MILLIMETER ARRAY
MEMO NO. 11

Interoffice Memorandum

CALIFORNIA INSTITUTE OF TECHNOLOGY

To: Frazer Owen Date: 8 March, 1984

From: Alan Moffet Mail Code: 105-24 Ext. 4977

Subject: Multi-element Array Configurations

At the advisory committee meeting on 1 March I showed some possible configurations for a multi-element millimeter telescope, and I offered to send you a memorandum on this subject. I have tried a number of possible configurations for circular multi-element telescopes, starting with the 24-element grouping shown in your artist's conception of the millimeter array. This consists of three concentric rings with 4, 8 and 12 elements. Because these numbers are even, it has a great deal of redundancy in its instantaneous u,v coverage. See figure 1.

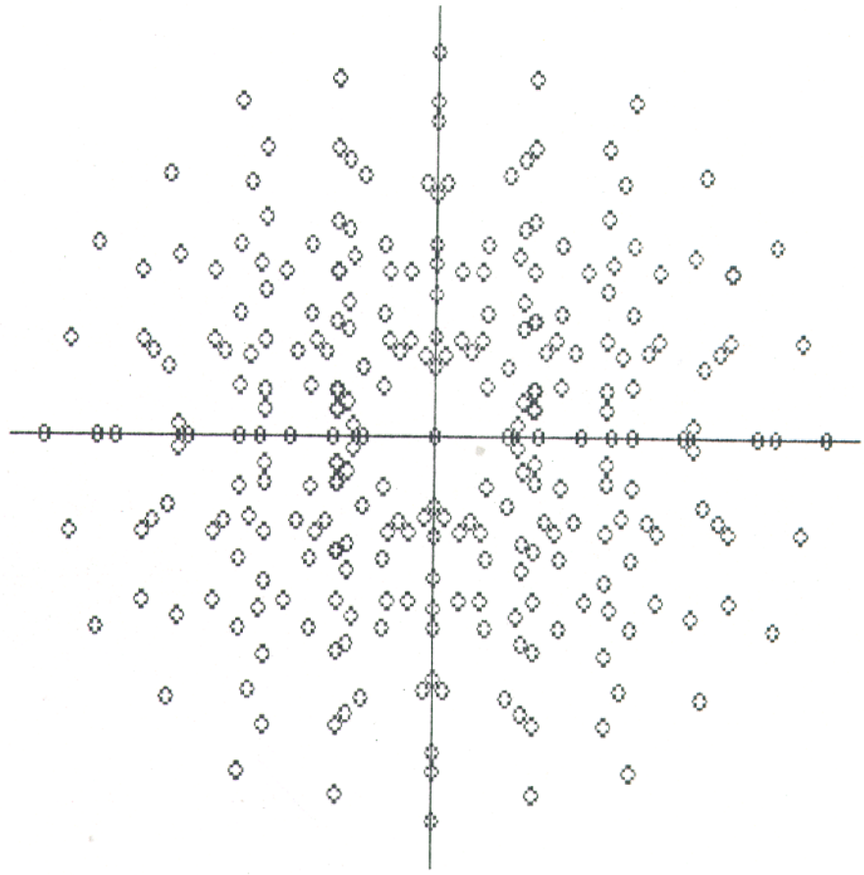
In general, redundancy is less if there are odd numbers of elements, and I have tried several combinations of concentric rings having elements N_i , diameters D_i , and angular skews S_i . The various combinations are summarized in Table I. There is a pleasant symmetry about the ring, shown in figure 2, but this leads to the well-known ring lobes. Adding elements inside the outer ring will break these up and emphasize the lower spatial frequencies.

Figures 3, 4 and 5 show three-ring configurations with low redundancy. There is a tendency for grouping of points in the u,v coverage with periods equal to 2% over the sum or difference of the numbers of elements in the various rings. This can be broken up by skewing the rings by appropriate angles. For example, rings with 3 and 13 elements produces "beats" with periods of 1/10 and 1/16 turn. Skewing one by 1/20 turn will help to break up one of these.

Table I

Tests of Multielement Telescope Configurations

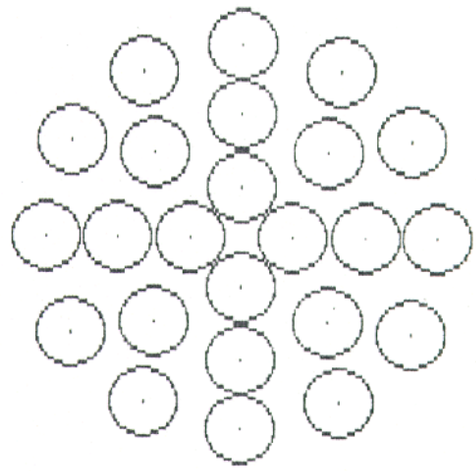
Figure	Total Elements	Elements per Ring			Ring Radii			Skews	
		N1	N2	N3	R1	R2	R3	S1	S2
1	24	4	8	12	.261	.631	1.0	0°	0°
2	19	0	0	0	-	-	1.0	-	-
3	23	3	3	15	.21	.53	1.0	5	10
4	21	3	5	13	.21	.58	1.0	250	100
5	23	3	7	13	.21	.60	1.0	33.8	27

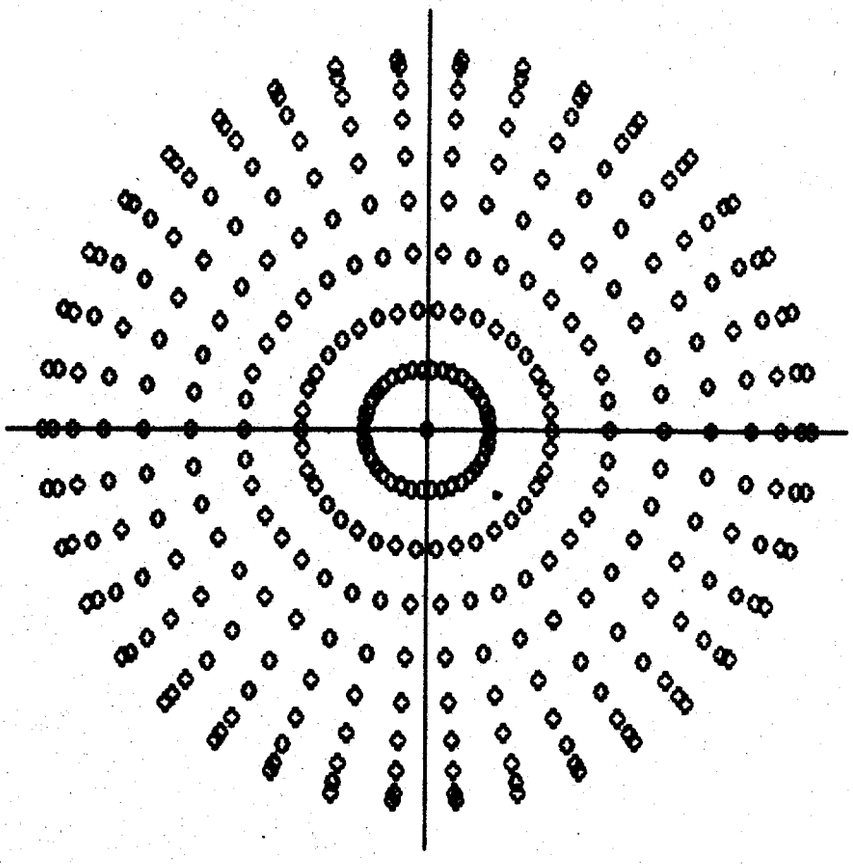


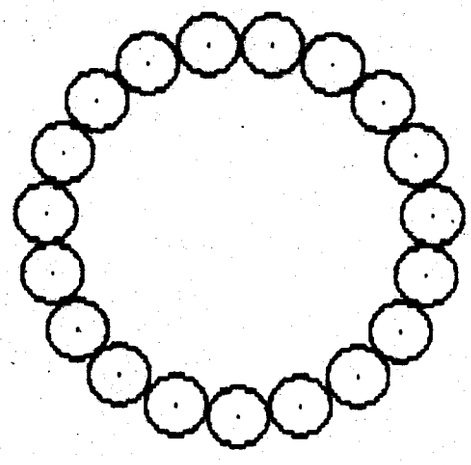
A

Figure 1

A





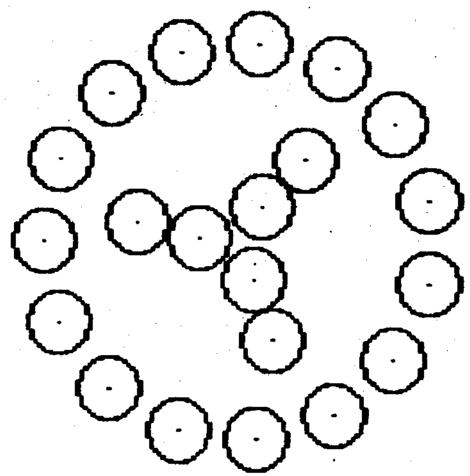


M

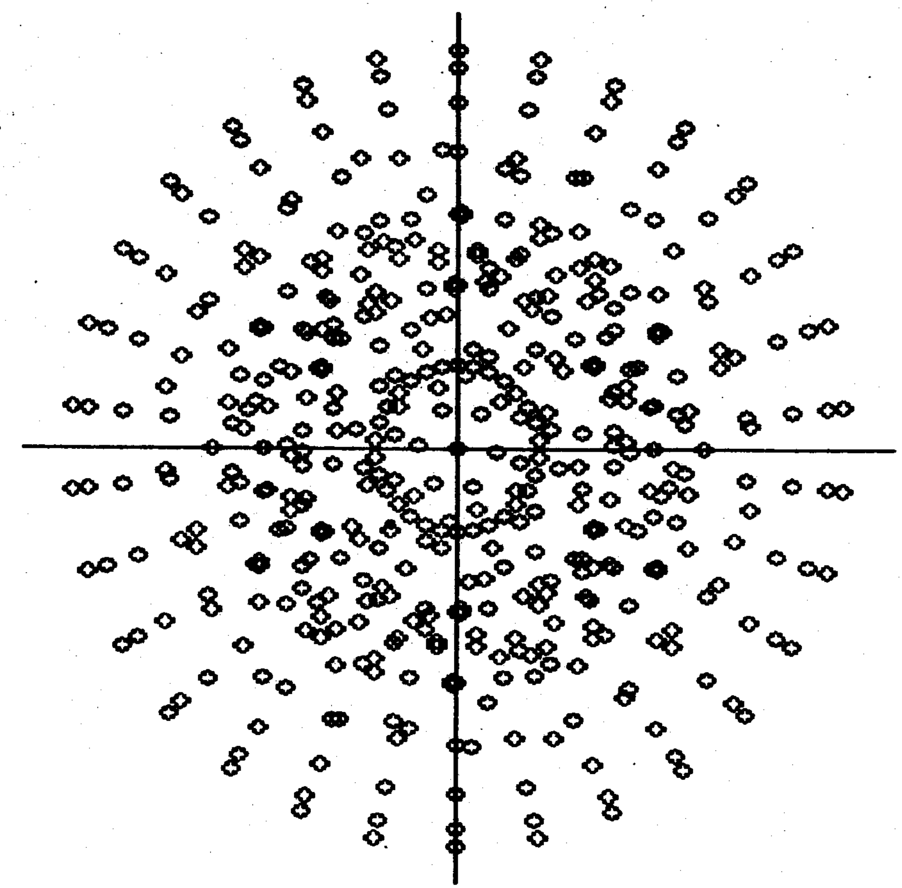
Figure 2

M

19 elements



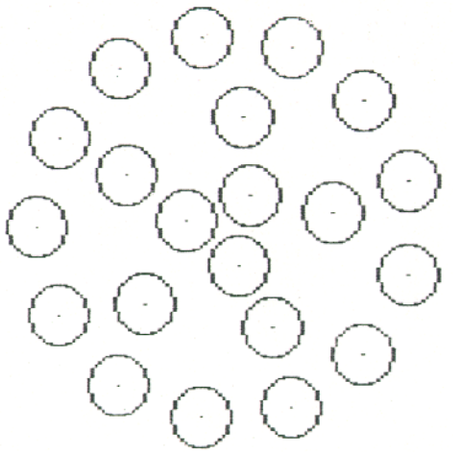
N



Skew 2 = $\frac{1}{36}$ .0278 R_1 = [illegible]
Skew = $\frac{1}{72}$ .0135 R_2 = .53

Figure 3

N



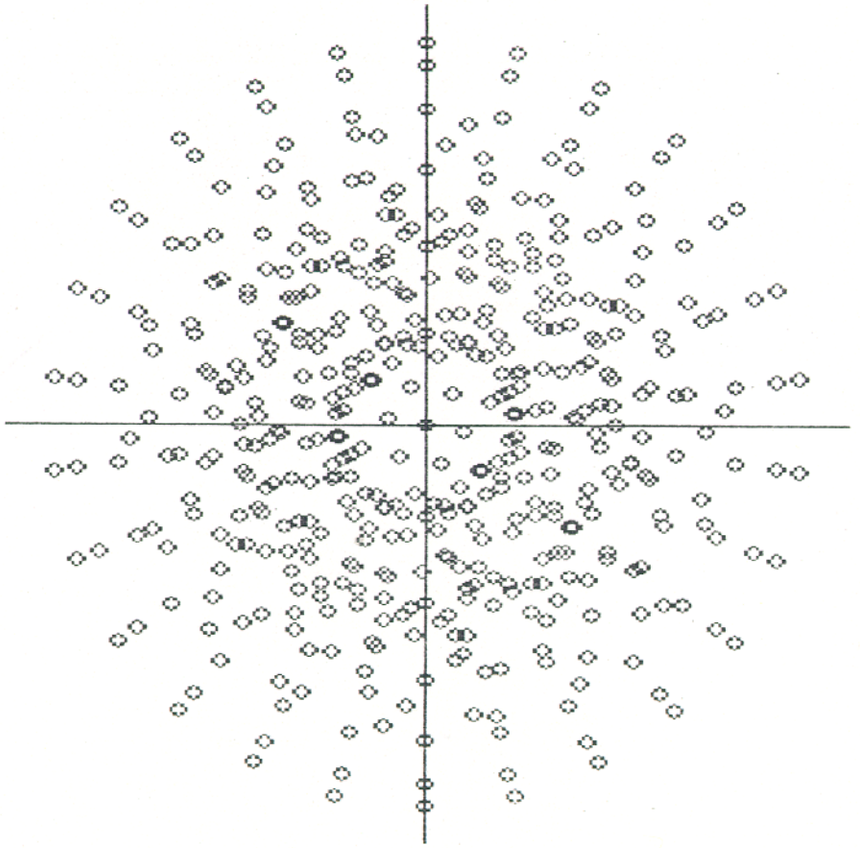
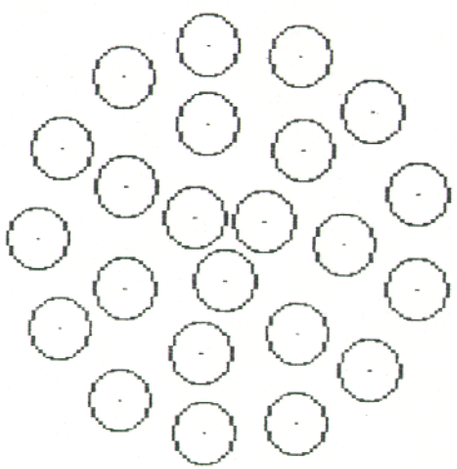
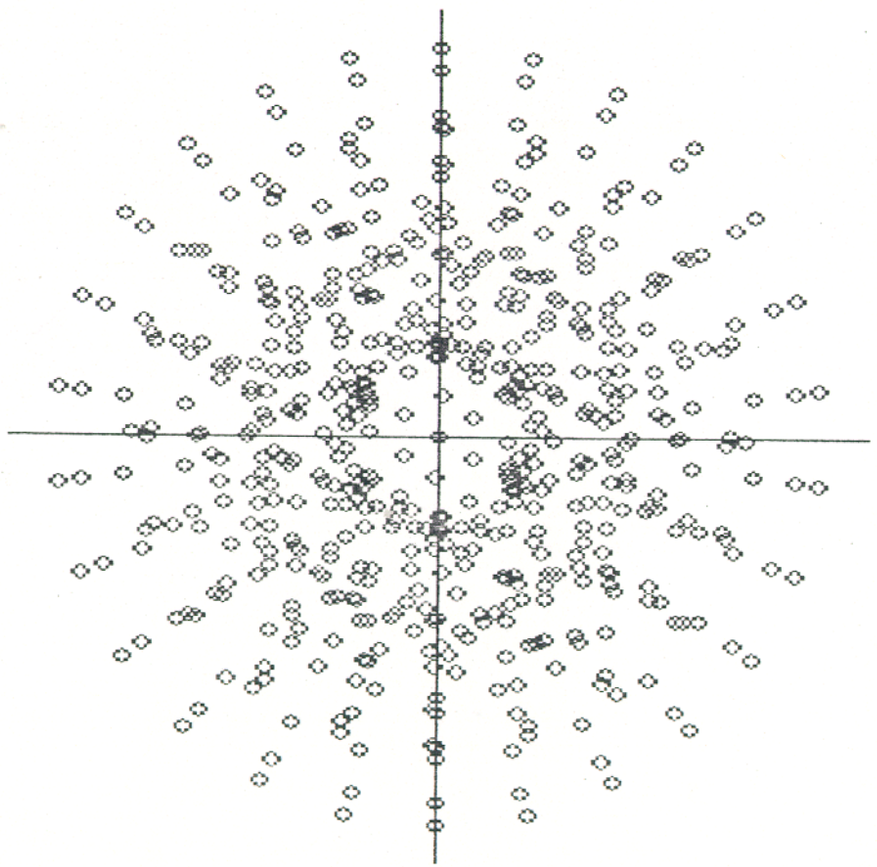


Figure 4



P



Skew2 = .075
Skew = 0938

Figure 5

P