 + 0.218842 i	-0.017754 + 0.265092 i
			4.639143	1.571823	0.101890 + 0.218842 i	-0.017754 + 0.265092 i
L209008	8.584394654325494	4	3.640405	1.645018	-0.157688 + 0.284172 i	-0.065890 + 0.359601 i
			3.640405	1.645018	-0.157688 + 0.284172 i	-0.065890 + 0.359601 i
L209009	9.417807631608254	8	3.896051	1.625815	0.169389 + 0.178320 i	-0.022882 + 0.337674 i
			3.896051	1.625815	0.169389 + 0.178320 i	-0.022882 + 0.337674 i
L209010	6.784755786925872	8	3.510605	1.757383	0.021372 + 0.438826 i	0.021372 + 0.438826 i
			3.510605	1.757383	0.021372 + 0.438826 i	0.021372 + 0.438826 i
L209011	10.759046640790302	4	4.752733	1.540936	0.116936 + 0.168791 i	-0.014099 + 0.249004 i
			4.752733	1.540936	0.116936 + 0.168791 i	-0.014099 + 0.249004 i
L209012	11.188477802451692	4	5.002783	1.543639	0.041363 + 0.230735 i	-0.013974 + 0.237327 i
			5.002783	1.543639	0.041363 + 0.230735 i	-0.013974 + 0.237327 i
L209013	6.784755786925872	4	3.510605	1.757383	-0.081143 + 0.015516 i	0.021372 + 0.438826 i
			3.510605	2.597391	-0.478628 + 0.438826 i	-0.122687 + 0.944937 i

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L209014	9.312341316558378	4	5.133314	1.597822	0.102011 + 0.053249 i	-0.018219 + 0.247331 i
			3.219682	1.923424	-0.263150 + 0.402460 i	-0.045293 + 0.570929 i
L209015	10.249194968003796	4	4.897249	1.394365	-0.098911 + 0.091027 i	-0.018513 + 0.196763 i
			3.212249	2.193286	-0.373402 + 0.401531 i	-0.131345 + 0.724979 i
L209016	10.562806312097179	4	5.433666	1.469902	-0.002242 + 0.198792 i	-0.002242 + 0.198792 i
			3.209200	2.120137	-0.346432 + 0.401150 i	-0.111373 + 0.682143 i
L209017	9.665346419357368	4	3.345817	2.423900	-0.438511 + 0.418227 i	-0.145466 + 0.853204 i
			3.957457	1.300343	0.030745 + 0.209114 i	-0.014167 + 0.212690 i
L209018	11.381786090554001	4	4.952088	1.254568	-0.079305 + 0.084395 i	0.002196 + 0.158887 i
			3.163774	1.971666	-0.294226 + 0.395472 i	-0.078316 + 0.604221 i
L209019	7.453573250340333	2	3.081365	1.633868	-0.108812 + 0.029318 i	0.078289 + 0.418528 i
			4.526280	2.893673	-0.321104 + 0.129642 i	0.253201 + 0.849501 i
L209020	9.124415509374947	2	3.515321	1.357326	0.054007 + 0.250395 i	-0.012121 + 0.261481 i
			3.864094	2.292773	-0.276850 + 0.142556 i	0.066417 + 0.673664 i
L209021	9.814729698836974	2	4.345927	1.501793	-0.122543 + 0.087127 i	-0.027971 + 0.256431 i
			4.368635	2.104637	0.162127 + 0.448337 i	-0.072162 + 0.496477 i
L209022	10.956657816642180	2	4.346633	1.313444	0.099036 + 0.105303 i	-0.010240 + 0.197915 i
			3.969596	1.880188	0.142193 + 0.393950 i	-0.037286 + 0.442129 i
L209023	9.634380159587867	4	4.937275	1.912972	-0.180819 + 0.225792 i	-0.022019 + 0.369282 i
			4.937275	1.912972	-0.180819 + 0.225792 i	-0.022019 + 0.369282 i
L209024	12.046092040094378	?	6.363961	1.732051	0.111111 + 0.157135 i	0.000000 + 0.235702 i
			6.363961	1.732051	0.111111 + 0.157135 i	0.000000 + 0.235702 i
L209025	11.381786090554001	4	4.952088	1.254568	-0.047482 + 0.143169 i	-0.002196 + 0.158887 i
			3.163774	1.783215	-0.205774 + 0.395472 i	-0.008935 + 0.502383 i
L209026	11.762234287078181	4	5.266751	1.268015	-0.049024 + 0.134815 i	-0.008877 + 0.152125 i
			3.169903	1.741091	-0.180161 + 0.396238 i	0.011218 + 0.477890 i
L209027	10.249194968003796	4	4.897249	1.394365	-0.096018 + 0.074119 i	0.018513 + 0.196763 i
			3.212249	1.684063	-0.126598 + 0.401531 i	0.054820 + 0.434530 i
L209028	10.740257667712518	4	4.733458	1.321759	0.088194 + 0.119397 i	0.000090 + 0.184542 i
			3.274267	1.680403	-0.094719 + 0.409283 i	0.082839 + 0.414654 i
L209029	11.294969135798693	2	5.619131	1.473422	0.089107 + 0.059316 i	-0.008324 + 0.192818 i
			3.751491	2.083512	-0.226744 + 0.468936 i	0.054499 + 0.573393 i
L209030	12.276562777744445	2	5.768266	1.340367	-0.077857 + 0.078971 i	-0.008000 + 0.155318 i
			3.539079	2.114873	-0.289549 + 0.442385 i	-0.014285 + 0.631577 i
L209031	10.215605664596744	4	4.383342	1.414214	0.097459 + 0.054794 i	-0.010578 + 0.227645 i
			5.332295	2.800686	0.214403 + 0.666537 i	0.214403 + 0.666537 i
L209032	12.457207980573867	4	6.276288	1.414214	0.017439 + 0.157398 i	-0.007714 + 0.158955 i
			5.104984	2.554645	0.026219 + 0.638123 i	0.026219 + 0.638123 i
L209033	12.631223225497331	4	5.492952	1.277707	-0.027343 + 0.143389 i	-0.006244 + 0.148340 i
			5.151133	2.638427	0.143124 + 0.643892 i	0.143124 + 0.643892 i
L209034	11.942872449472387	1	5.136465	2.212491	0.221002 + 0.327263 i	0.091127 + 0.458390 i
			5.130584	1.449655	-0.024471 + 0.201834 i	0.016994 + 0.203381 i

TABLE 1 (continued)

link	volume	num sym	cusp vol	min trans	homological cusp shape	geometrical cusp shape
L209035	11.373522432864332	1	5.442364	2.387652	0.261688 + 0.251973 i	-0.004685 + 0.523709 i
			5.046845	1.547535	0.117772 + 0.104375 i	-0.013706 + 0.236469 i
L209036	11.471628355983366	4	5.703922	3.111040	0.310734 + 0.712990 i	-0.299130 + 0.724994 i
			5.189791	1.414214	0.095575 + 0.108483 i	-0.015772 + 0.191386 i
L209037	11.471628355983366	4	5.703922	2.862289	0.060734 + 0.712990 i	0.060734 + 0.712990 i
			5.189791	1.414214	0.076669 + 0.154685 i	-0.015772 + 0.191386 i
L209038	13.040401369708246	4	5.733463	1.288009	-0.055685 + 0.118509 i	-0.005181 + 0.144488 i
			5.581174	2.803938	-0.068325 + 0.697647 i	-0.068325 + 0.697647 i
L209039	12.536170258246075	1	5.485095	2.079836	-0.017971 + 0.393495 i	-0.017971 + 0.393495 i
			5.331931	1.497772	-0.105119 + 0.101501 i	0.003405 + 0.210311 i
L209040	12.046092040094378	?	6.363961	1.732051	0.000000 + 0.235702 i	0.000000 + 0.235702 i
			6.363961	2.449490	0.222222 + 0.157135 i	0.000000 + 0.471405 i
L209041	12.957429429593484	2	7.239870	2.168085	-0.065565 + 0.310801 i	0.036433 + 0.320491 i
			5.570009	1.564290	-0.092569 + 0.168935 i	-0.023585 + 0.217097 i
L209042	13.948417728284888	2	6.916088	1.624583	0.001141 + 0.190800 i	0.001141 + 0.190800 i
			7.400834	2.278019	0.117866 + 0.305053 i	0.012531 + 0.350145 i
L209043	same complement as (2,4) torus link					
L209044	6.138138789085247	4	3.058171	1.550544	0.118666 + 0.039868 i	-0.064266 + 0.382271 i
			3.058171	2.318603	-0.564266 + 0.382271 i	0.214709 + 0.822924 i
L209045	5.333489566898120	8	2.645751	1.414214	-0.156250 + 0.082680 i	0.000000 + 0.377964 i
			2.645751	1.414214	-1.125000 + 0.330719 i	0.000000 + 0.377964 i
L209046	6.138138789085247	8	3.058171	1.550544	0.064266 + 0.382271 i	0.064266 + 0.382271 i
			3.058171	1.550544	-0.935734 + 0.382271 i	0.064266 + 0.382271 i
L209047	3.663862376708876	8	2.000000	1.414214	0.250000 + 0.250000 i	0.000000 + 0.500000 i
			2.000000	1.414214	-1.750000 + 0.250000 i	0.000000 + 0.500000 i
L209048	7.706911802810127	4	3.538856	1.288009	-0.109157 + 0.074538 i	-0.013570 + 0.233605 i
			2.935423	1.912843	-0.693325 + 0.366928 i	0.126743 + 0.596305 i
L209049	same complement as (2,6) torus link					
L209050	4.415332477453866	4	2.304110	1.682610	0.296097 + 0.388986 i	0.088302 + 0.601410 i
			2.304110	1.682610	-0.423371 + 0.071724 i	0.088302 + 0.601410 i
L209051	5.978240565858970	2	2.895313	1.742197	-0.172112 + 0.064435 i	-0.026289 + 0.522844 i
			2.929333	2.226017	0.365309 + 0.635931 i	-0.213752 + 0.787783 i
L209052	8.209021220809309	2	3.461056	1.364670	0.134022 + 0.122959 i	0.003716 + 0.268988 i
			3.349059	2.052447	0.200330 + 0.556843 i	-0.157840 + 0.586431 i
L209053	satellite of (2,4) torus link					
L209054	7.517689896474569	4	4.148656	1.958565	-0.082012 + 0.447278 i	-0.082012 + 0.447278 i
			4.148656	1.958565	-0.082012 + 0.447278 i	-0.082012 + 0.447278 i
L209055	8.997351943606996	4	4.645751	1.414214	0.099174 + 0.065820 i	0.000000 + 0.215250 i
			4.645751	2.765095	-0.375000 + 0.580719 i	0.141318 + 0.797845 i
L209056	8.997351943606996	4	4.645751	1.414214	-0.099174 + 0.065820 i	0.000000 + 0.215250 i
			4.645751	2.765095	-0.625000 + 0.580719 i	-0.141318 + 0.797845 i

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L209057	8.355502146379566	2	4.269296	1.682230	0.165226 + 0.153022 i	0.028124 + 0.329020 i
			4.227473	2.289107	0.048321 + 0.615966 i	0.048321 + 0.615966 i
L209058	9.966511883698373	2	4.634835	1.405887	-0.072474 + 0.184802 i	0.007300 + 0.212974 i
			3.988781	2.041189	-0.108645 + 0.498598 i	-0.108645 + 0.498598 i
L209059	5.333489566898120	2	2.645751	2.000000	-1.000000 + 1.322876 i	0.000000 + 0.755929 i
			3.307189	2.000000	0.133178 + 0.030908 i	0.045455 + 0.601307 i
L209060	5.333489566898120	2	2.645751	2.000000	2.000000 + 1.322876 i	0.000000 + 0.755929 i
			3.307189	2.000000	-0.250000 + 0.132288 i	-0.045455 + 0.601307 i
L209061	satellite of (2,4) torus link					
L306001	5.333489566898120	?	2.645751	2.000000	-0.375000 + 0.330719 i	0.250000 + 0.661438 i
			2.645751	2.000000	-0.375000 + 0.330719 i	0.250000 + 0.661438 i
			2.645751	2.000000	-0.375000 + 0.330719 i	0.250000 + 0.661438 i
L306002	7.327724753417752	?	4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
			4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
			4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
L306003	(3,3) torus link					
L307001	7.706911802810127	12	2.935423	1.658967	-0.193325 + 0.366928 i	-0.027140 + 0.467210 i
			2.935423	1.658967	-0.193325 + 0.366928 i	-0.027140 + 0.467210 i
			2.935423	1.658967	-0.193325 + 0.366928 i	-0.027140 + 0.467210 i
L308001	6.551743287887868	4	3.332295	2.495350	-0.464403 + 0.416537 i	-0.163413 + 0.904793 i
			3.710131	2.495350	-0.295146 + 0.121359 i	0.071194 + 0.833074 i
			3.710131	2.495350	-0.295146 + 0.121359 i	0.071194 + 0.833074 i
L308002	8.793345603864991	4	3.104984	1.905514	-0.276219 + 0.388123 i	-0.073066 + 0.575425 i
			3.881782	1.905514	0.130534 + 0.427872 i	-0.074096 + 0.455646 i
			3.881782	1.905514	0.130534 + 0.427872 i	-0.074096 + 0.455646 i
L308003	8.967360848788455	12	3.151133	1.632535	-0.106876 + 0.393892 i	0.062653 + 0.413395 i
			3.151133	1.632535	-0.106876 + 0.393892 i	0.062653 + 0.413395 i
			3.151133	1.632535	-0.106876 + 0.393892 i	0.062653 + 0.413395 i
L308004	10.149416064096536	8	6.928203	2.000000	0.000000 + 0.288675 i	0.000000 + 0.288675 i
			3.464102	2.000000	-0.250000 + 0.433013 i	0.000000 + 0.577350 i
			3.464102	2.000000	0.250000 + 0.433013 i	0.000000 + 0.577350 i
L308005	9.802001165794123	4	5.058171	2.635949	0.185734 + 0.632271 i	0.185734 + 0.632271 i
			4.544039	2.000000	0.213849 + 0.272020 i	-0.041063 + 0.436272 i
			4.544039	2.000000	0.213849 + 0.272020 i	-0.041063 + 0.436272 i
L308006	10.666979133796239	?	5.291503	2.645751	0.000000 + 0.661438 i	0.000000 + 0.661438 i
			5.291503	2.000000	0.000000 + 0.377964 i	0.000000 + 0.377964 i
			5.291503	2.000000	0.000000 + 0.377964 i	0.000000 + 0.377964 i
L308007	complement is thrice-punctured sphere cross circle					
L308008	5.333489566898120	?	2.645751	2.000000	0.250000 + 0.661438 i	-0.250000 + 0.661438 i
			2.645751	2.000000	0.250000 + 0.661438 i	-0.250000 + 0.661438 i
			2.645751	2.000000	-0.625000 + 0.330719 i	0.250000 + 0.661438 i

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L308009	7.327724753417752	?	4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
			4.000000	2.828427	-0.500000 + 0.500000 i	0.000000 + 1.000000 i
			4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
L308010	satellite of (2,4) torus link					
L309001	10.740257667712518	4	4.134788	1.747048	-0.183581 + 0.165725 i	-0.000181 + 0.369085 i
			3.274267	2.303964	-0.405281 + 0.409283 i	-0.141049 + 0.785266 i
			4.134788	1.747048	-0.183581 + 0.165725 i	-0.000181 + 0.369085 i
L309002	11.762234287078181	4	4.234103	1.607862	0.017754 + 0.304249 i	0.017754 + 0.304249 i
			3.169903	2.036866	-0.319839 + 0.396238 i	-0.097701 + 0.639482 i
			4.234103	1.607862	0.017754 + 0.304249 i	0.017754 + 0.304249 i
L309003	11.294969135798693	4	3.751491	2.170974	-0.273256 + 0.468936 i	0.028492 + 0.626872 i
			3.751491	2.170974	-0.273256 + 0.468936 i	0.028492 + 0.626872 i
			4.045339	1.502339	-0.114612 + 0.059988 i	0.011741 + 0.278471 i
L309004	12.276562777744445	4	3.539079	1.959568	-0.210451 + 0.442385 i	0.036068 + 0.540092 i
			3.539079	1.959568	-0.210451 + 0.442385 i	0.036068 + 0.540092 i
			4.112431	1.340367	0.102653 + 0.146508 i	0.009888 + 0.217985 i
L309005	9.312341316558378	4	3.219682	1.867927	-0.236850 + 0.402460 i	-0.025226 + 0.540670 i
			3.507769	1.867927	-0.234221 + 0.165133 i	0.036439 + 0.494662 i
			3.507769	1.867927	-0.234221 + 0.165133 i	0.036439 + 0.494662 i
L309006	10.562806312097179	4	3.712042	1.718159	0.139305 + 0.340671 i	0.004485 + 0.397584 i
			3.712042	1.718159	0.139305 + 0.340671 i	0.004485 + 0.397584 i
			3.209200	1.718159	-0.153568 + 0.401150 i	0.035260 + 0.457220 i
L309007	9.665346419357368	?	3.345817	1.690893	-0.061489 + 0.418227 i	-0.061489 + 0.418227 i
			3.345817	1.690893	-0.061489 + 0.418227 i	-0.061489 + 0.418227 i
			3.345817	1.690893	-0.061489 + 0.418227 i	-0.061489 + 0.418227 i
L309008	11.751836165335249	4	3.387794	1.790834	0.145301 + 0.423474 i	-0.060606 + 0.465438 i
			6.775589	1.790834	-0.030303 + 0.232719 i	0.024911 + 0.234013 i
			3.387794	2.209586	-0.354699 + 0.423474 i	-0.083185 + 0.710833 i
L309009	11.751836165335249	8	6.775589	1.790834	-0.118009 + 0.109585 i	0.024911 + 0.234013 i
			3.387794	2.209586	-0.354699 + 0.423474 i	-0.083185 + 0.710833 i
			3.387794	2.209586	-0.354699 + 0.423474 i	-0.083185 + 0.710833 i
L309010	13.323360921667843	4	5.096031	1.677630	0.102236 + 0.230867 i	-0.029865 + 0.272872 i
			5.110366	2.577657	0.084911 + 0.638796 i	0.084911 + 0.638796 i
			5.096031	1.677630	0.102236 + 0.230867 i	-0.029865 + 0.272872 i
L309011	13.040401369708246	4	4.755814	1.658967	0.031118 + 0.285962 i	0.031118 + 0.285962 i
			5.581174	2.883655	0.181675 + 0.697647 i	0.181675 + 0.697647 i
			4.755814	1.658967	0.031118 + 0.285962 i	0.031118 + 0.285962 i
L309012	13.813278440805412	4	5.464102	1.414214	0.000000 + 0.183013 i	0.000000 + 0.183013 i
			5.464102	2.732051	0.000000 + 0.683013 i	0.000000 + 0.683013 i
			3.464102	2.000000	-0.250000 + 0.433013 i	0.000000 + 0.577350 i

TABLE 1 (continued)

link	*volume*	*num sym*	*cusp vol*	*min trans*	*homological cusp shape*	*geometrical cusp shape*
L309013	5.333489566898120	?	2.645751	2.000000	-0.312500 + 0.165359 i	0.250000 + 0.661438 i
			2.645751	2.000000	-1.375000 + 0.330719 i	0.250000 + 0.661438 i
			2.645751	2.000000	-0.312500 + 0.165359 i	-0.250000 + 0.661438 i
L309014	7.706911802810127	12	2.935423	1.658967	0.027140 + 0.467210 i	0.027140 + 0.467210 i
			2.935423	1.658967	-0.806675 + 0.366928 i	0.027140 + 0.467210 i
			2.935423	1.658967	0.027140 + 0.467210 i	0.027140 + 0.467210 i
L309015	8.355502146379566	4	4.227473	2.829898	-0.548321 + 0.615966 i	-0.193729 + 0.905739 i
			2.987721	1.682230	-0.140003 + 0.045821 i	-0.096864 + 0.452870 i
			4.227473	2.829898	-0.548321 + 0.615966 i	-0.193729 + 0.905739 i
L309016	9.966511883698373	4	3.988781	2.535377	-0.391355 + 0.498598 i	0.016805 + 0.805427 i
			3.408369	1.405887	0.142020 + 0.174101 i	-0.015646 + 0.289104 i
			3.988781	2.535377	-0.391355 + 0.498598 i	0.016805 + 0.805427 i
L309017	5.333489566898120	?	2.645751	2.000000	1.500000 + 1.322876 i	-0.250000 + 0.661438 i
			2.645751	2.000000	-0.250000 + 0.094491 i	0.250000 + 0.661438 i
			2.645751	2.000000	1.500000 + 1.322876 i	0.250000 + 0.661438 i
L309018	7.327724753417752	?	4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
			4.000000	2.000000	0.000000 + 0.500000 i	0.000000 + 0.500000 i
			4.000000	2.000000	-1.000000 + 0.500000 i	0.000000 + 0.500000 i
L309019	7.327724753417752	?	4.000000	2.828427	0.500000 + 0.500000 i	0.000000 + 1.000000 i
			4.000000	2.000000	1.000000 + 0.500000 i	0.000000 + 0.500000 i
			4.000000	2.000000	0.200000 + 0.100000 i	0.000000 + 0.500000 i
L309020	10.991587130126628	4	4.000000	1.414214	0.000000 + 0.250000 i	0.000000 + 0.250000 i
			6.000000	3.162278	-0.250000 + 0.750000 i	-0.250000 + 0.750000 i
			4.000000	2.828427	-0.500000 + 0.500000 i	0.000000 + 1.000000 i
L309021	satellite of Whitehead link					
L408001	10.149416064096536	?	3.464102	2.000000	-0.250000 + 0.433013 i	0.000000 + 0.577350 i
			3.464102	2.000000	-0.250000 + 0.433013 i	0.000000 + 0.577350 i
			3.464102	2.000000	-0.250000 + 0.433013 i	0.000000 + 0.577350 i
			3.464102	2.000000	-0.250000 + 0.433013 i	0.000000 + 0.577350 i
L408002	7.327724753417752	64	4.000000	2.828427	-0.500000 + 0.500000 i	0.000000 + 1.000000 i
			4.000000	2.828427	-0.500000 + 0.500000 i	0.000000 + 1.000000 i
			4.000000	2.828427	-0.500000 + 0.500000 i	0.000000 + 1.000000 i
			4.000000	2.828427	-0.500000 + 0.500000 i	0.000000 + 1.000000 i
L408003	satellite of (2,2) torus link					
L409001	11.751836165335249	16	3.387794	1.790834	-0.145301 + 0.423474 i	0.060606 + 0.465438 i
			3.387794	1.790834	-0.145301 + 0.423474 i	0.060606 + 0.465438 i
			3.387794	1.790834	-0.145301 + 0.423474 i	0.060606 + 0.465438 i
			3.387794	1.790834	-0.145301 + 0.423474 i	0.060606 + 0.465438 i

TABLE 1 (continued)

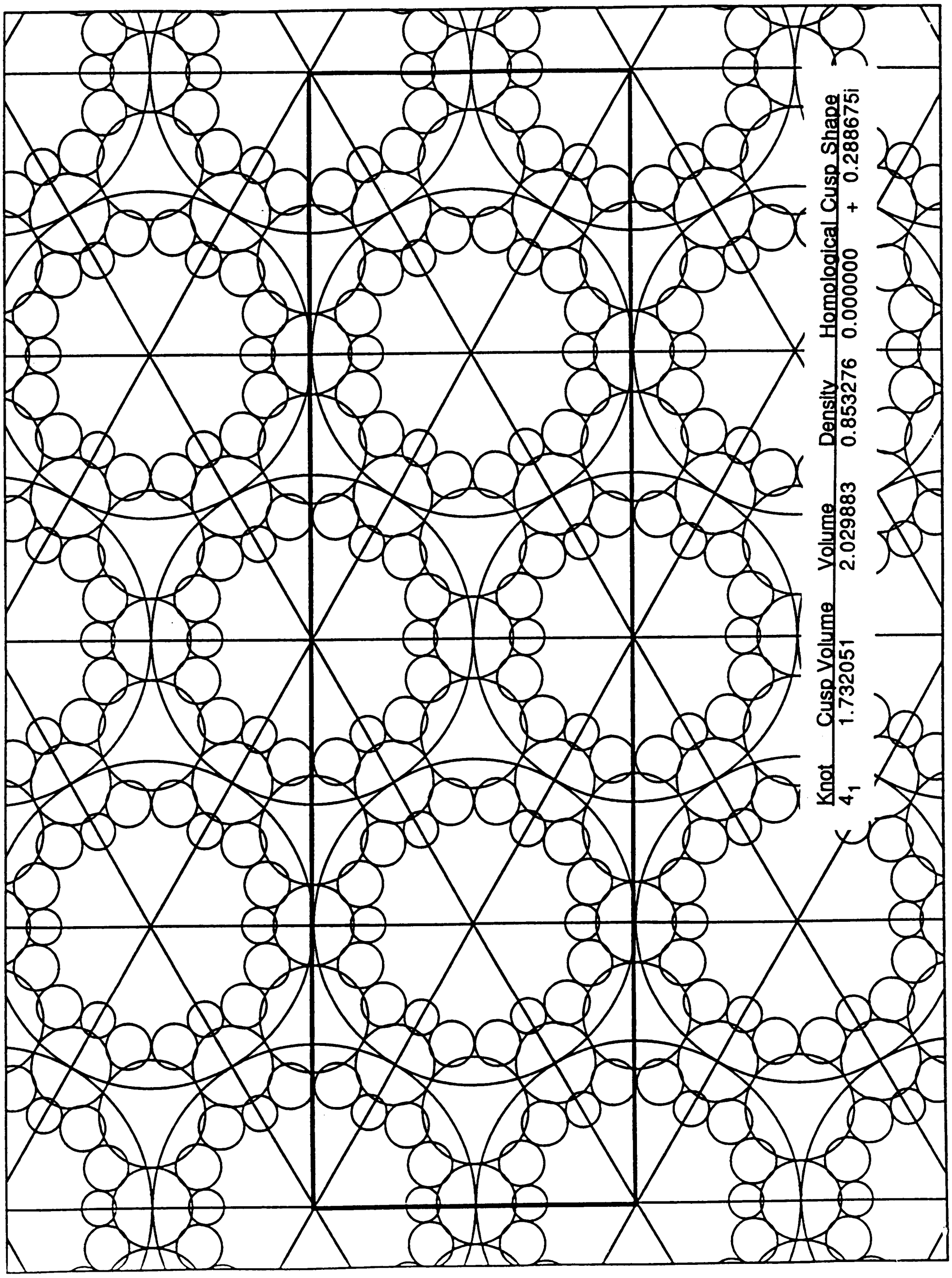

Knot Cusp Volume Volume Density Homological Cusp Shape
4_1 1.732051 2.029883 0.853276 0.000000 + 0.288675i

TABLE 2

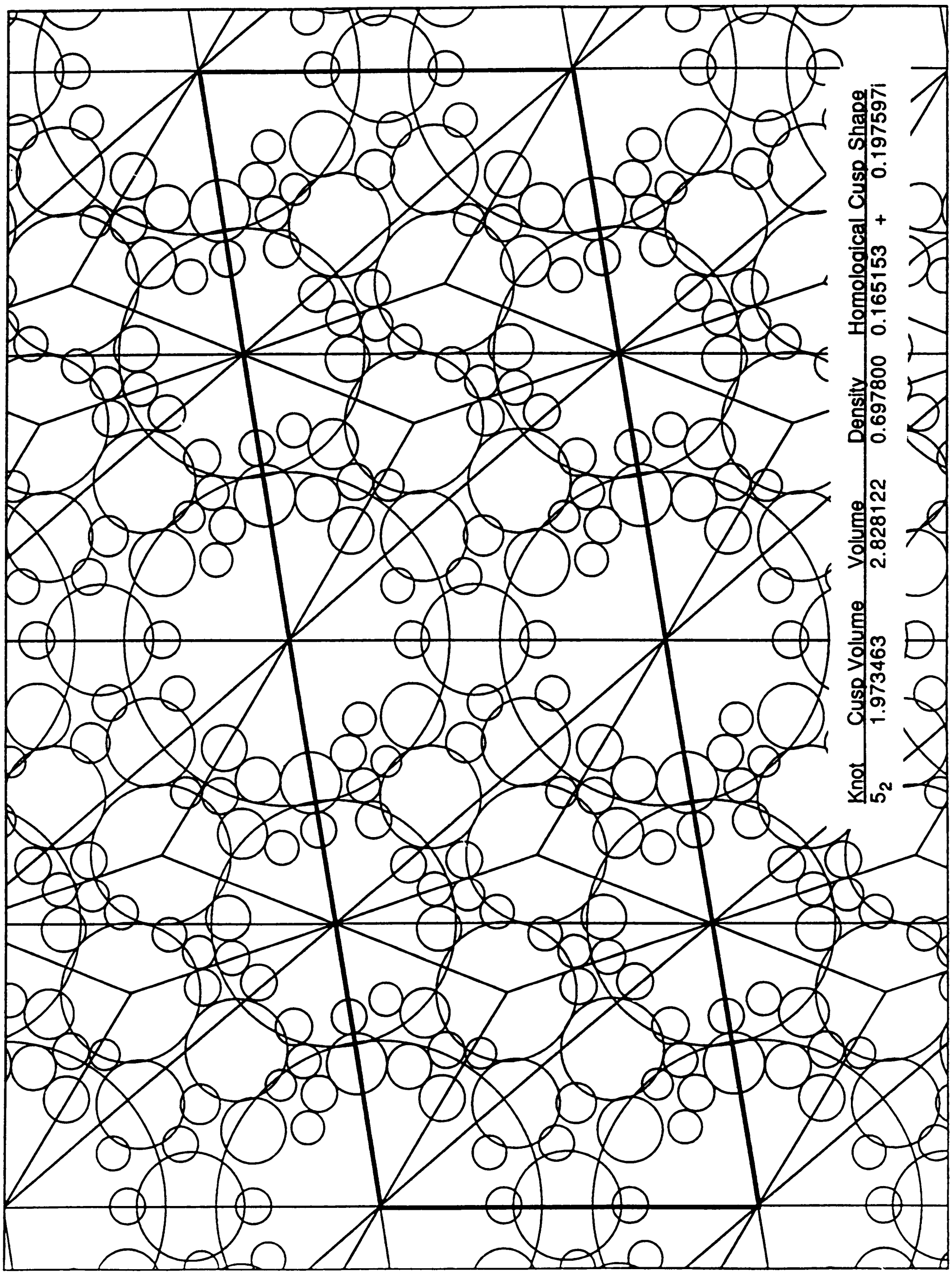
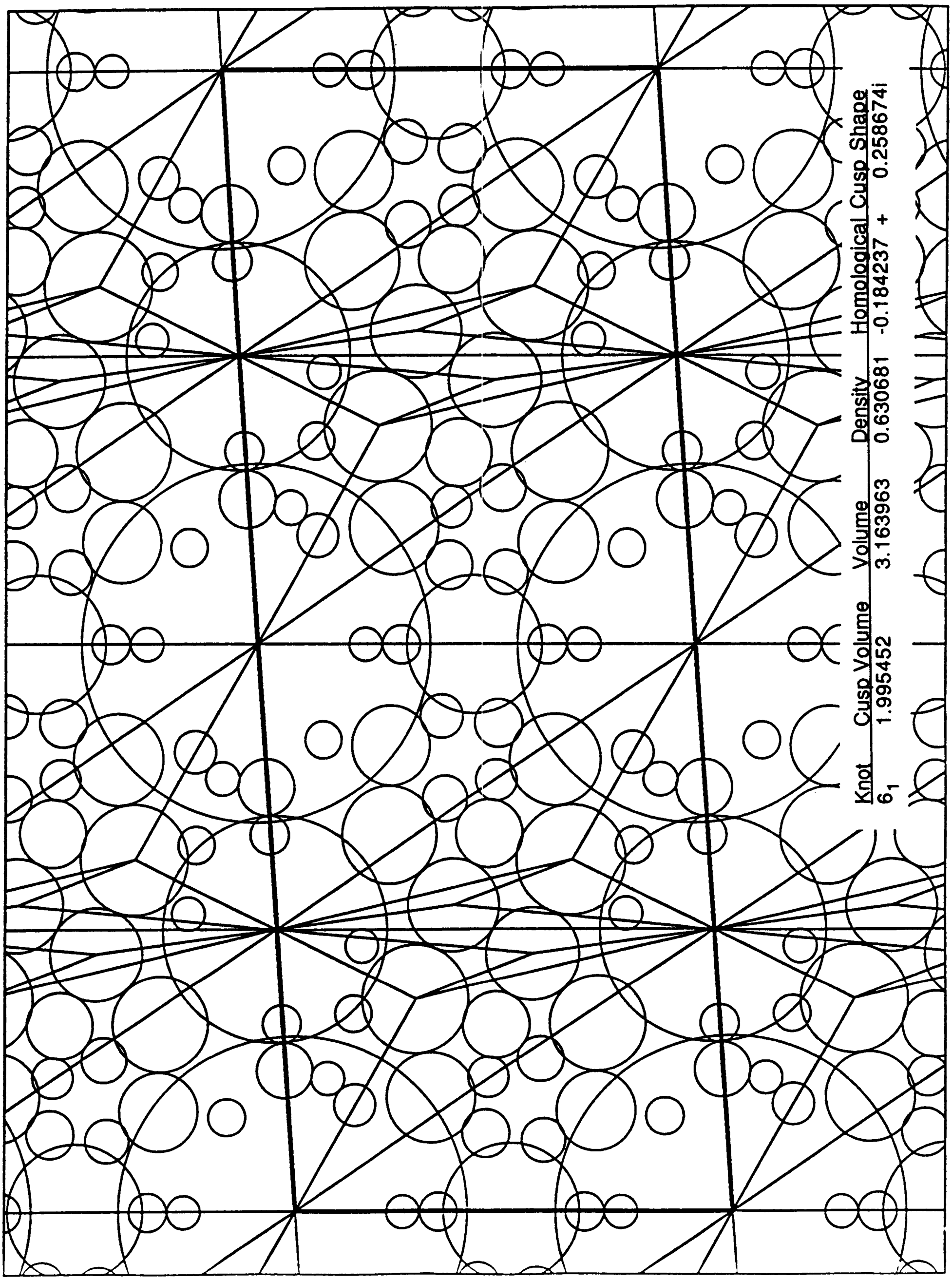


TABLE 2 (continued)



Knot	Cusp Volume	Volume	Density	Homological Cusp Shape
6_1	1.995452	3.163963	0.630681	-0.184237 + 0.258674i

TABLE 2 (continued)

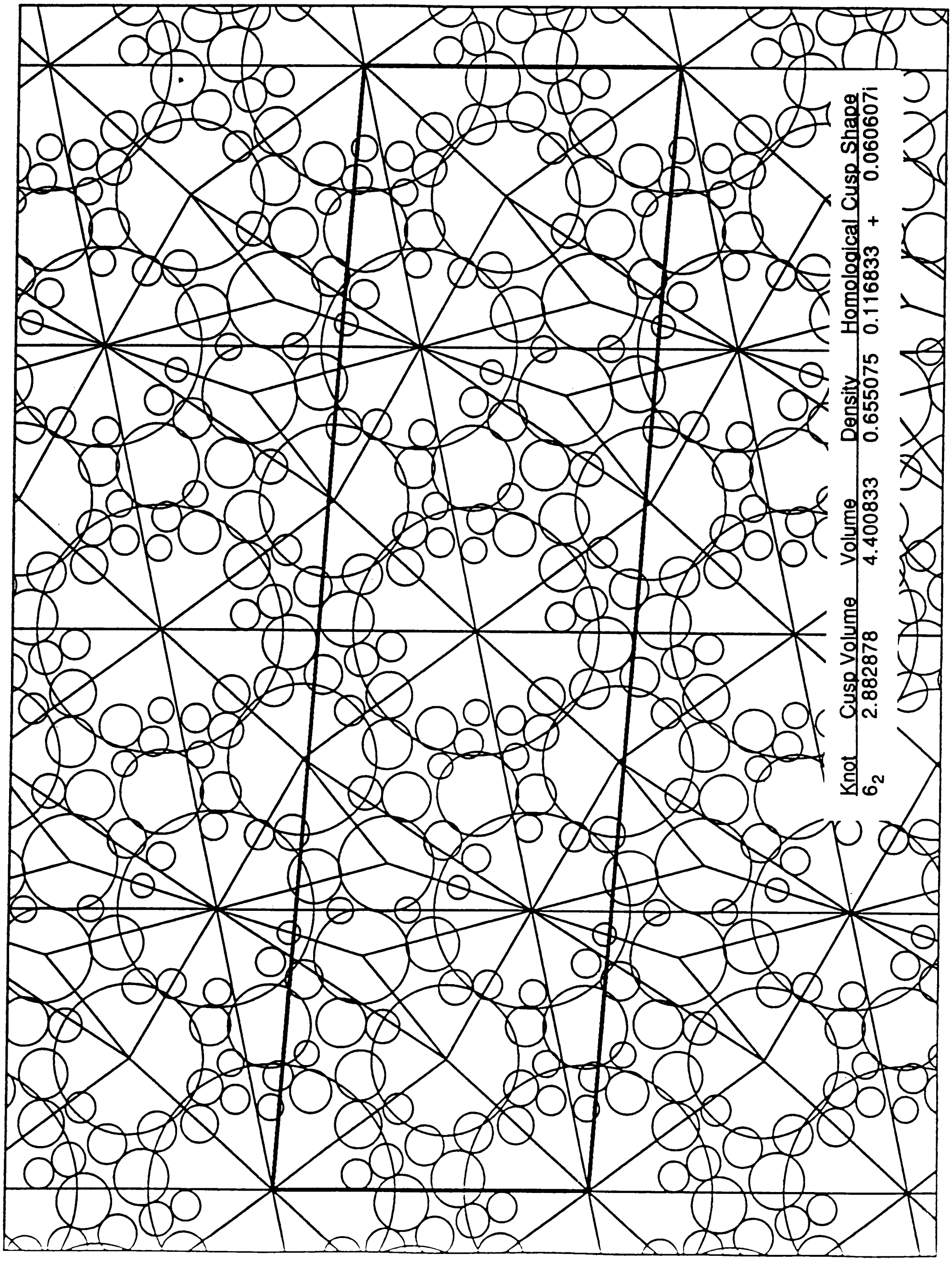


TABLE 2 (continued)

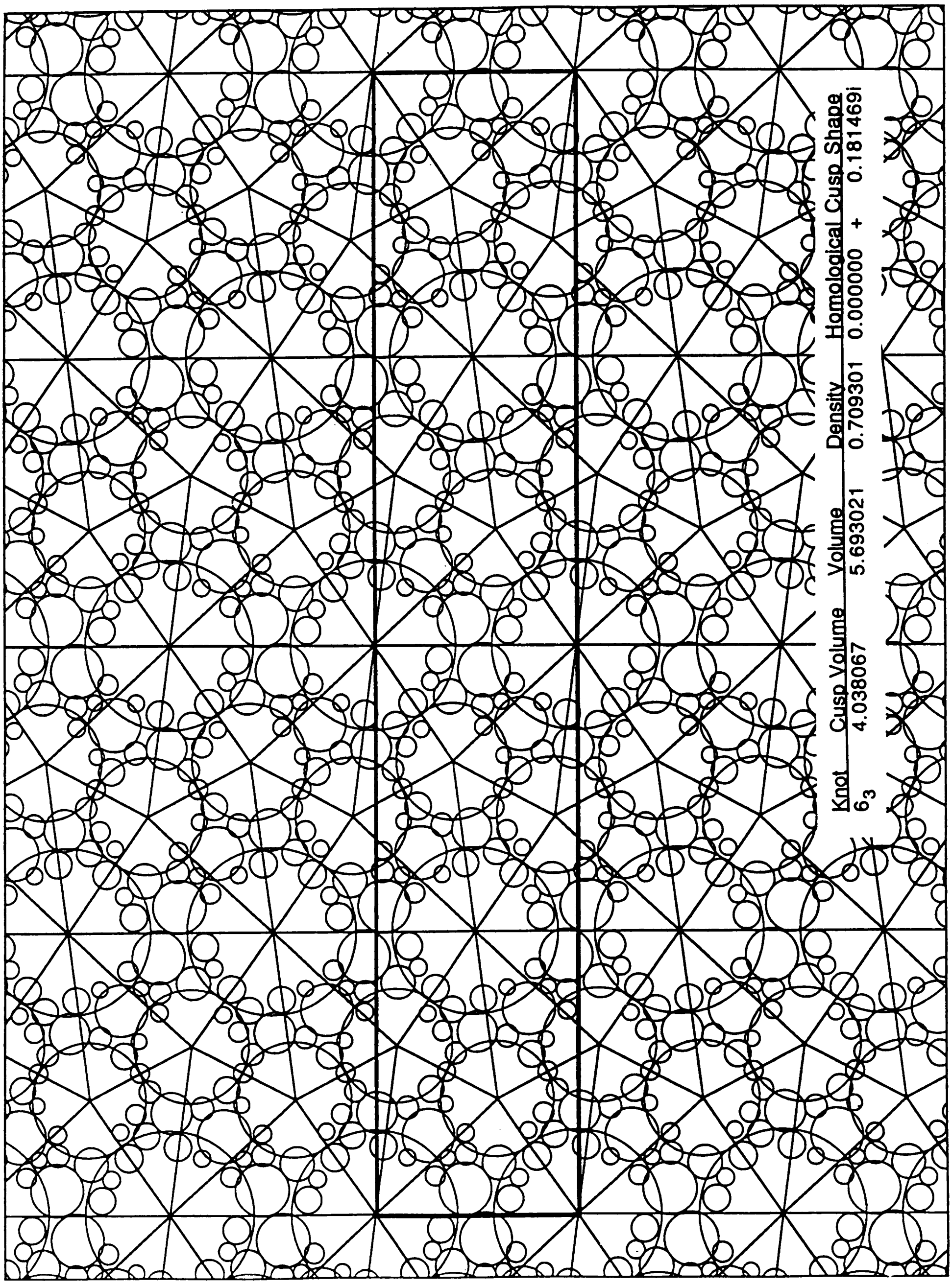


TABLE 2 (continued)

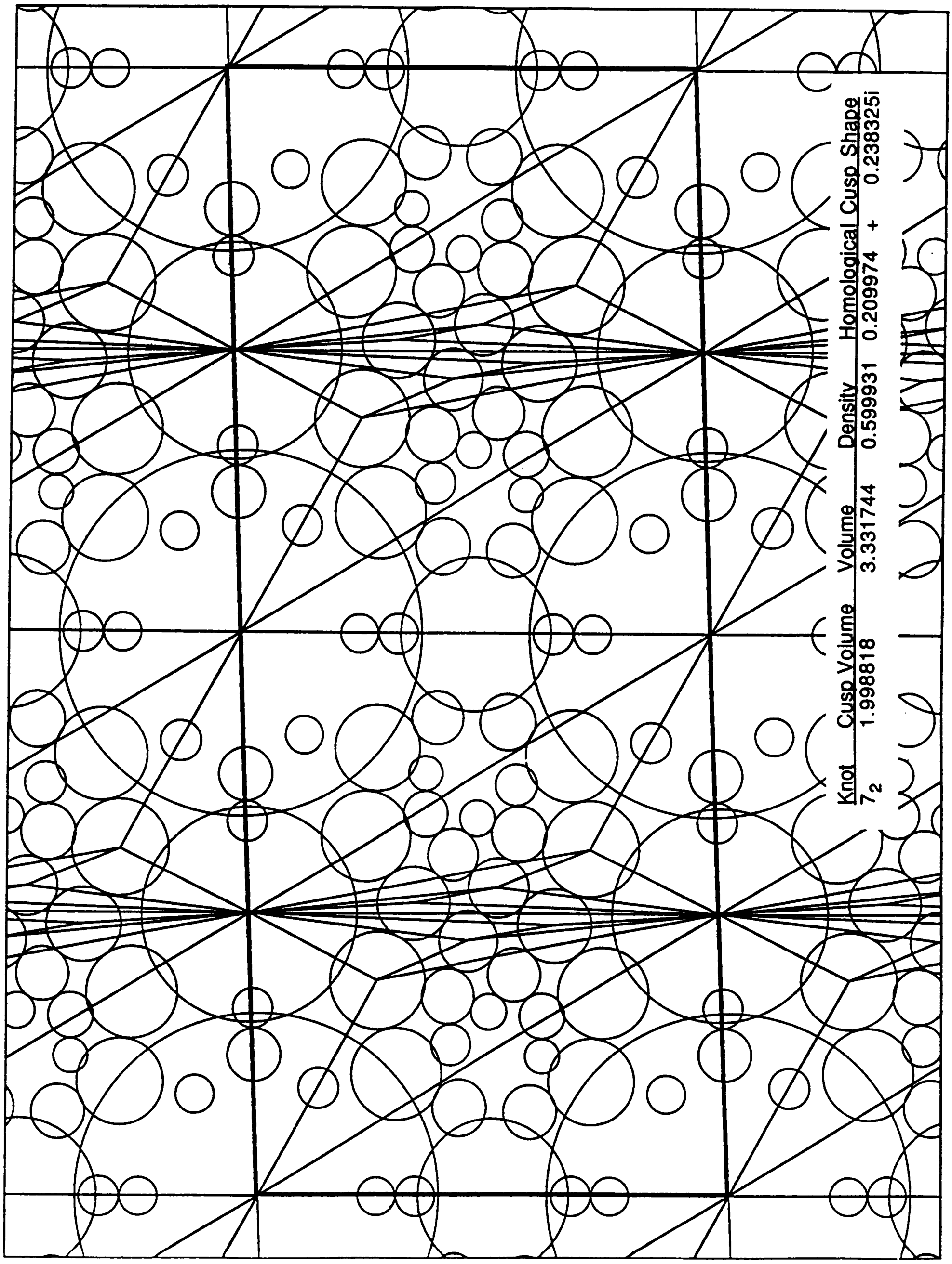


TABLE 2 (continued)

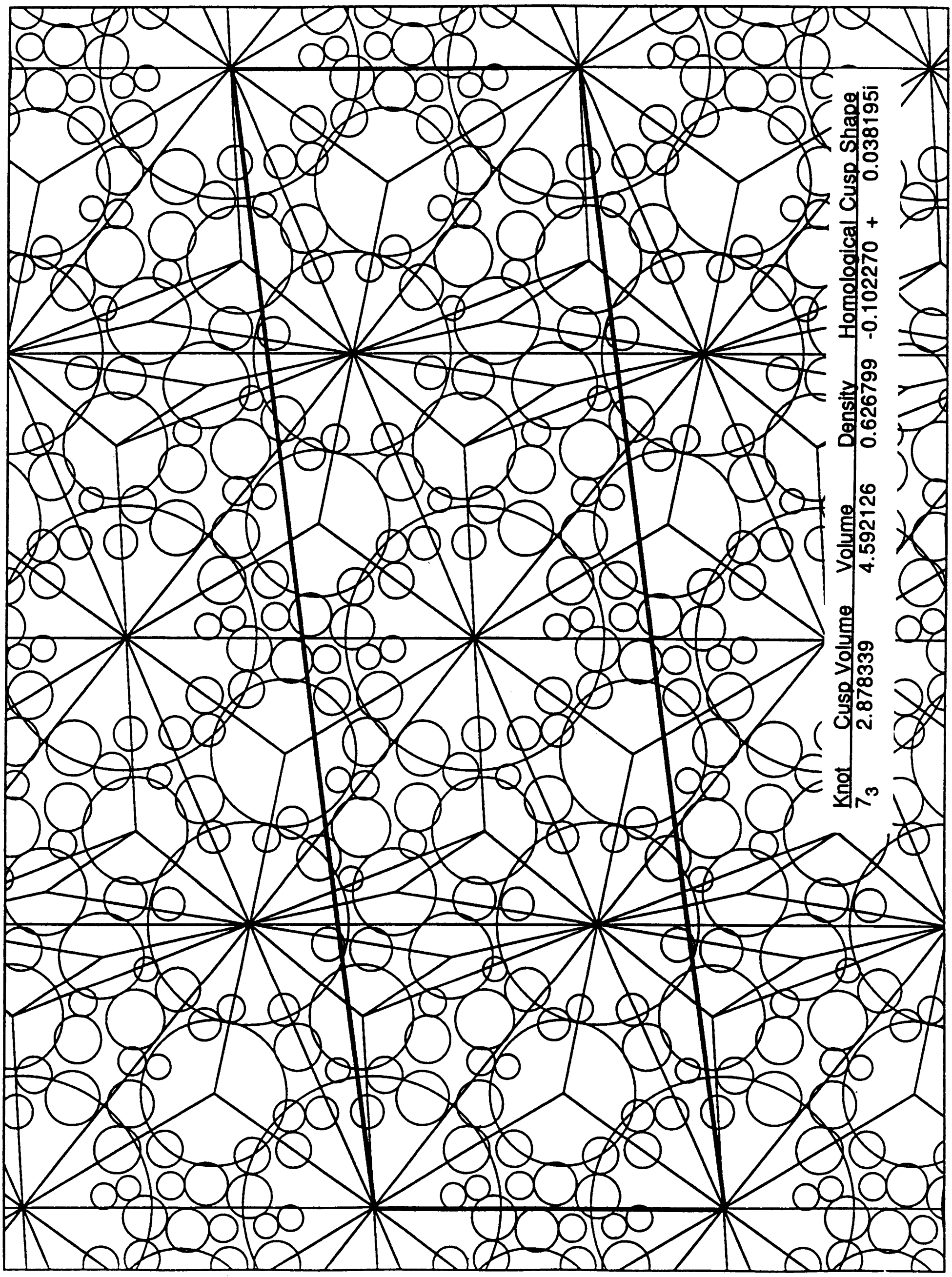


TABLE 2 (continued)

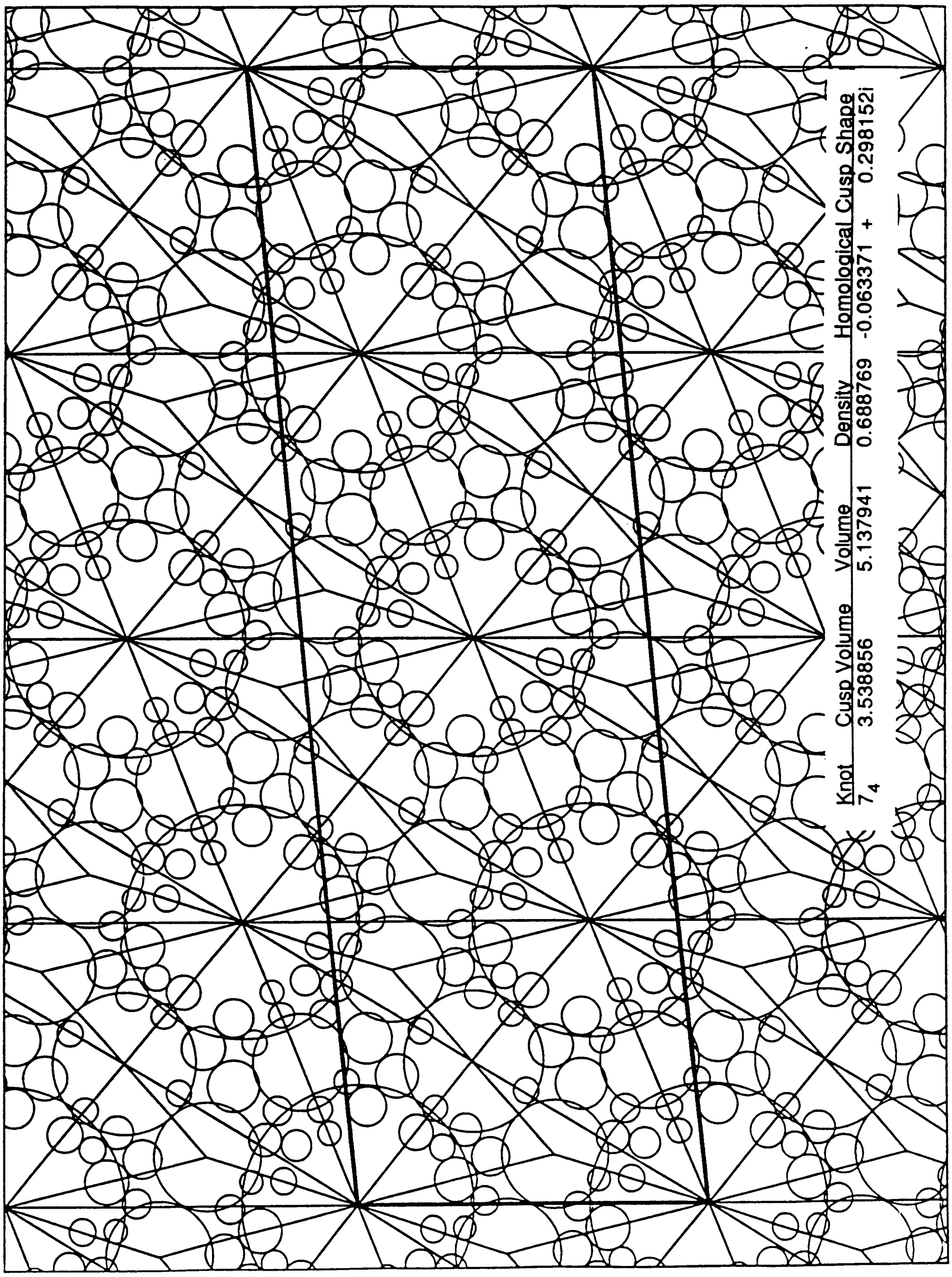


TABLE 2 (continued)

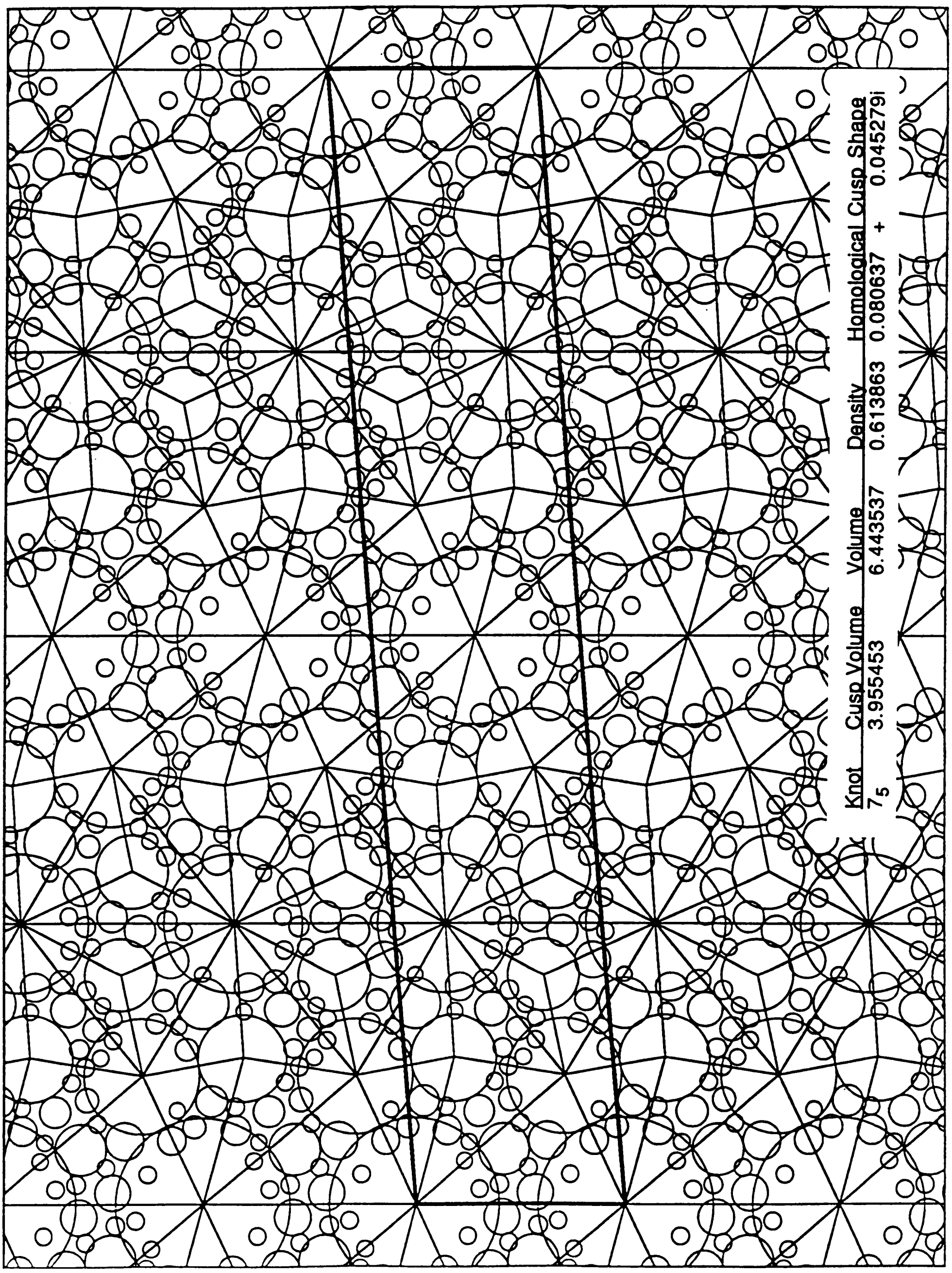


TABLE 2 (continued)

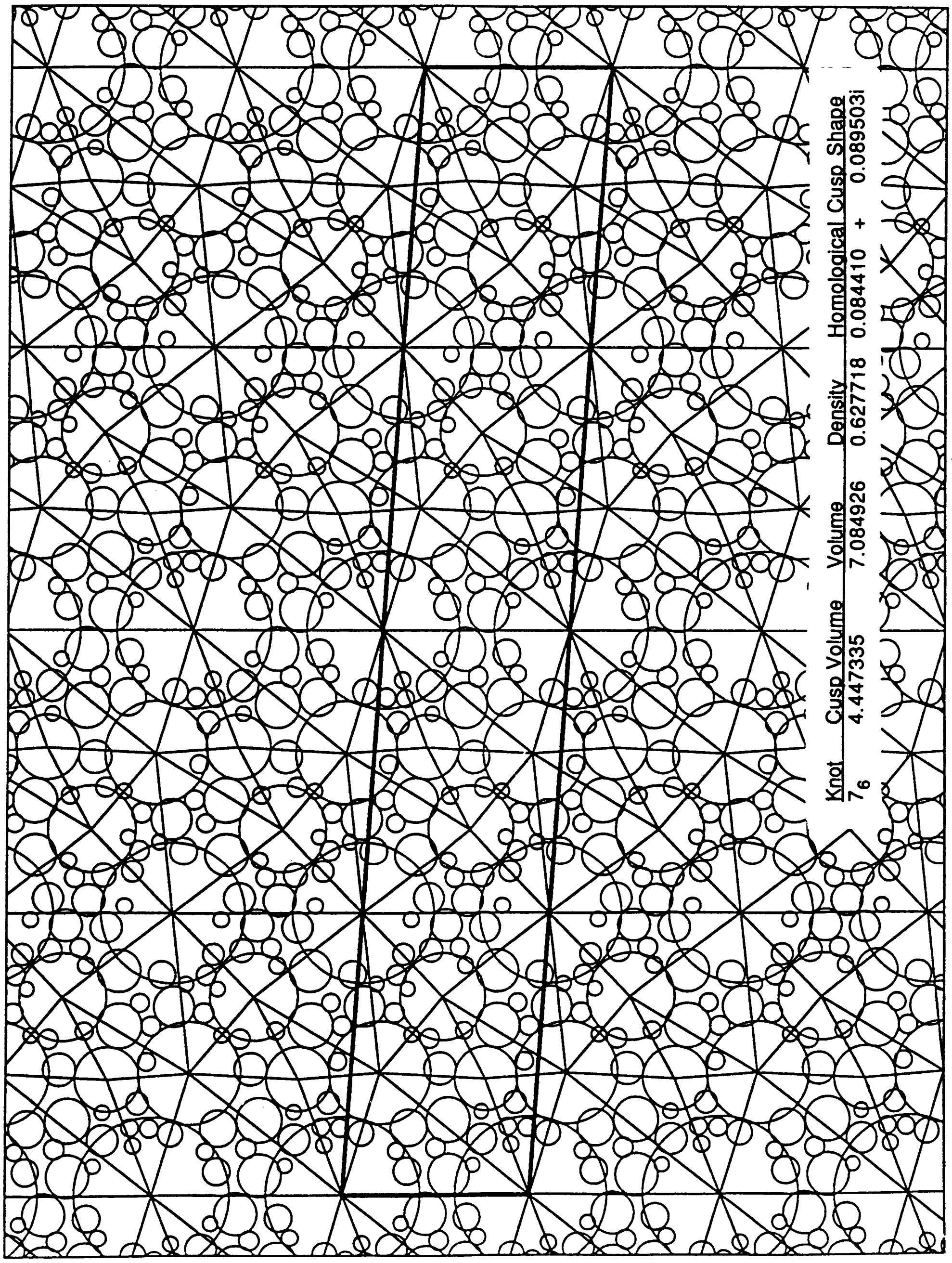
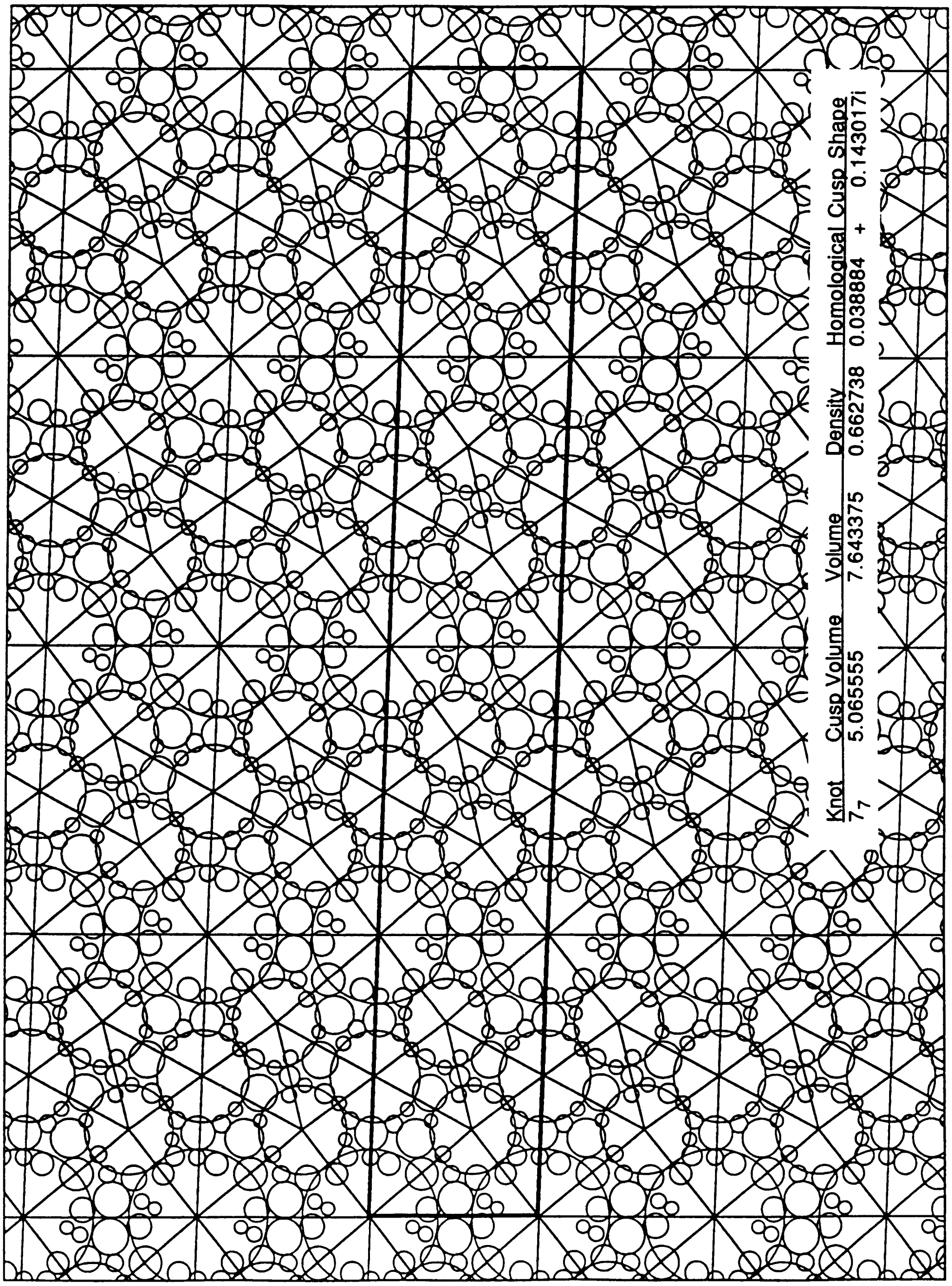


TABLE 2 (continued)



Knot	Cusp Volume	Volume	Density	Homological Cusp Shape
7_7	5.065555	7.643375	0.662738	0.038884 + 0.143017i

TABLE 2 (continued)

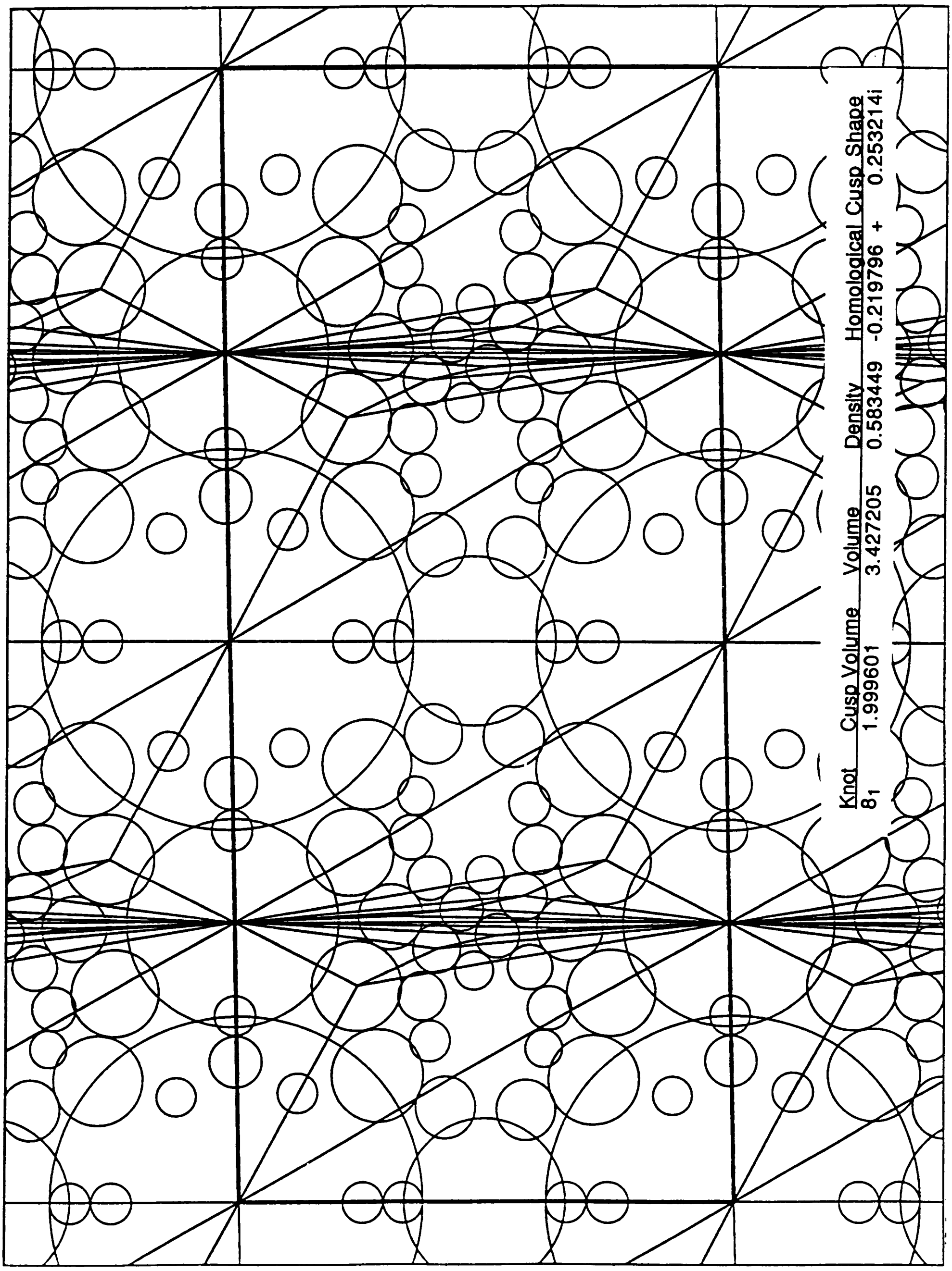


TABLE 2 (continued)

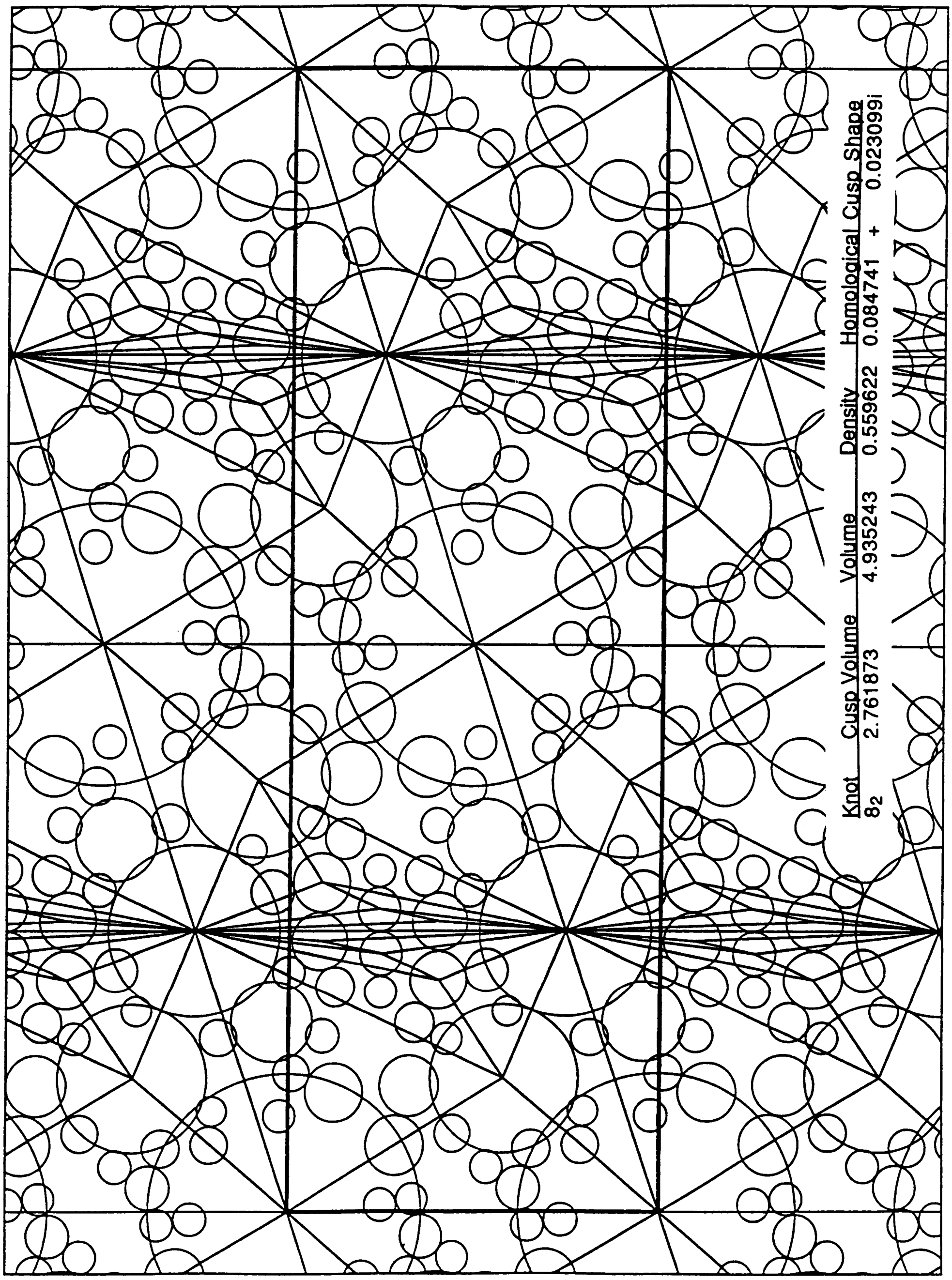


TABLE 2 (continued)

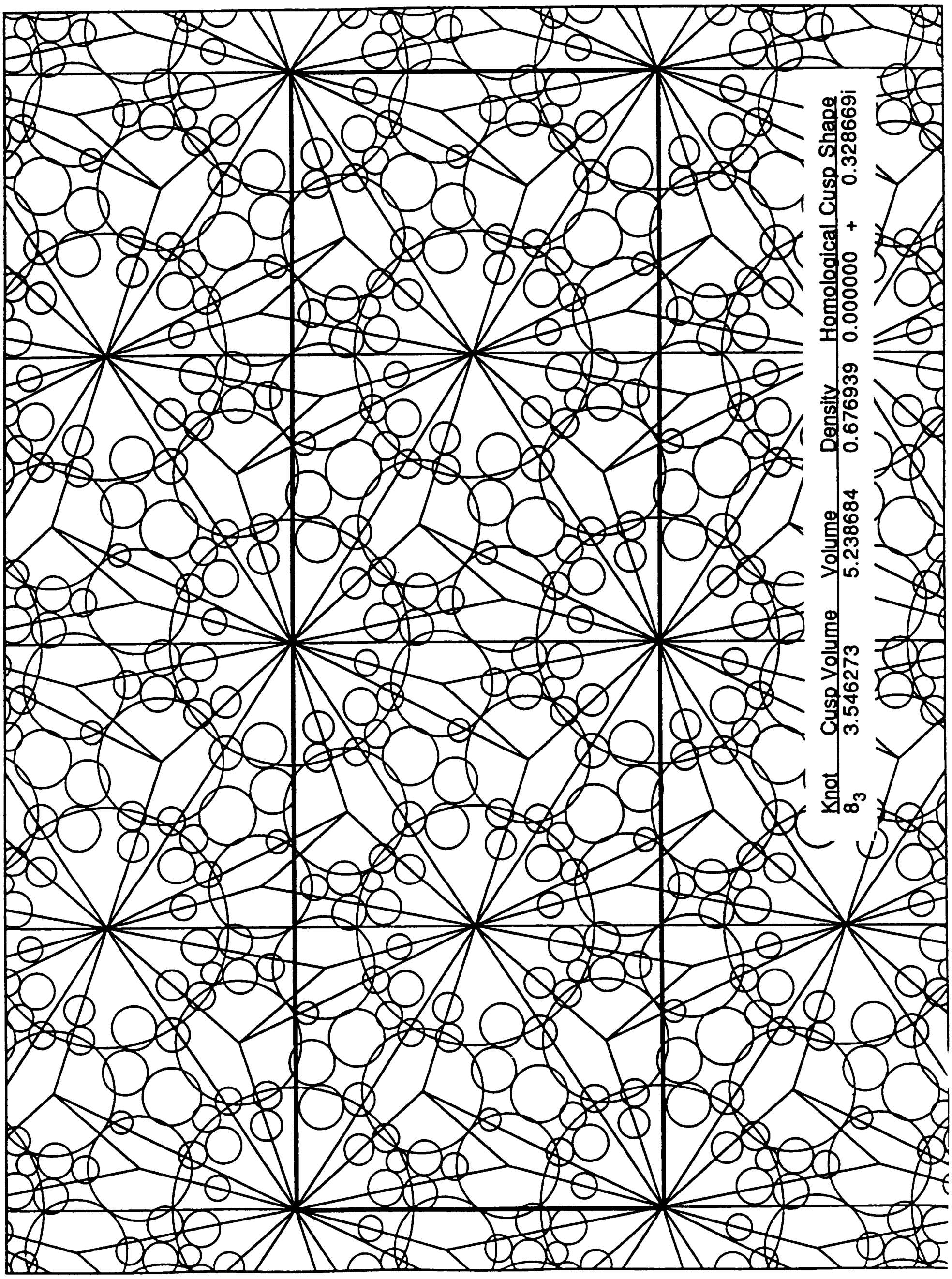


TABLE 2 (continued)

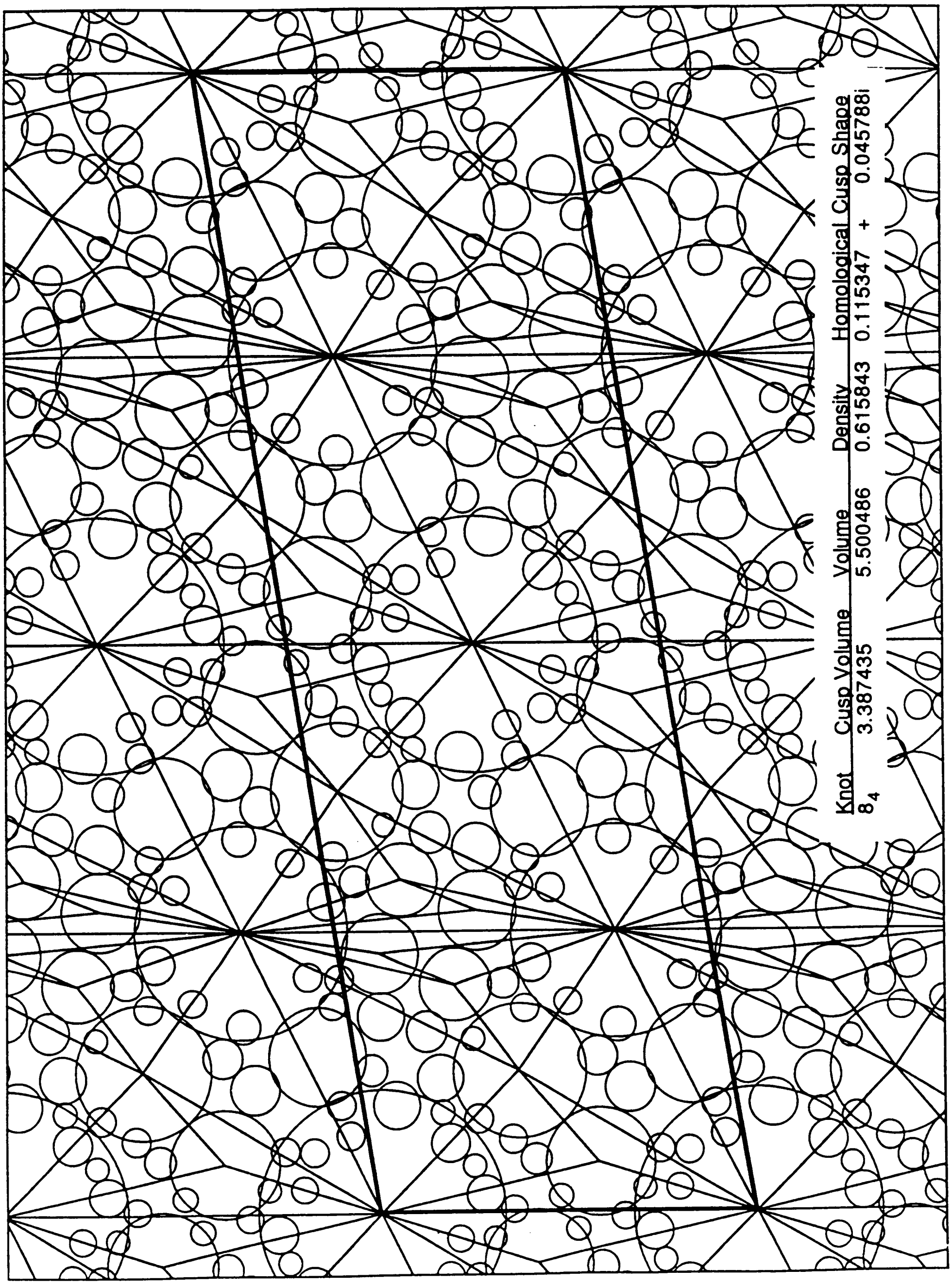


TABLE 2 (continued)

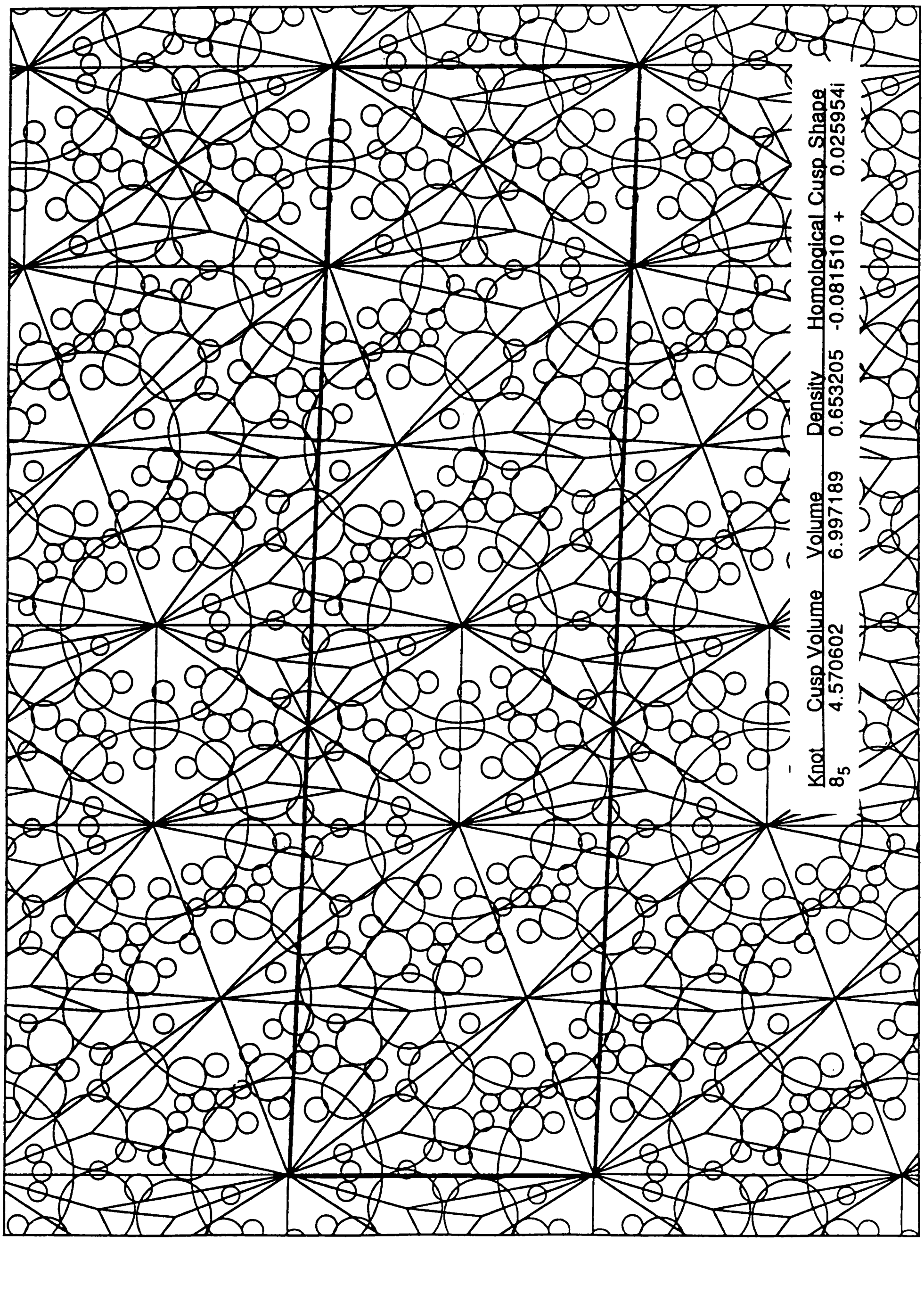


TABLE 2 (continued)

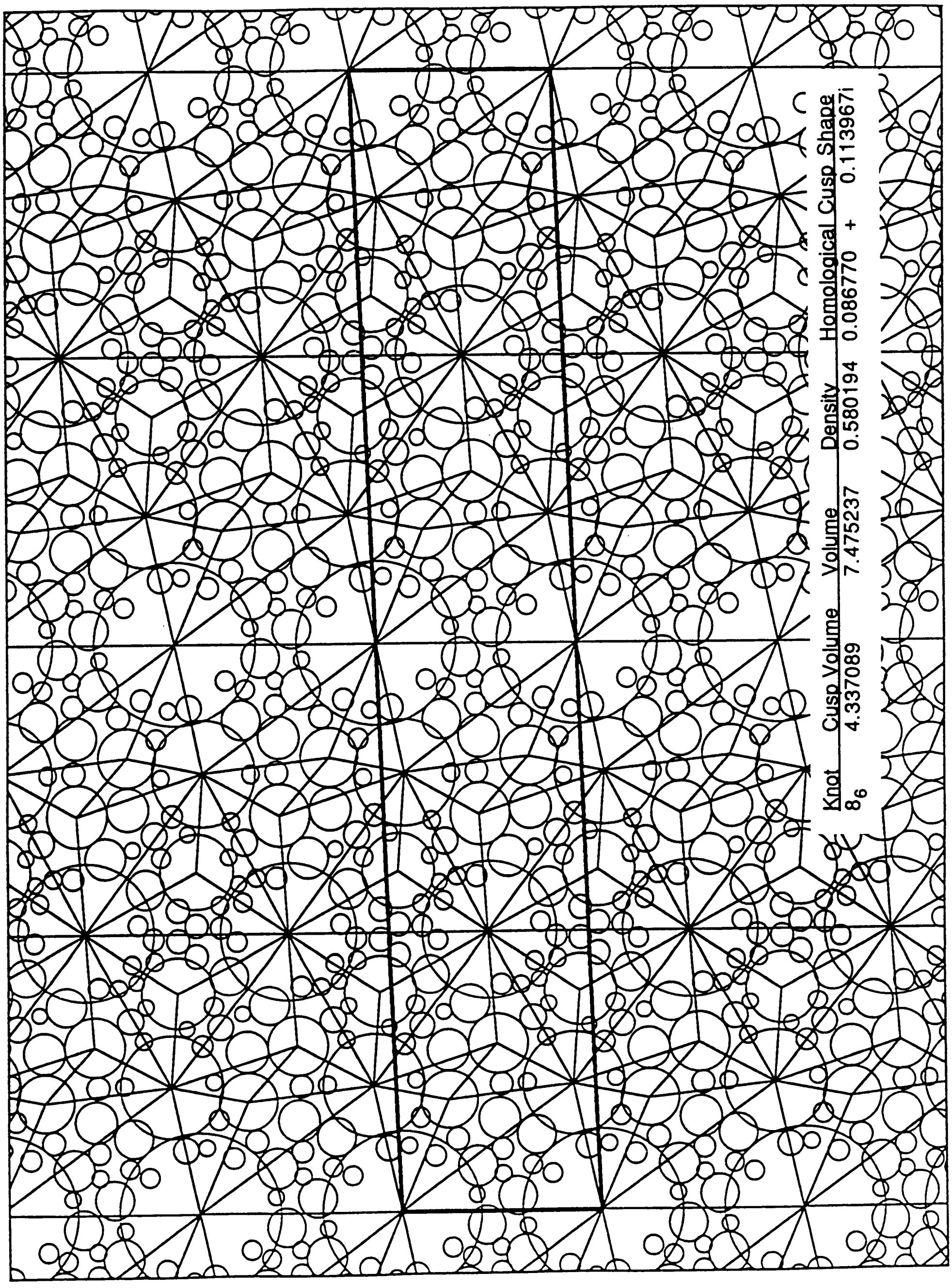


TABLE 2 (continued)

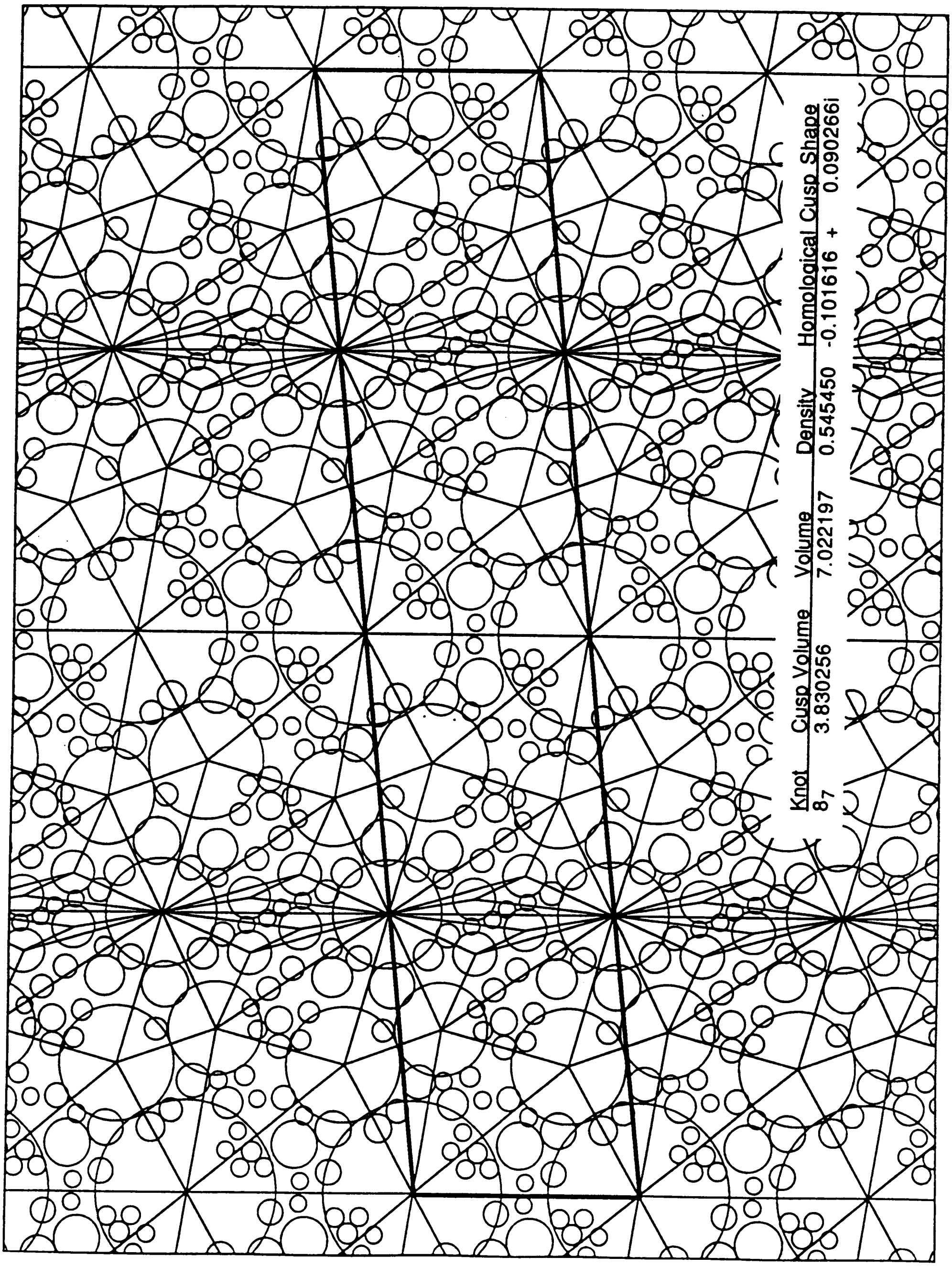


TABLE 2 (continued)

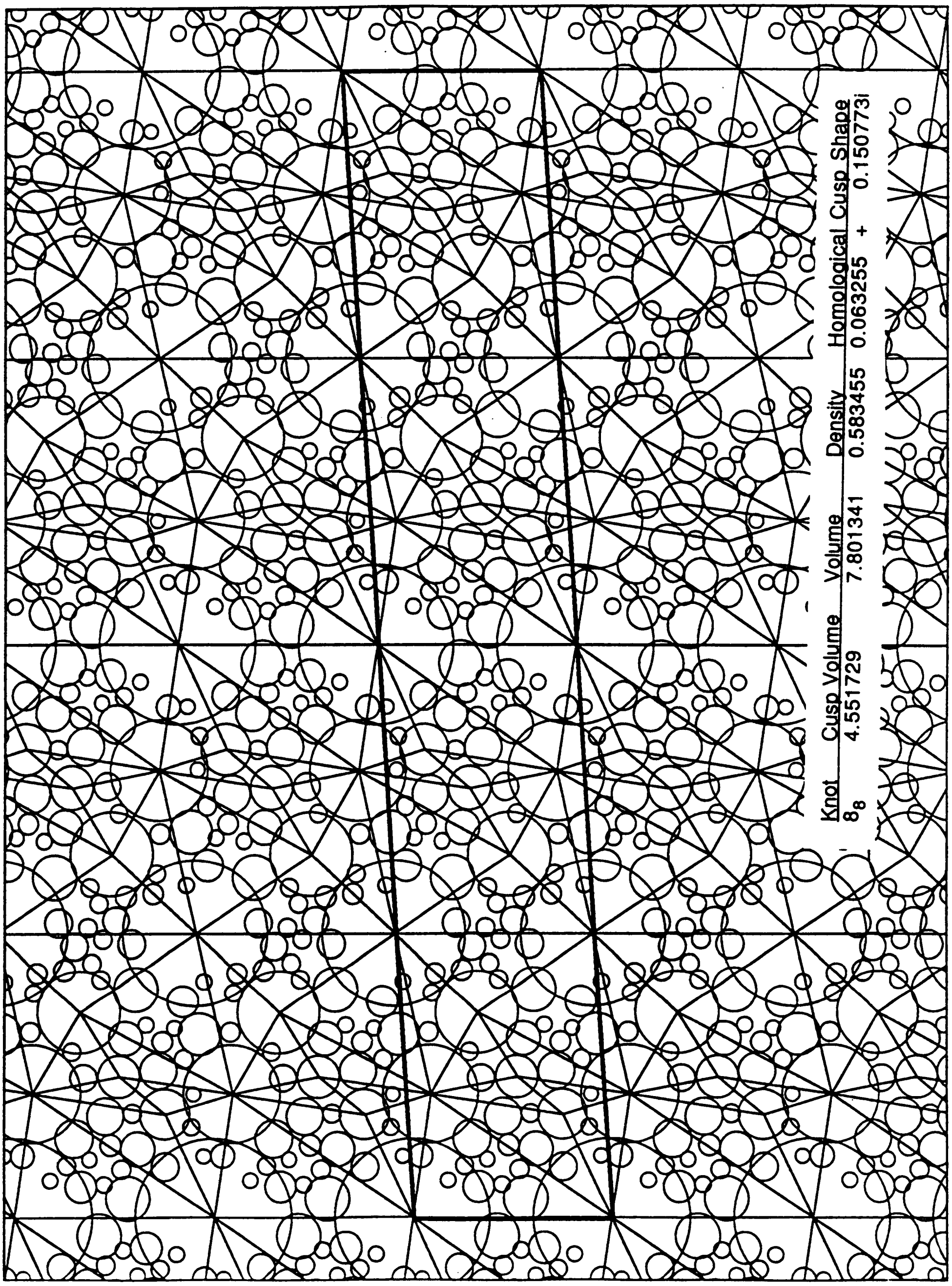


TABLE 2 (continued)

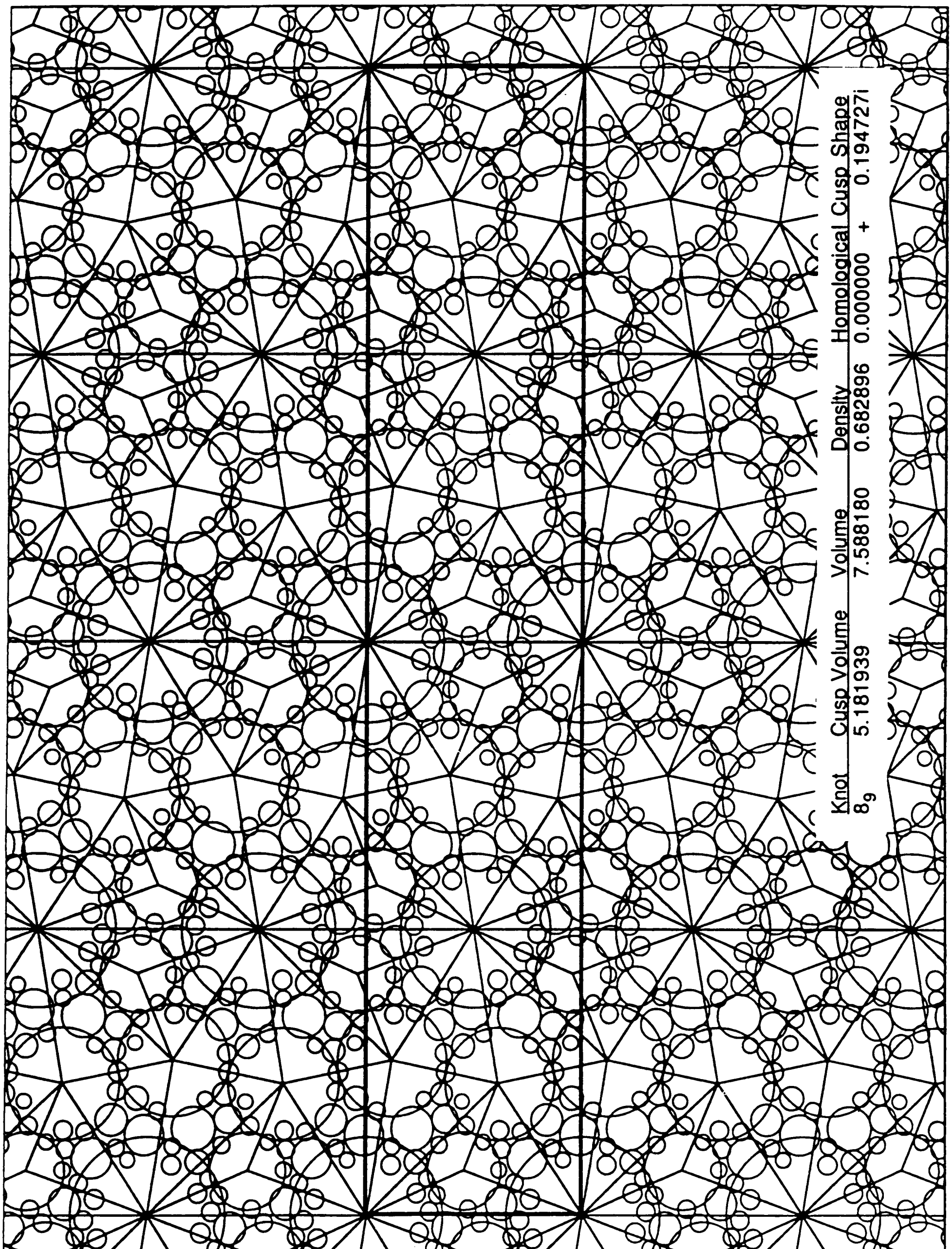


TABLE 2 (continued)

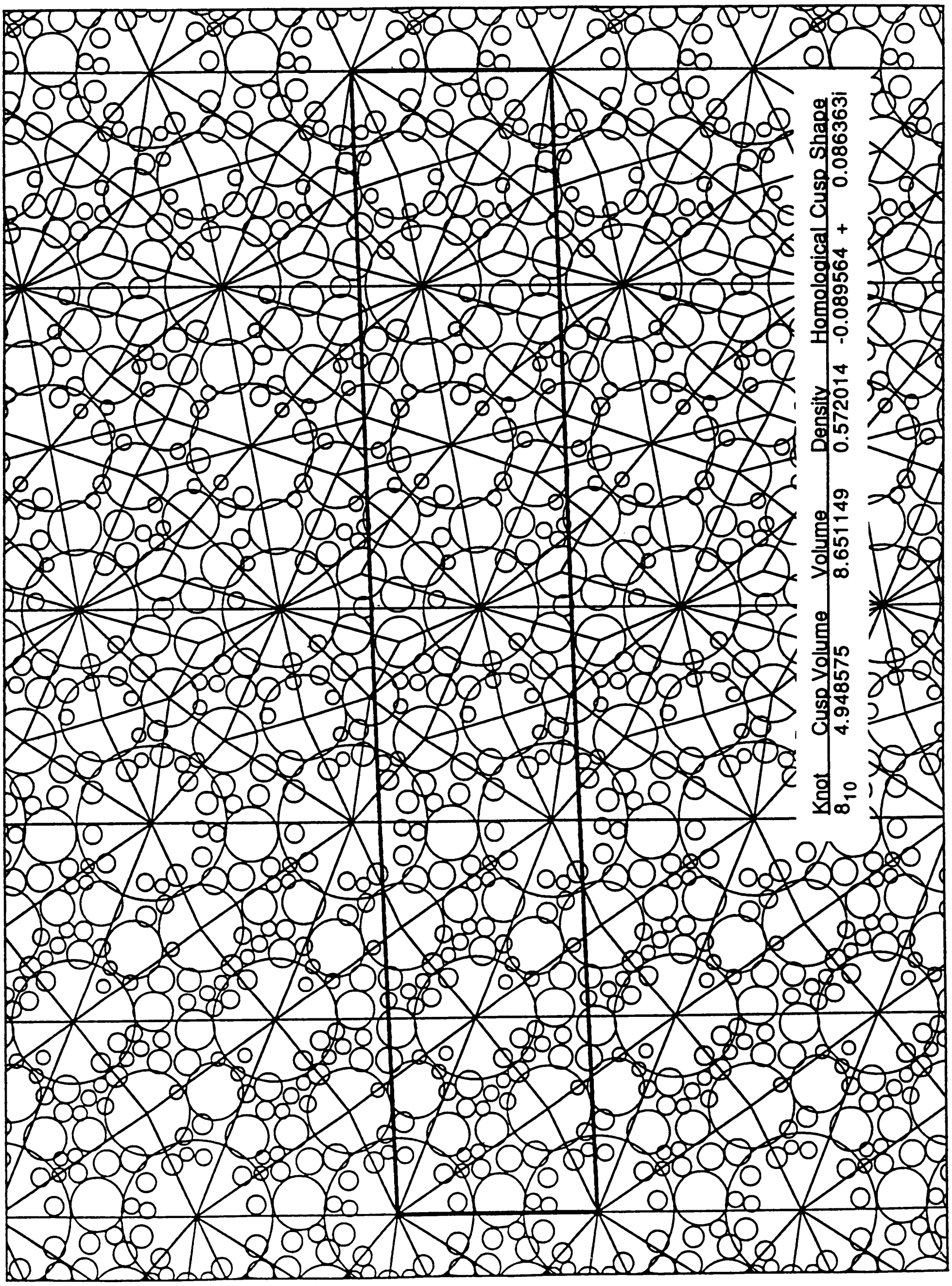


TABLE 2 (continued)

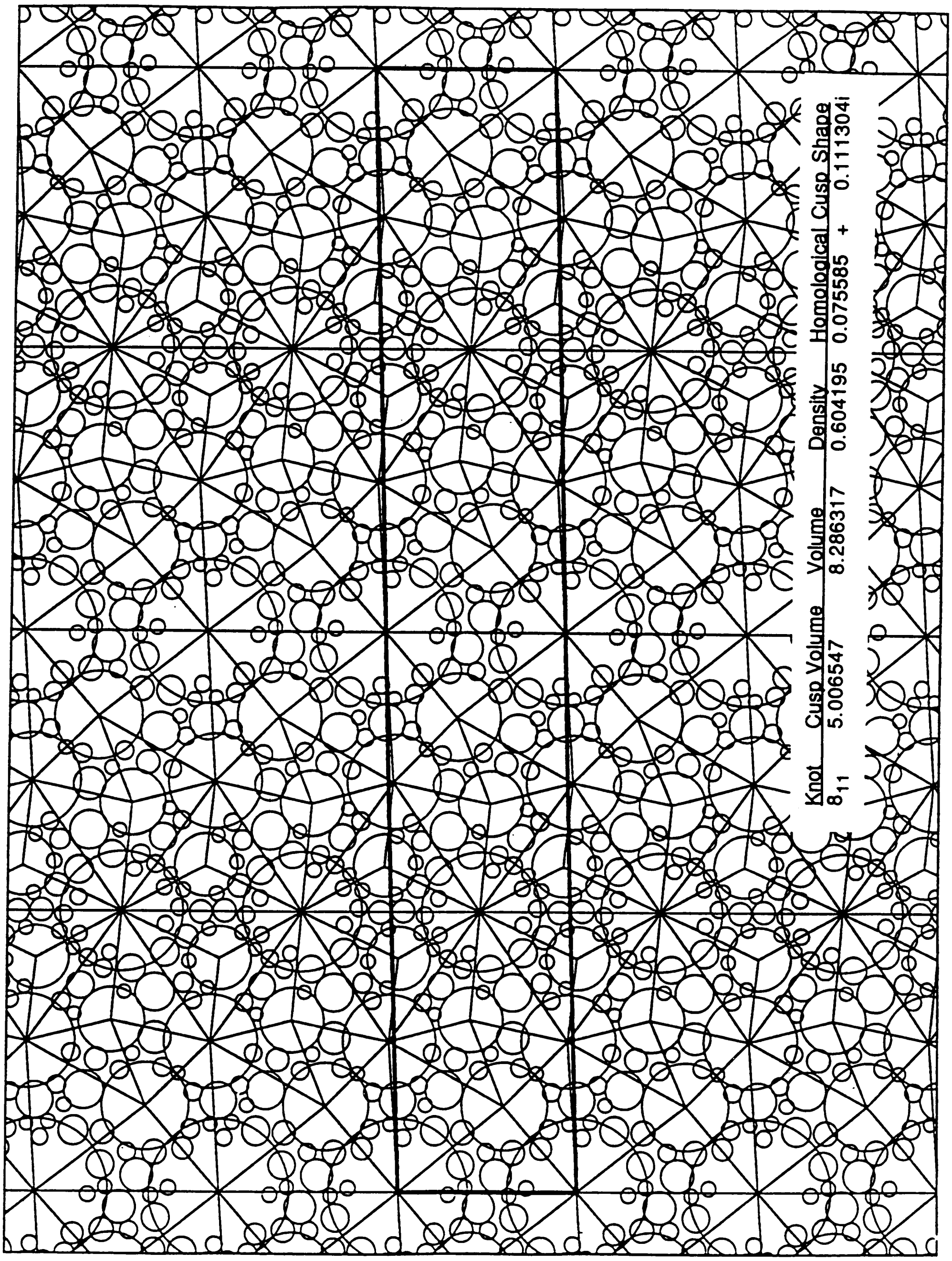


TABLE 2 (continued)

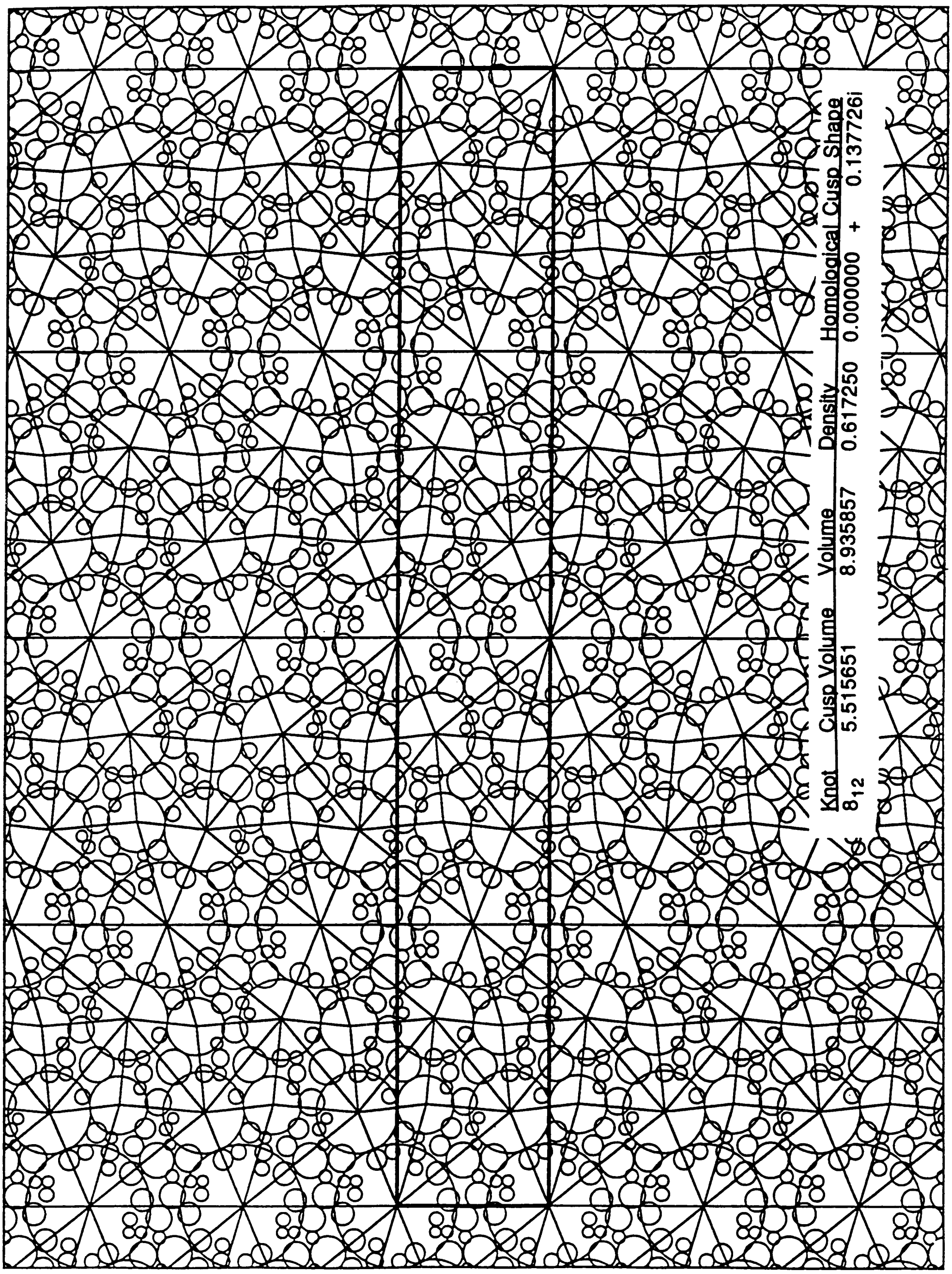
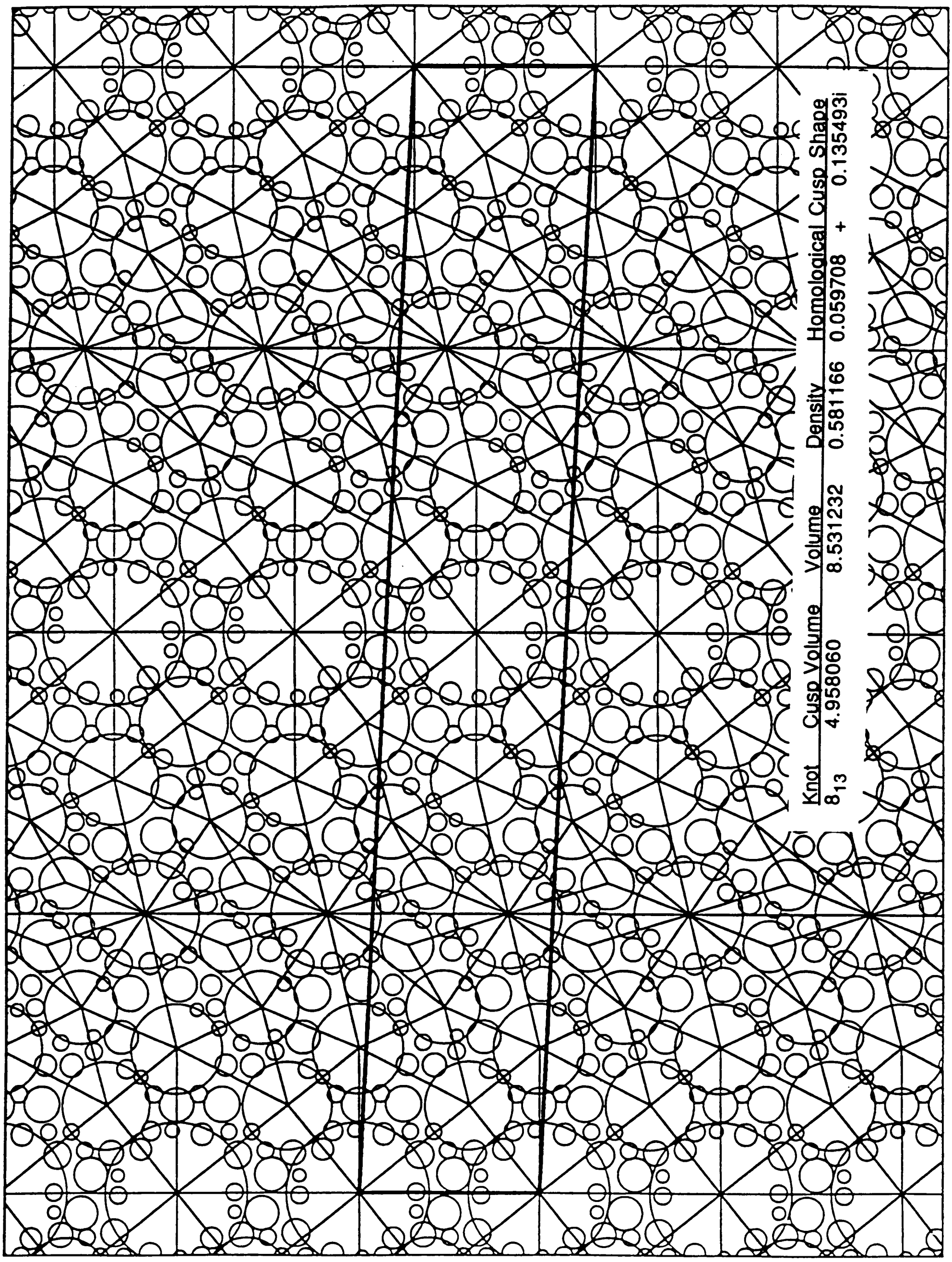


TABLE 2 (continued)



Knot	Cusp Volume	Volume	Density	Homological Cusp Shape
8_{13}	4.958060	8.531232	0.581166	0.059708 + 0.135493i

TABLE 2 (continued)

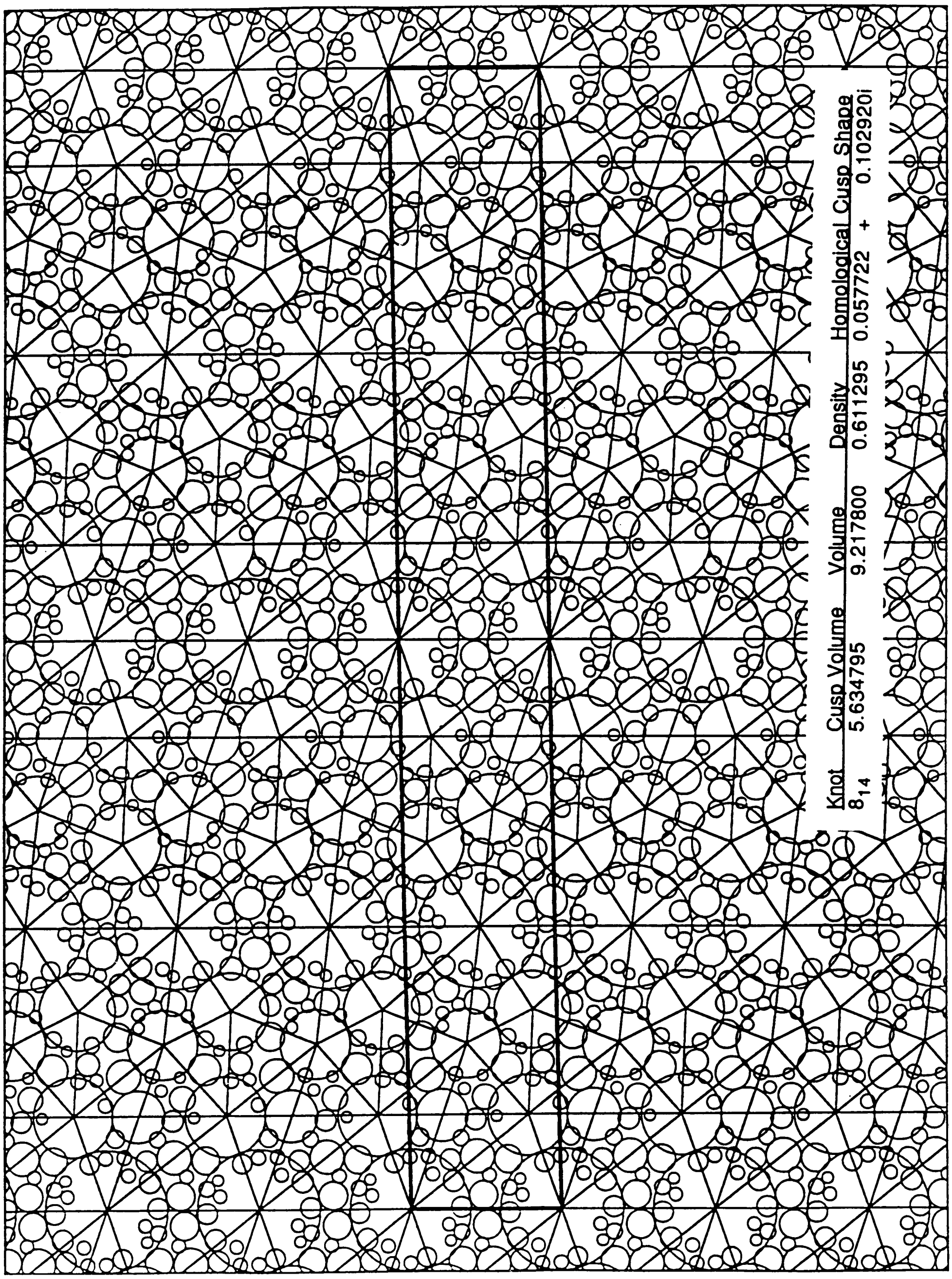
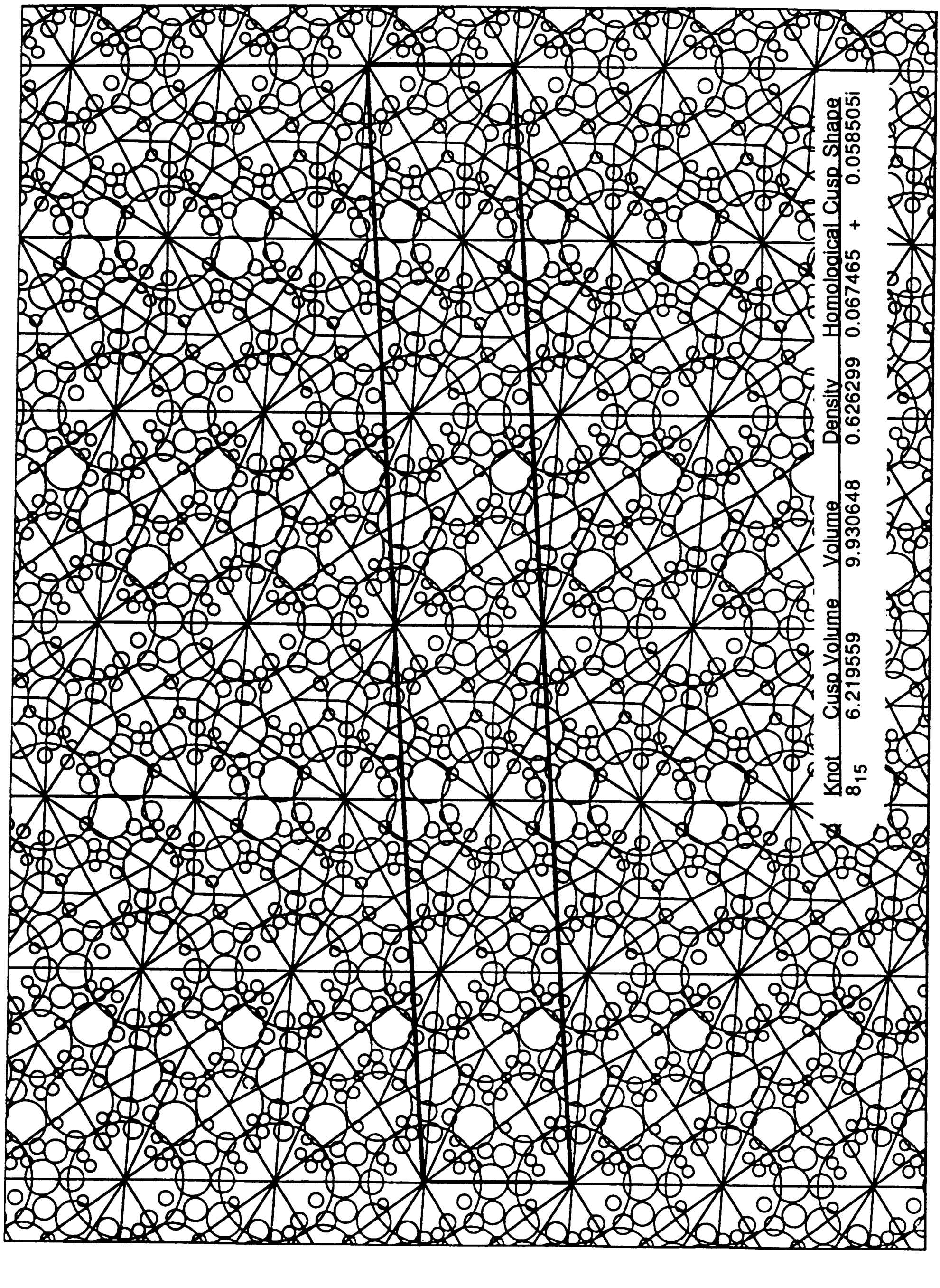


TABLE 2 (continued)



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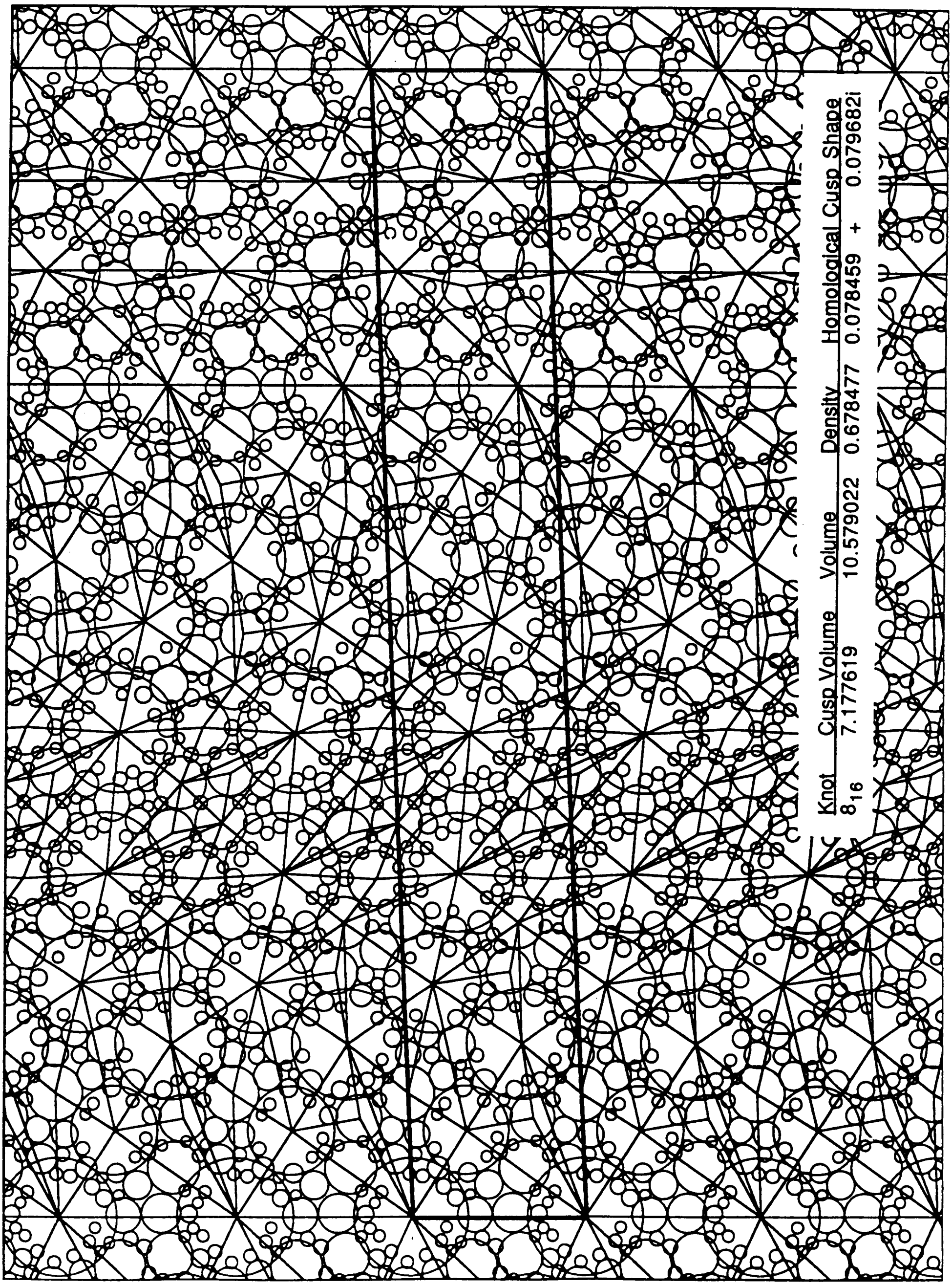

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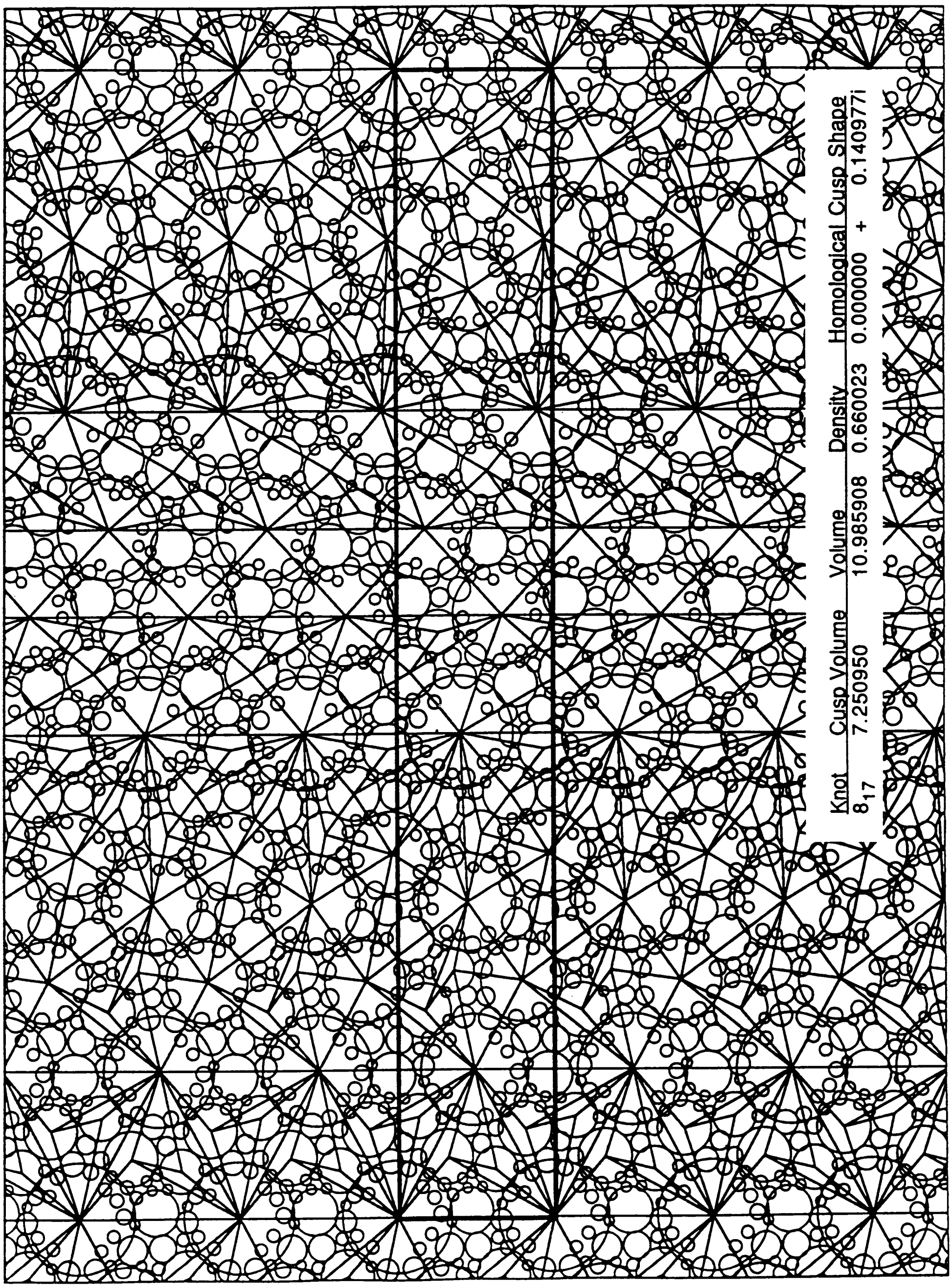

TABLE 2 (continued)

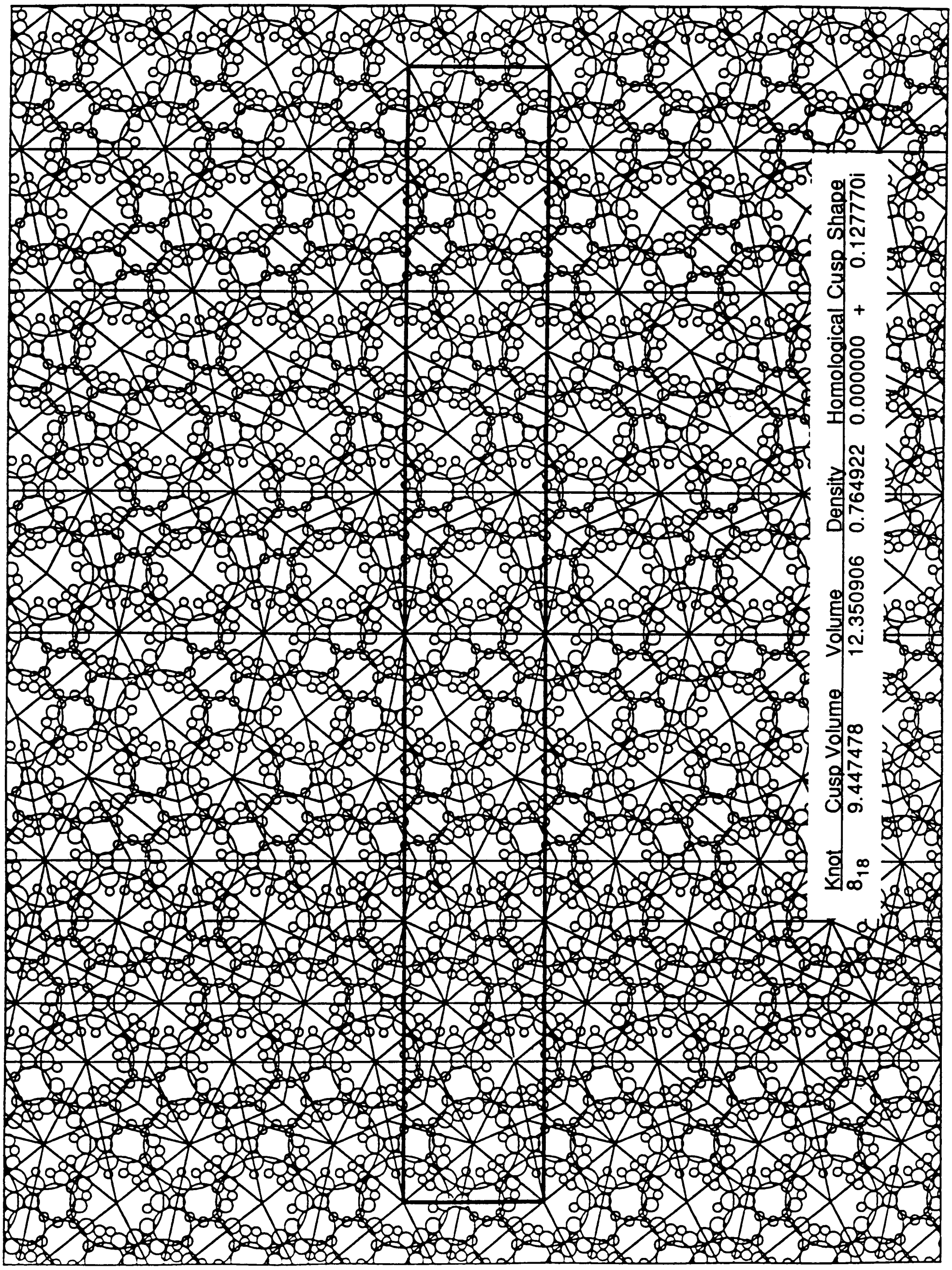

TABLE 2 (continued)

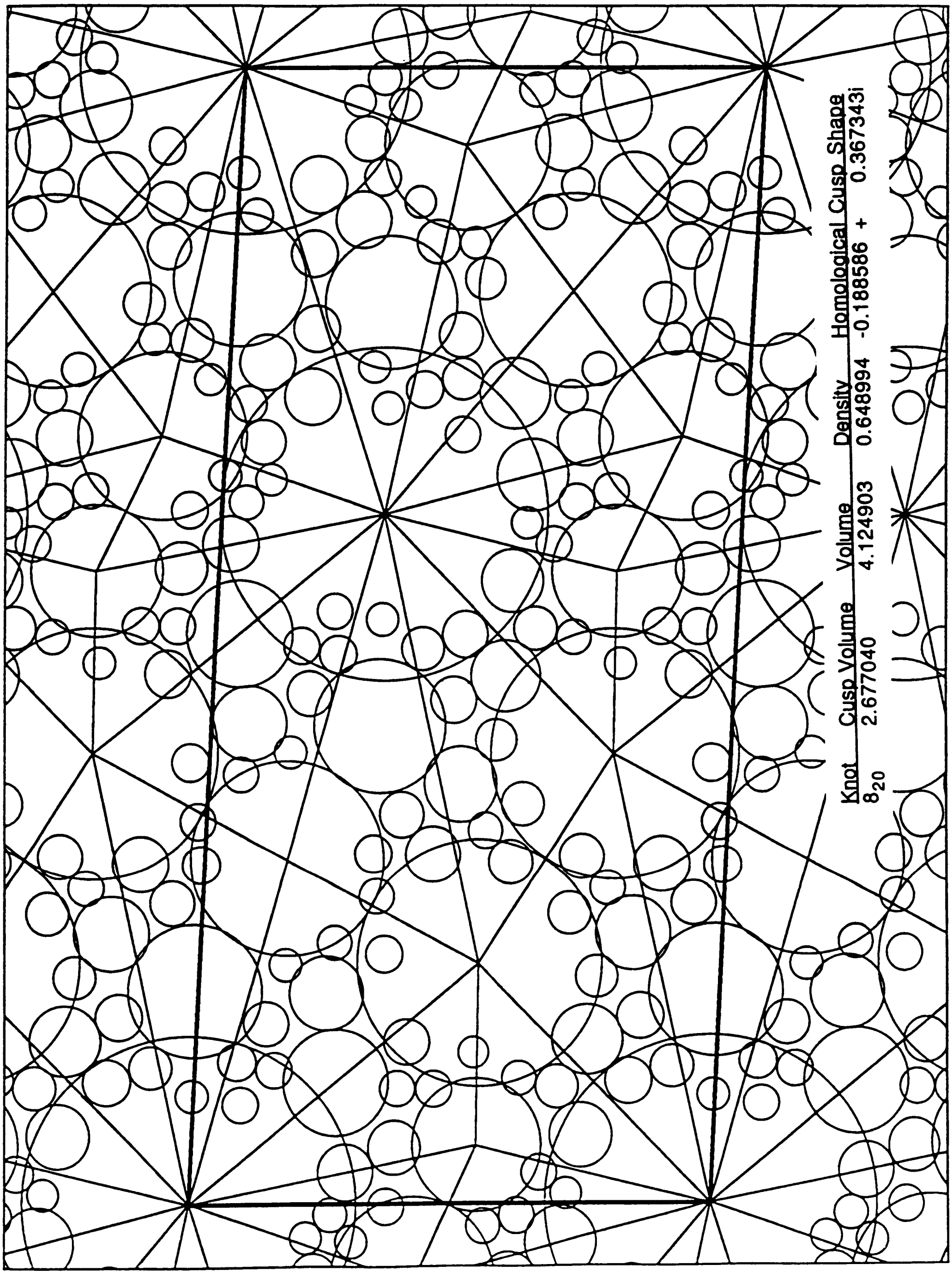

TABLE 2 (continued)

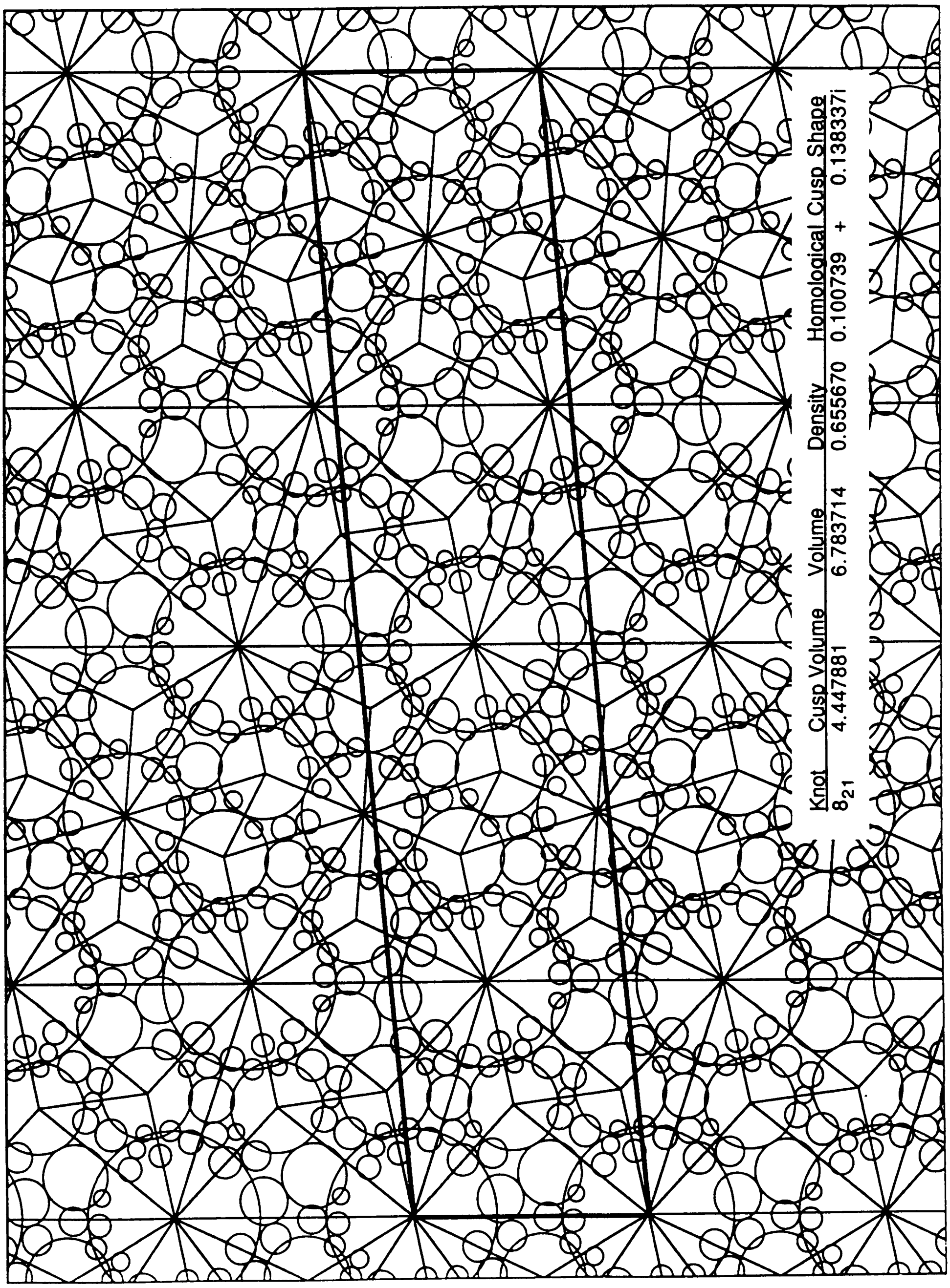

TABLE 2 (continued)

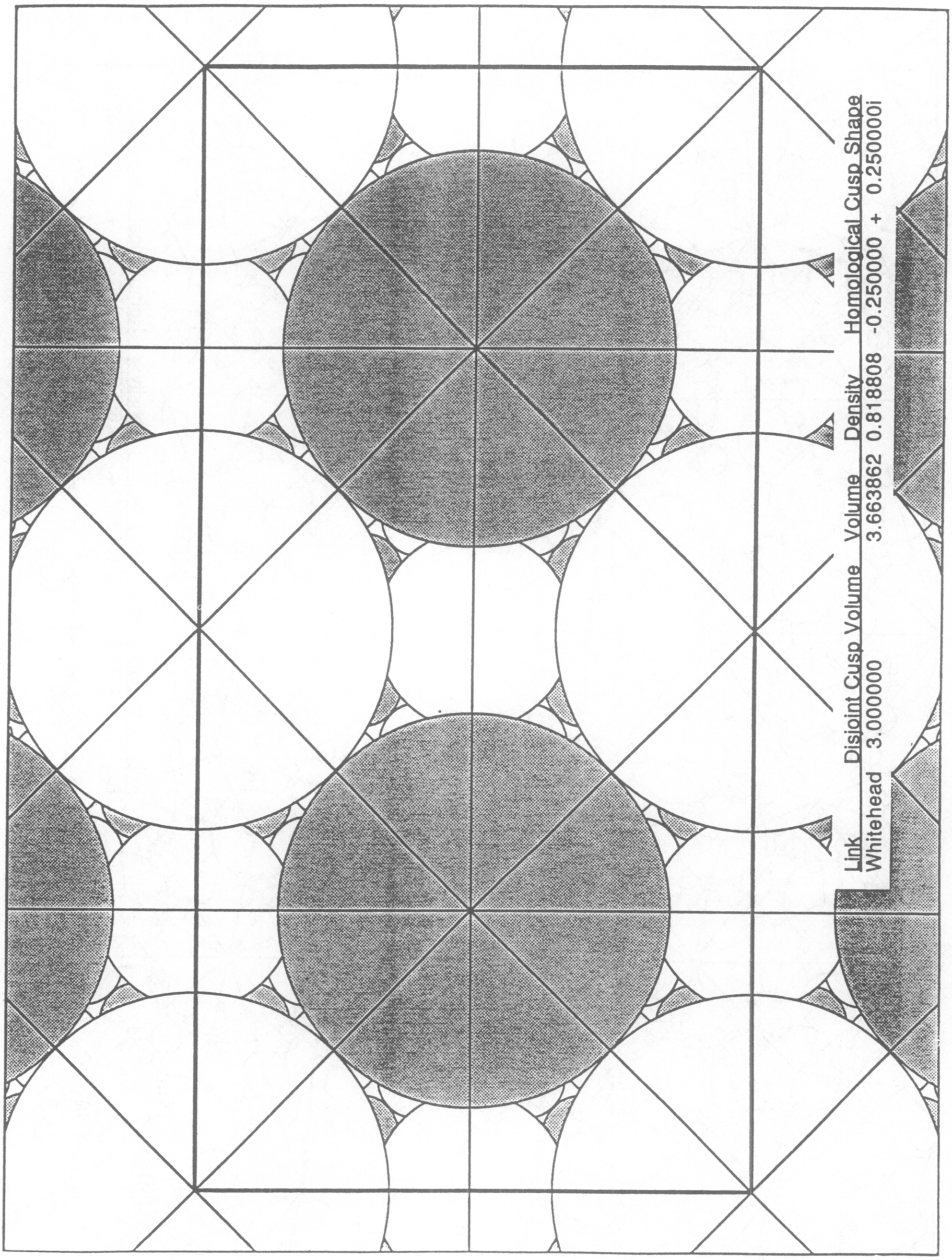

TABLE 2 (continued)

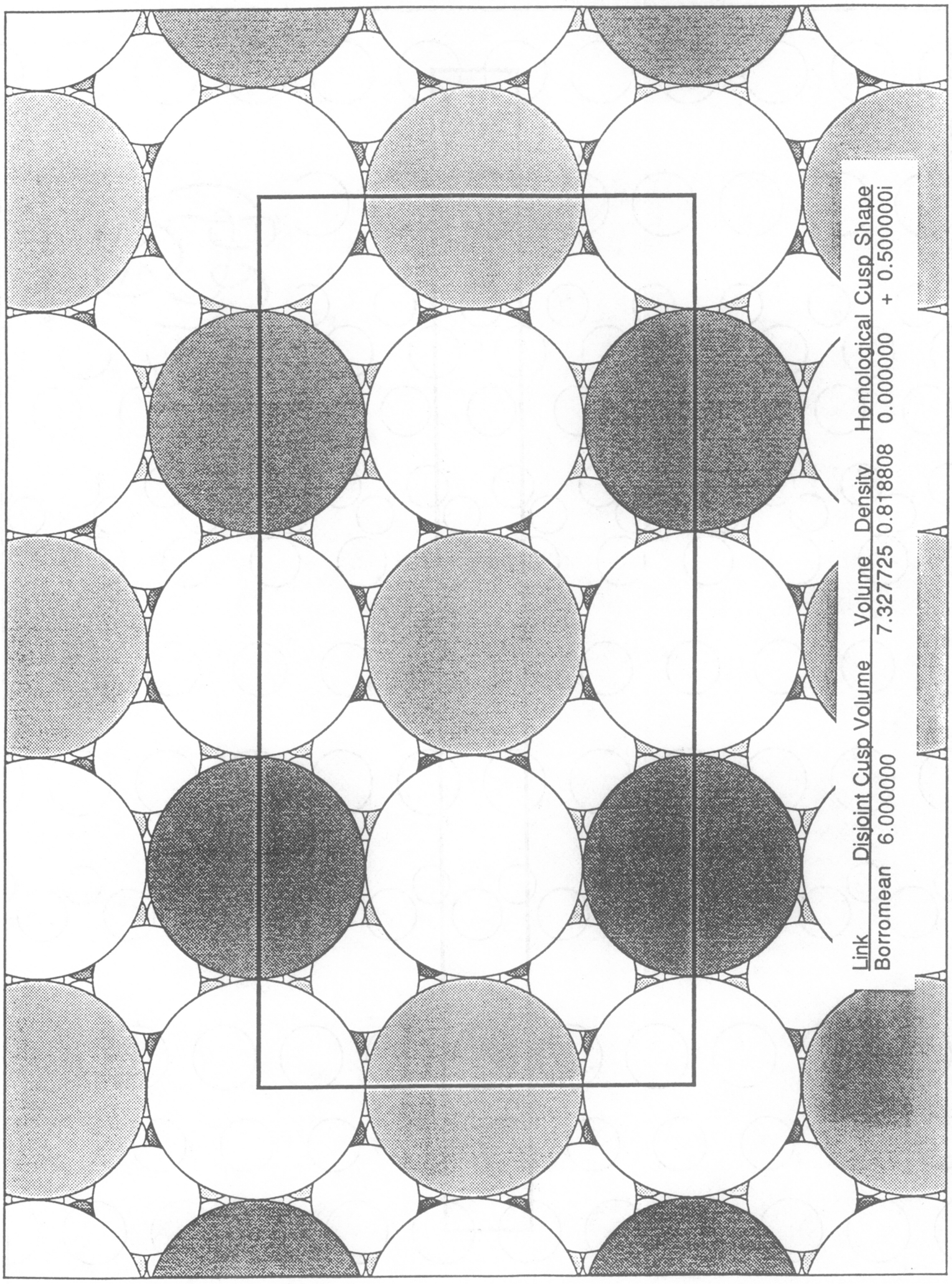

TABLE 2 (continued)

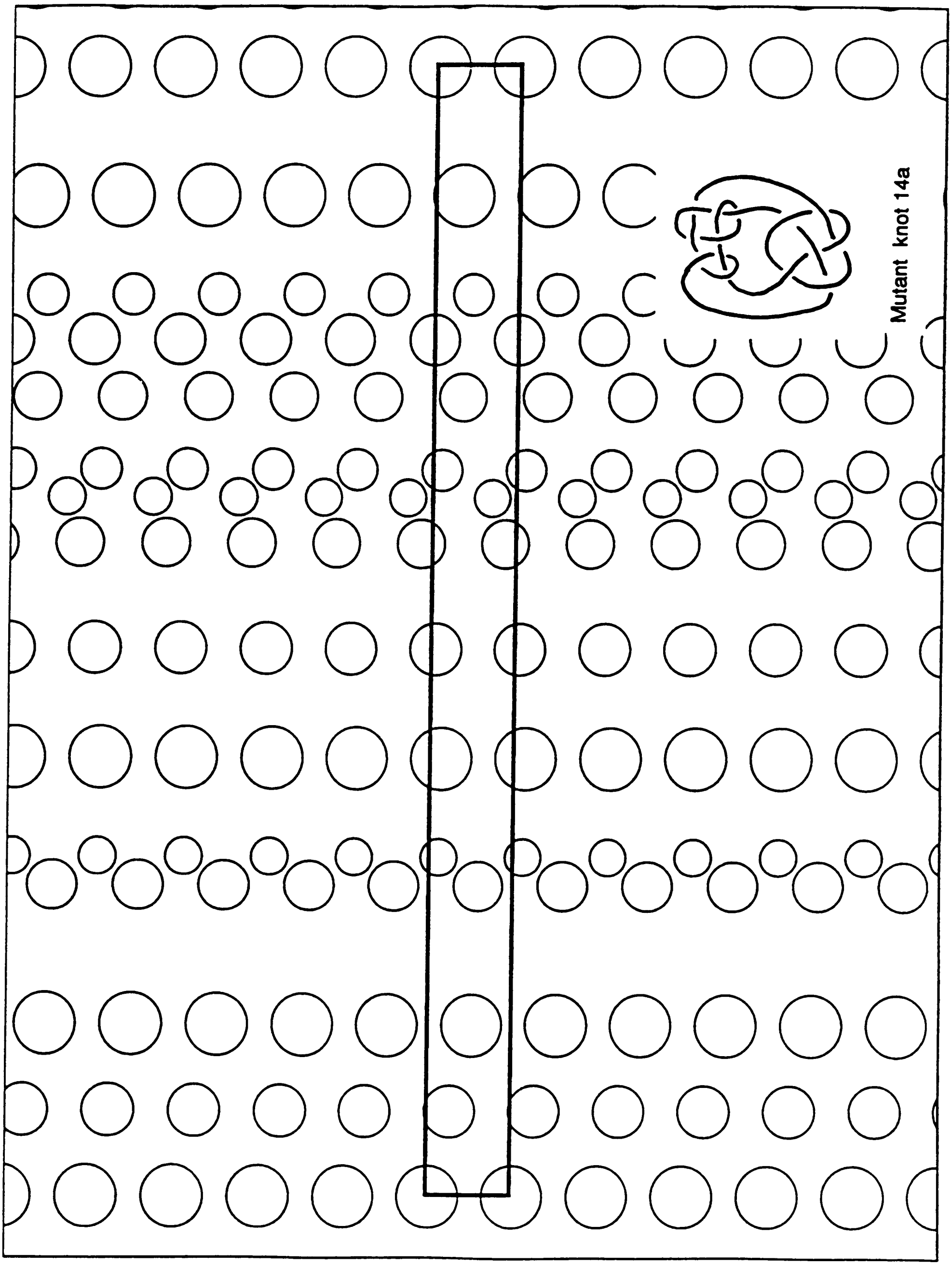

TABLE 2 (continued)

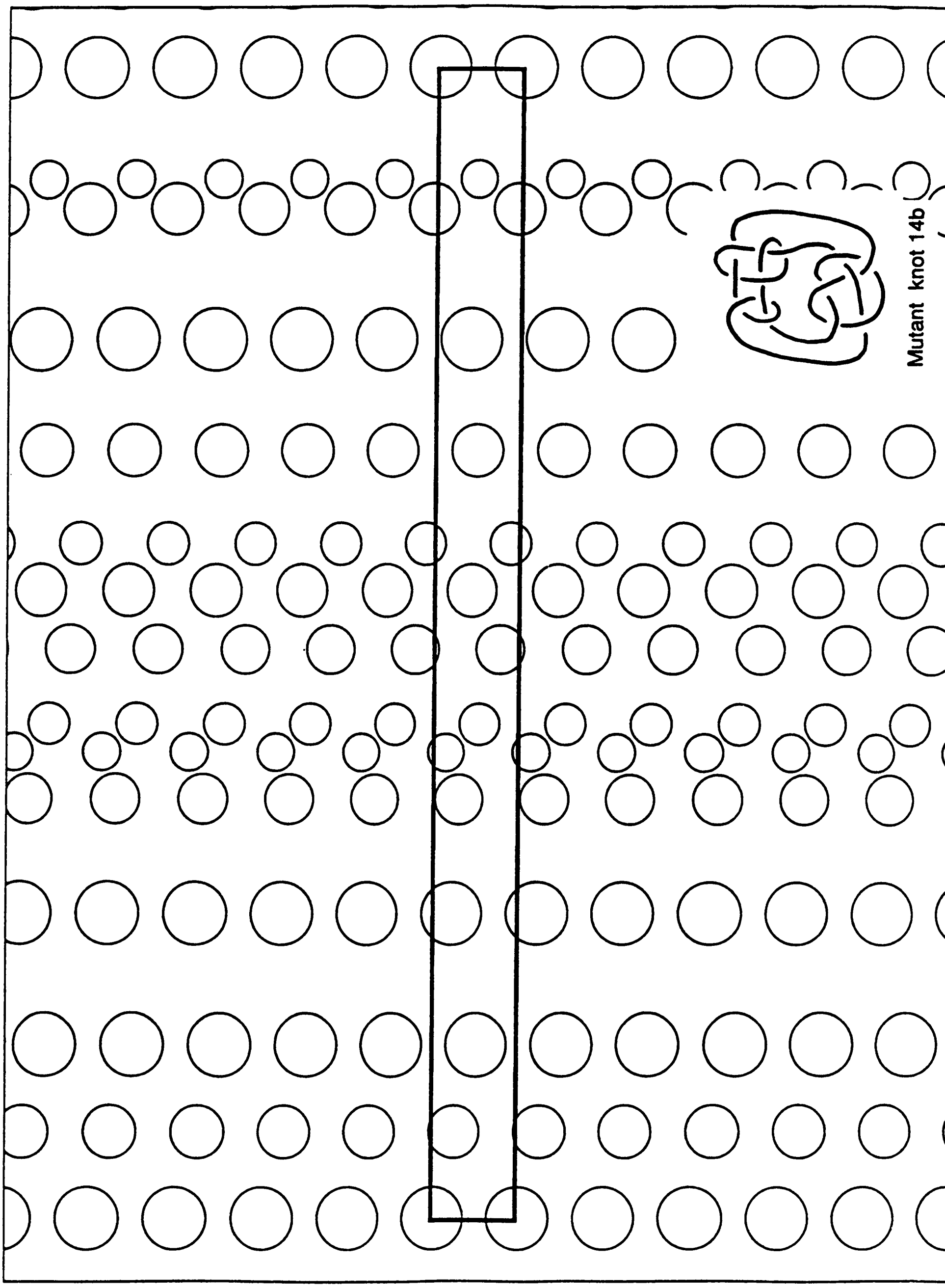

TABLE 2 (continued)

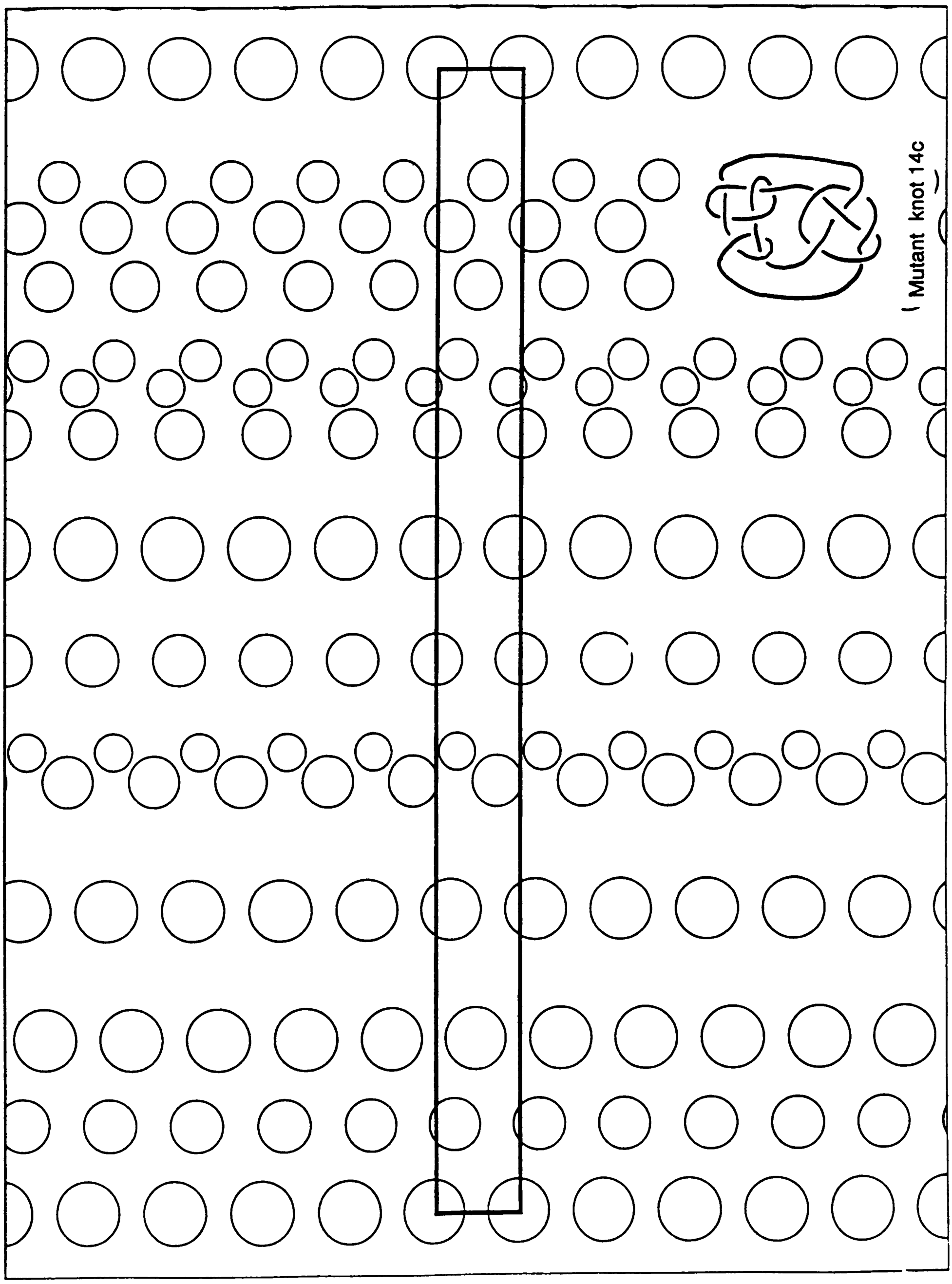

TABLE 2 (continued)

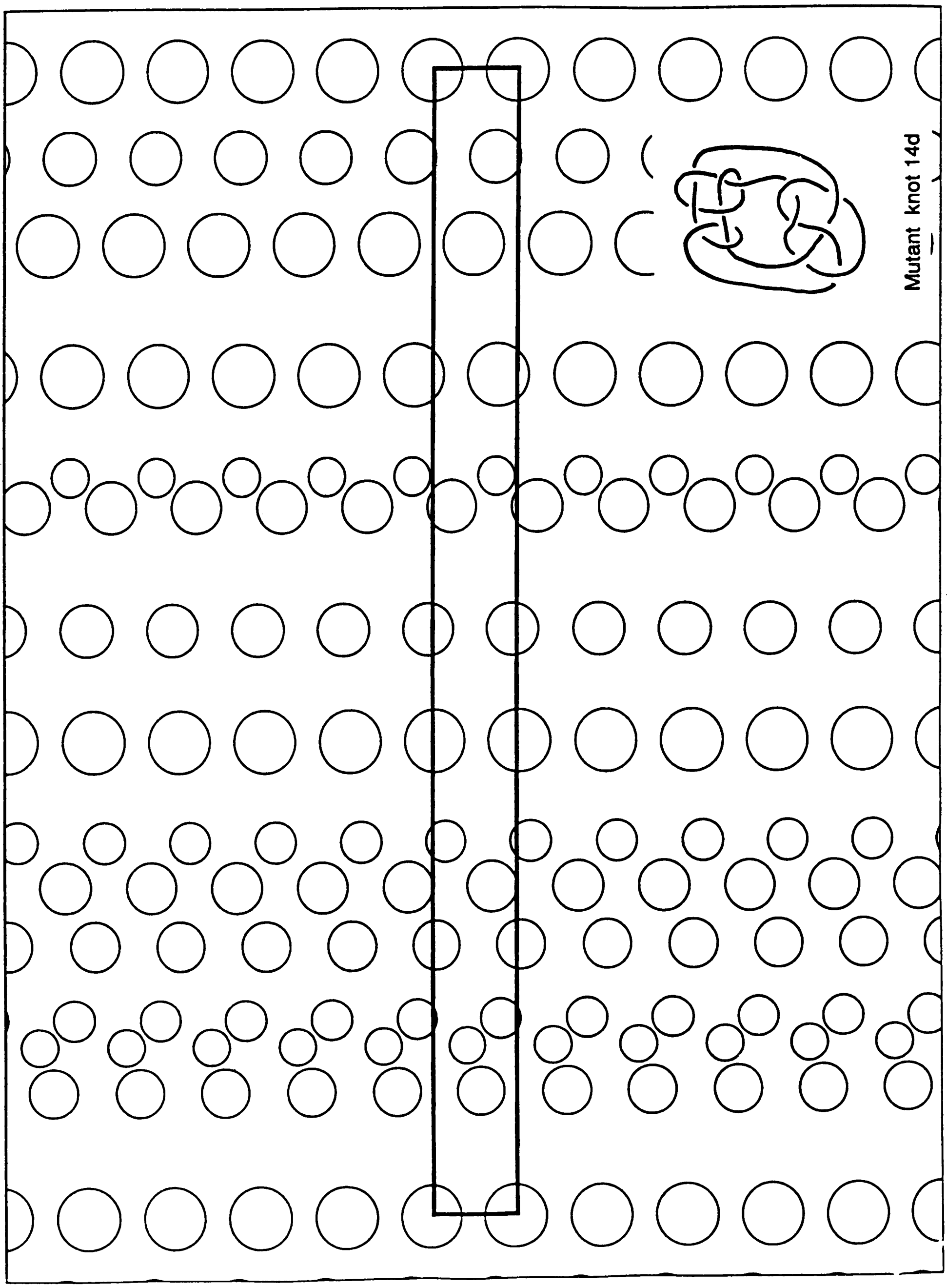

TABLE 2 (continued)

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