The Basics

This document contains circular patterns designed to produce sound by modulating a beam of light. The patterns should be rotated while shining a laser pointer at the concentric tracks of black and white marks. The reflected light is converted to audio with a photodiode receiver such as Lite2Sound PX. Creative control of the sound is achieved by gestural technique of moving the laser beam and controlling how it illuminates the spinning pattern.

The Setup

Print out the patterns. Cut them out along their circular outline. Wheel I is designed to fit a turntable. Cut a hole in its center to fit the spindle of the turntable. Wheels II and III are designed to fit 120mm square electric fans, typically rotating at 60Hz (~3600 RPM). Cut a small hole in the center and align the crosshair with the fan's axle. Use double-sided tape to fix the wheel to the fan. Always use caution when experimenting with a rapidly spinning fan motor!

The wheels will tend to curl if printed on plain printer paper - for better results use spray adhesive to mount the wheel on stiff cardstock.

Begin rotating the wheel. Turn on Lite2Sound PX and listen with headphones or line out to an amplifier. Aim the Lite2Sound sensor at the wheel and hold it 1 to 3 feet away. Shine a laser pointer at the wheel. You'll hear harmonic sounds and you can control the pitch by selecting which track to illuminate. Add vibrato by exploiting the Doppler effect, stutter notes by interrupting the beam, and develop other creative opto-sonic methods.

Technical

Set your printer to its highest quality setting when printing the patterns. The darker black it prints, the better the sound output will be. (Uses a lot of ink). If you can print on glossy photo paper, that will give the strongest signal with least noise.

The reflected light is amplitude modulated at a frequency equal to the rotational rate (Hz) multiplied by the number of divisions on the track. See the tables at the end of this document.

Lite2Sound PX is most sensitive to red light, so a red laser pointer is a good choice.

Q. Why doesn't an LED work as well as a laser pointer?
A. The LED is not focused to a sharp point. Its light strikes a broad area of the disc. This is like putting a low-pass filter on the modulations... the patterns are out of focus, averaged out to zero. The sound is much quieter as a result.
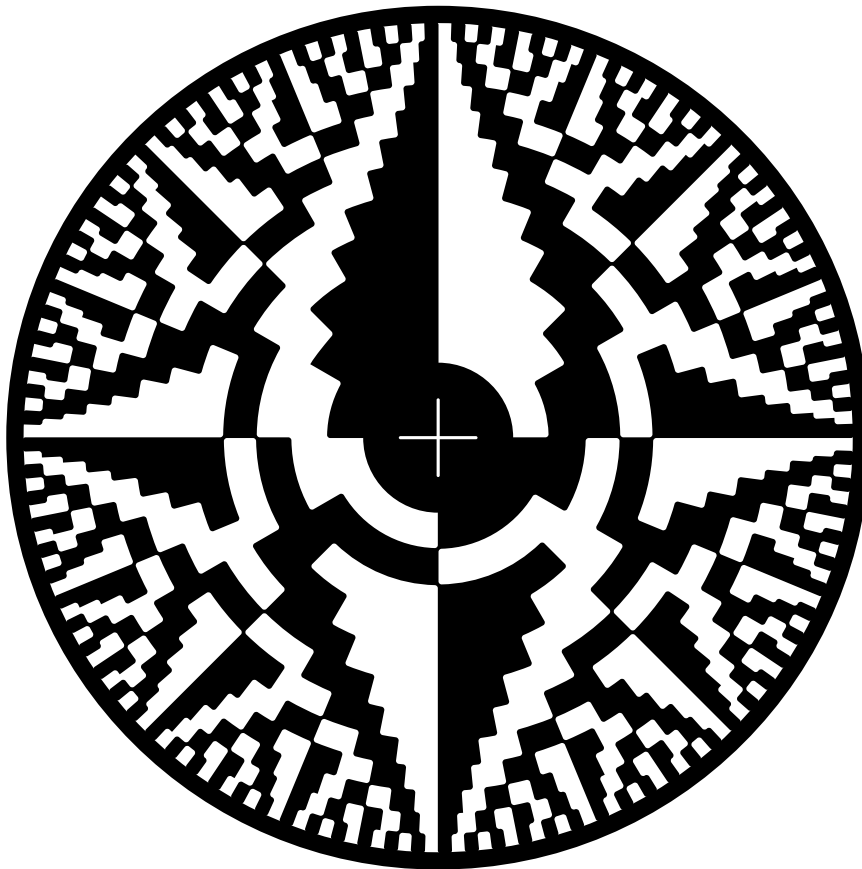
A laser line projector or laser cross projector can play multiple tracks simultaneously, for stronger chords.
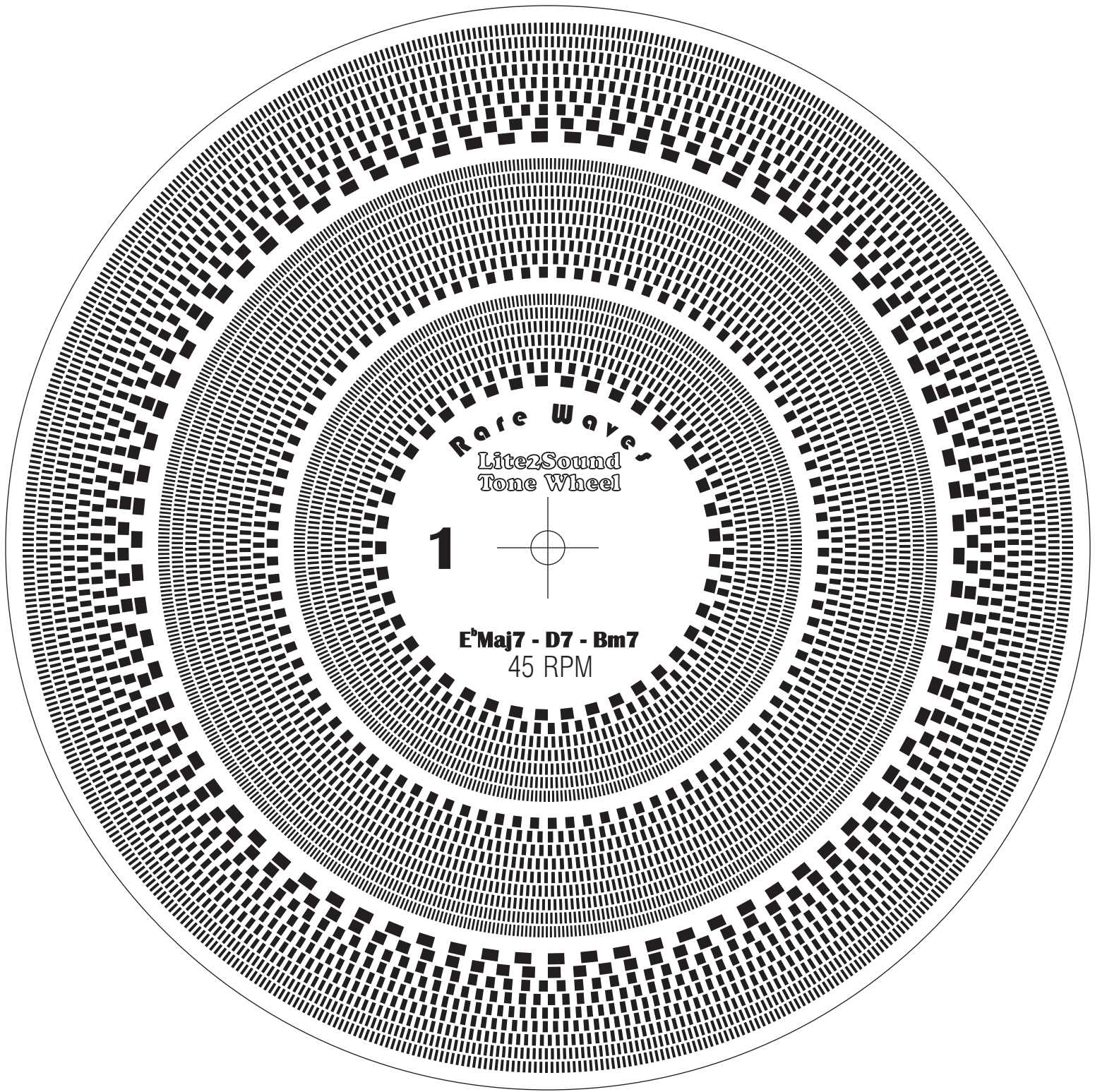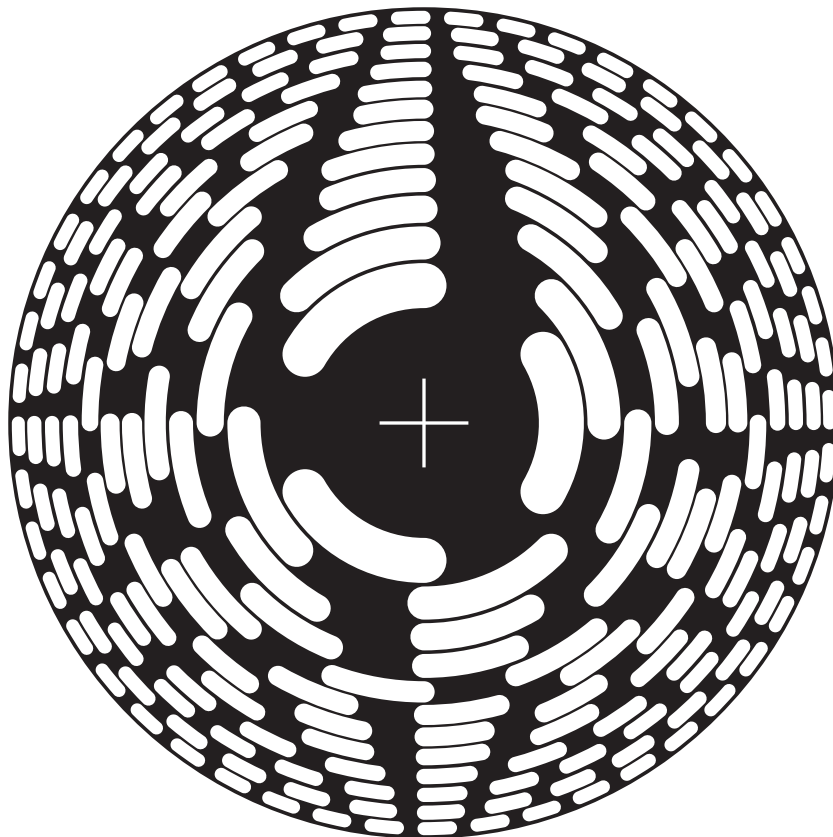
Rare Waves

**Lite2Sound
Tone Wheel**
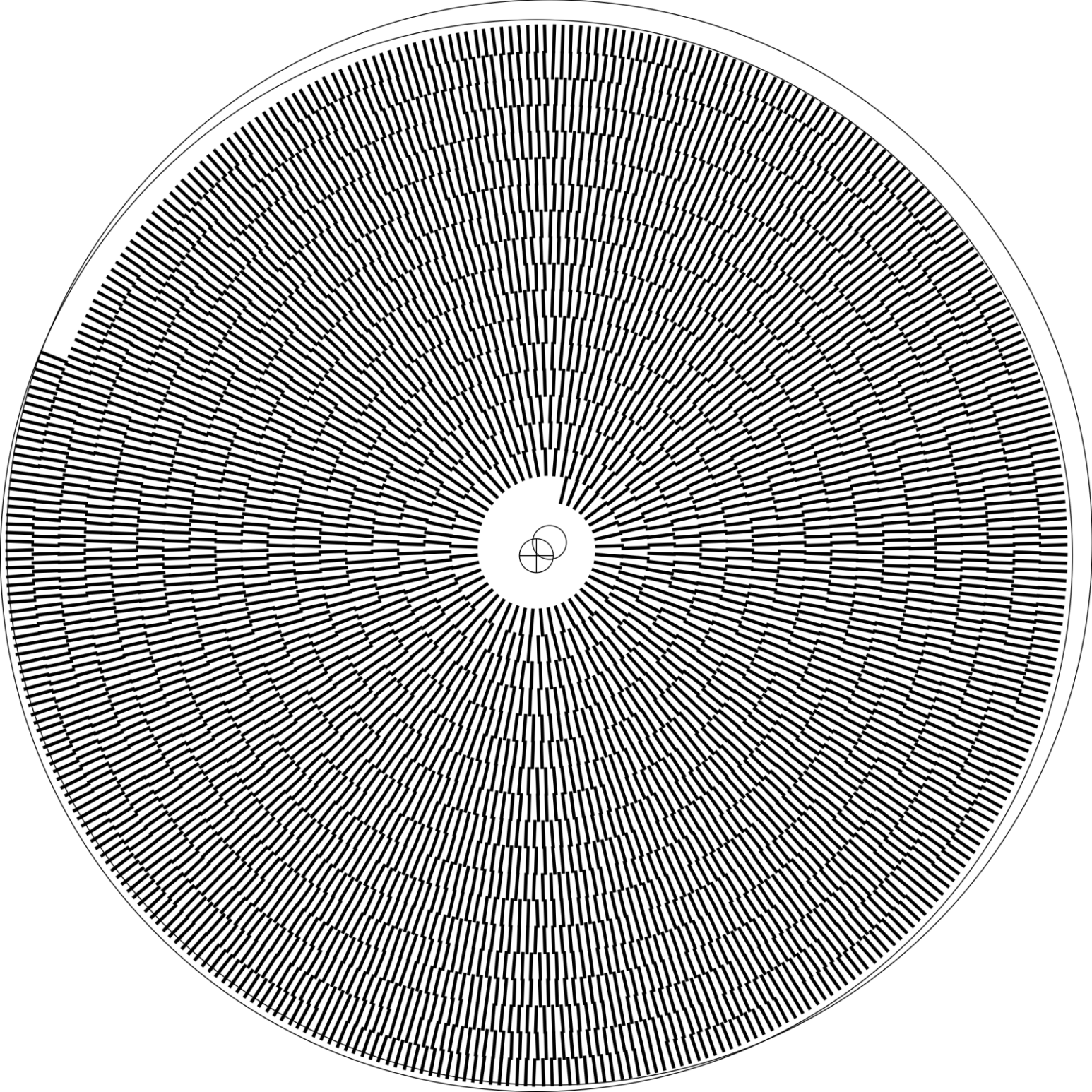
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E♭Maj7 - D7 - Bm7
45 RPM

WHEEL II

ROOT-5TH
110 mm OD
12 TRACKS

2014 Rare Waves LLC

WHEEL III

ROOT-4TH-5TH
110 mm OD
12 TRACKS
0.025" BLANK INTERALVS
2014 Rare Waves LLC

Wheel I. Number of divisions per track and approximate pitches at 45 RPM.

Track	Bm7	divisions	Hz
Z7	B	41	30.75
Z6	B	82	61.50
Z5	B	165	123.75
Z4	D	196	147.00
Z3	Gb	247	185.25
Z2	A	293	219.75
Z1	Db	370	277.50

Track	D7	divisions	Hz
Y9	D	98	73.50
Y8	C	174	130.50
Y7	E	220	165.00
Y6	Gb	247	185.25
Y5	A	293	219.75
Y4	C	349	261.75
Y3	D	392	294.00
Y2	Gb	493	369.75
Y1	A	587	440.25

Track	EbMaj7	divisions	Hz
X9	Bb	78	58.50
X8	Eb	104	78.00
X7	Bb	155	116.25
X6	D	196	147.00
X5	G	261	195.75
X4	A	293	219.75
X3	D	392	294.00
X2	G	523	392.25
X1	A	587	440.25

Wheel II. Number of divisions per track and octave relationships

Scale tone	OCT 1	OCT 2	OCT3	OCT4	OCT5
Root	2	4	8	16	32
5th (3:2)	3	6	12	24	48

Wheel III. Number of divisions per track and octave relationships

Scale tone	OCT 1	OCT 2	OCT3	OCT4	OCT5
Root	3	6	12	24	48
4th (4:3)	4	8	16	32	
5th (3:2)		9	18	36	