

2/14/25 – “L”

Ideal Pitch Field Linearity

“True Beauty is hidden within Simplicity”

By Christophe S Becker “Old Temecula”



Temecula California USA 2025

1 Corinthians 13:8

[Theremin World](#) as we know it and my own website knowledge Hwy79.com will pass away.

(All my Sound samples & links go away when my website concludes) – Save [Theremin-Phoenix.zip](#) 10 Meg

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Lev Sergeyevich Termen discovered the Theremin Phenomenon which is composed of three principals of Nature that led to a Musical Instrument, all combined bears his name.

Theremin Phenomenon

(A Discovery)

1. Heterodyning was discovered by hearing the interaction between two similar Radio Frequencies.
2. Produces an authentic beautiful voice/sound from Nature. (Alive)
3. “Ideal pitch field linearity” is the actual “**Miracle of Nature**” which makes playing the theremin even possible.

Theremin Instrument

(The Invention)

- Using the Theremin Phenomenon
RF/Audio Detection & sound shaping
- Audio Amplification
Speaker
- Proximity Volume Control
- Power supply

[The Electrodeum is a theremin pitch antenna circuit for “Ideal Pitch Field Linearity”](#)

“As with anything in life once you have the Answer it all becomes obvious.”

Three engineers studied the “*Becker Electrode*” or “*Lev Antenna*” approach in 2012, seemed to actually get it and for reasons unknown to me they abruptly stopped exploring how it worked.

“I was then known as RS Theremin”

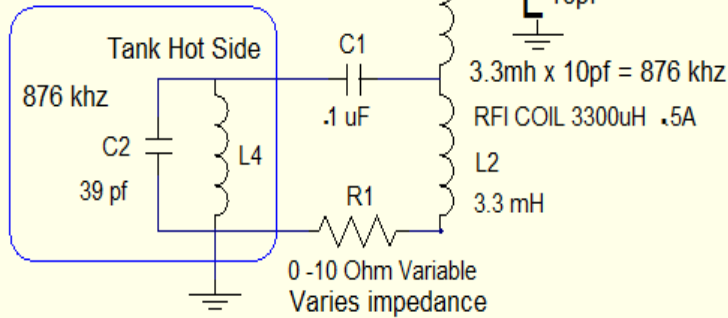
[The Theremin World Link](#)

“It’s time had not yet come”

Ideal Pitch Field Linearity

2/01/25 Electrodeum Setup by
Christophe S Becker

L2 = 33 mh for EWS



by Old Temecula

Pitch Antenna
Spring Coil

Hand Capacitance



3.3mh x 10pf = 876 khz

RFI COIL 3300uH .5A

L2

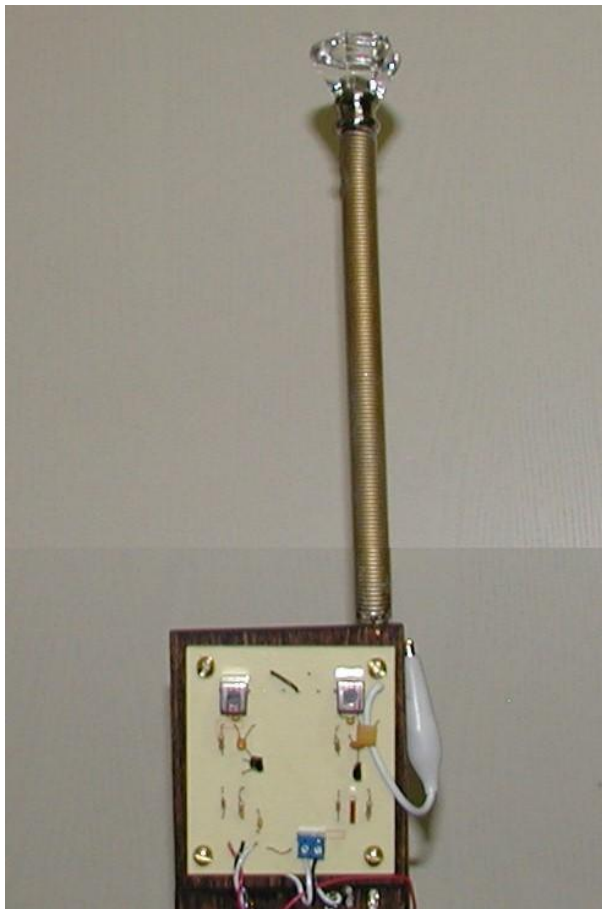
3.3 mH

0-10 Ohm Variable
Varies impedance

R1-10 ohm Potentiometer in series with the RF choke and ground can sweep the full audio pitch range. This Pot verifies if the Electrodeum circuit is resonating which validates "ideal pitch field linearity" is **On**.

This Pot "location" could also have another application I have not fully explored, maybe thermal drift balance?

Normally R1 is Not Needed
Bypass with a wire connection



This simple construction is the authentic "analog" theremin pitch side revealing its simplicity. Seen are two heterodyning oscillators with the "Electrodeum" pitch antenna circuit when used with hand proximity the response is:

"Ideal Pitch Field Linearity"

Before "audio wave shaping" the sound as heard from this simple configuration is more or less the fluty whistle sound heard from basic theremin design.

The "Becker Electrode" pitch antenna is a coiled wire or a slightly stretched spring. The image is shortened but it is about 18" tall. (45 cm)

Stretched out the spring wire is about 306" or 777cm in total wire length. (25.6 feet)

I would use exactly the same components & frequency I used at first then research it further.

Un-like the critical EtherWave Standard series pitch tuning the "Electrodeum" circuit is parallel tuning which is more broadband where if the theremin tank oscillator is tuned 50 kHz above or below the actual pitch antenna circuit frequency then "ideal pitch field linearity" still remains.

Linearity is either On or Off, there is no almost linear. If all theremin designs used this approach all precision Thereminists could easily move between different theremin makes & models.

Experiment: Seems the “*Electrodeum*” setup might work with an EtherWave Standard that has become completely out of “pitch tuning alignment” by bypassing those special RF chokes or if they are no longer available. Change L2-3.3mh .5 amp to a 33mh or raise freq to ~ 900 kHz?

Experiment: The “*Electrodeum*” might even be tested on the popular digital Open Theremin.

Heterodyning is a Phenomenon of Nature and occurs when two RF frequencies are mixed together at the detector diode of the circuit. It is important the two oscillators do not know the other one exists or they will interact or fight one another creating unwanted distortion in the RF/Audio wave shape. Distance between the coils is best to isolate from any Inductive, Capacitive or RF interactions. Feedback from the pitch antenna RF also can interact with the circuits causing unwanted distortion, you see a grounded brass plate over my fixed oscillator.

* * *

The “*Electrodeum*” uses the “*Becker Electrode*” (stretched spring coil) in a simple tuned circuit.

In this video Valery Shamarin sets my *Theremin Phoenix* circuit boards on top of the boxes they were shipped. He begins to play in a “*pitch field of ideal linearity*” where the musical notes line up evenly spaced. At the start of the video you hear Valery say “*First time*” as I had never heard my theremin design make music until it arrived in St Petersburg Russia for the “*100 Year Theremin Celebration*”.

[Original YouTube Video](#)



The authentic theremin voice is shaped on both sides of the RF/Detector diode allowing for a range of timbre/voices from smooth to edgy as heard in this video, with the twist of a knob.

In this sound sample Peter Theremin (great grandson of Leon Theremin) performs with a beautiful vocal sound/timbre. Christmas 2020 Valery Shamarin performs "When the Lights Go Down".

Performed by Peter Theremin ["Silent Night"](#) - - Valery Shamarin captures [My Angel's Voice](#)

I only have a handful of demonstrations as I was never able to play a theremin and did not know what my design could do musically until it arrived in St. Petersburg Russia in 2020.

* * *

My Theremin Phoenix setup tunes to around 900 kHz ([Phoenix Timbre Schematic](#))



Becker Electrode Construction



Shove the $\frac{1}{4}$ " wood stick all the way to the opposing spring end, then mark where shown below. Add $\frac{1}{2}$ " to the right, cut the stick and insert it in behind the cross loop for a $\frac{1}{2}$ " stretch on the spring. Epoxy spring to the stick on each end.



The plastic tube most importantly shields against air currents and static discharge.

Note: Use a 1/2" (13 mm) "stretch" on the spring for a tuned coil antenna. The stretch slightly insulates each coil turn from one another.

[Century Extension Spring](#) (substitute at your own risk)

Century C-253 9/16" x 16-1/2" x .054" (14.3 mm x 419.1 mm x 1.372 mm)

Approximately 195 turns - 306" or 777cm in total wire length

About 16 turns per inch (approx. 252 turns at a 1/2" I.D. diameter)

Experiment for the EtherWave Standard: (I do not know if it will work)

Two of these RF chokes from Mouser have 4x 10mh chokes, put three in series for 30mh.

[Mouser #:710-750311896](#) Outside of being tuned to 900 kHz I do not know if it will work.

Common Mode Chokes / Filters MID-D11 10mH@10kHz THT 370mA 2.5Ohm

Due to RF skin affects you want to use the largest wire gauge for the [Mouser RF choke](#).

* * *

* My own interpretation of how it all works *

The theremin variable oscillator feeds the pitch antenna with a high frequency current which transposes into radiated RF energy which itself is a phenomenon or miracle of nature.

RF radiates from the pitch antenna through the "Air Space" between the hand and antenna.

The hand/body is more conductive than the "Air Space" for RF to *flow*. By varying the width of the "Air Space" the RF current *flow* within the Antenna or "*Becker Electrode*" changes the "*impedance*" of the "*Electrodeum*" circuit. This impedance change has a remarkable effect on the impedance of the theremin "variable oscillator" which lines up the musical notes.

* This alignment of the musical notes is a discovery & phenomena *

Again what I believe happens is the proximity of the hand varies the gap/distance of the "Air Space" which affects the "*Becker Electrode*" current flow. It is better to call the theremin hand proximity affect not just simple capacitance, rather varying the "**Radiation Resistance**".

I refer to RF energy as a *flow or radiates*, easier to visualized, but actually this all happens instantaneously. The RF current or electrons in the "*Becker Electrode*" vibrate rather than *flow*.

The RF at the antenna has a wave shape which is near identical to the detected audio wave shape. Anything that changes the RF wave shape also changes the audio wave shape. This is one reason why the authentic theremin performance sounds "**alive**" and not sterile. A direct "earth-ground" is very important as the RF energy needs somewhere to go or it will distort the wave shape as the Radio Frequency wavelength can be up to 300 kilometers in length.

I wish all of you the best of success, Christophe S Becker February 2025

I originally called the “Becker Electrode” the “Lev Antenna” but this offended a few.

Linearity Study by Greg “gnsmith116” Northern Virginia, USA

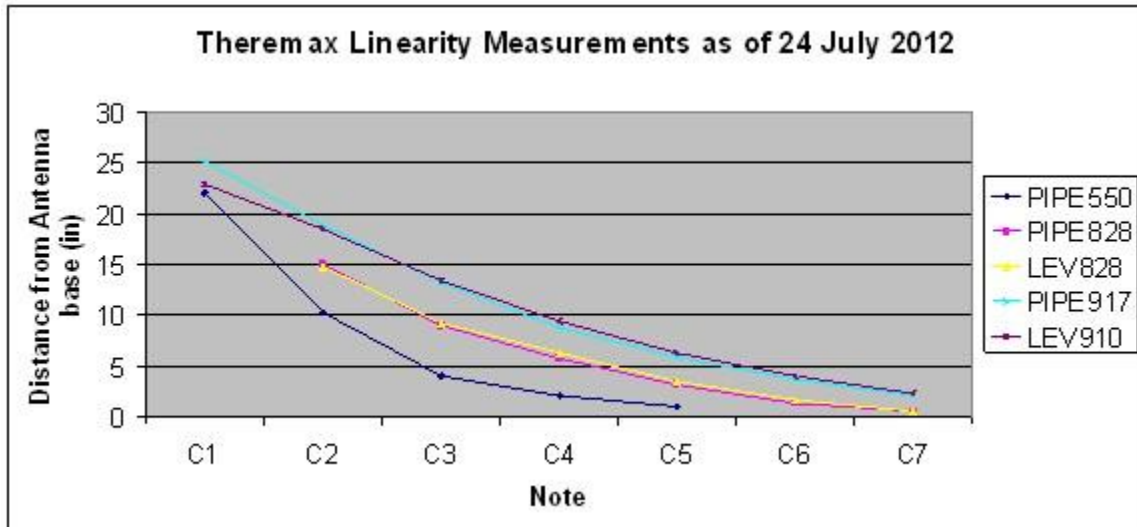
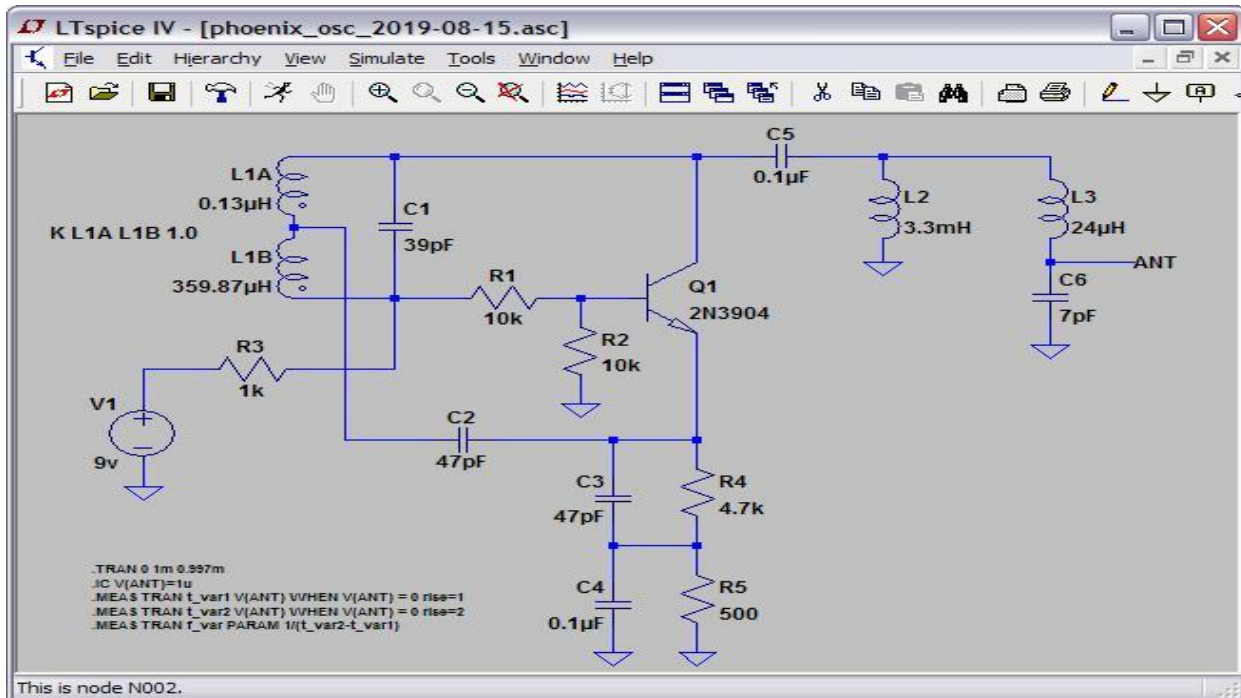


Chart is the “Becker Electrode” connected to a “PAiA Theremax” re-tuned to 900 kHz.

Viewing my 1996 PAiA schematic change C6 & C10 to 68pf (47pf) and C14 & C18 to 100pf. Basically your swapping the oscillator frequencies. I do prefer the 47pf

Fred said: "If those linearity measurements are accurate, they are astoundingly good! LEV910 and PIPE917 in particular. LEV910 is the very top line with the “Becker Electrode”.

[LTspice configuration](#) by dewster found nothing unusual. (Is the date someone’s 123rd birthday ?)



Is there an ideal frequency that is best for this dual impedance relationship?

The “Electrodeum” circuit operates at ~ 900 kHz?

- The Theremin is a Journey of Perseverance -

By Christophe S Becker "Old Temecula"



Temecula California USA 2025

- *What Temecula means* -

*Derived from the Luiseño Native American word "Temecunga,"
which means "where the sun shines through the mist"*

* * *

Lev Sergeyevich Termen (Leon Theremin) discovered a beautiful phenomenon of nature (heterodyning) which is ideal for a completely new & original approach to creating music.

The miracle of his discovery is "*ideal pitch field linearity*" where the musical notes line up in open space similar to the spacing of piano keyboard keys. This natural phenomena allows a precision Thereminist to move between different theremin models and adapt quickly for a skillful performance.

The EtherWave Standard properly tuned can have this "ideal linearity" within in a design that is a solid build. Where the EWS comes up short is Moog Music being a synth developer never fully developed the authentic theremin voice/sound.

A newbie **buying a used theremin** would never know if their struggled playing is made more difficult by not having a theremin with "ideal linearity" or a tuned pitch antenna. Worse is an un-tuned pitch antenna destroying simple performing in a linear pitch field as the musical notes do not line up spaced out evenly.

The authentic analog theremin has a more natural voice in how it expresses itself in the hands of a skilled artist. Here is one of the finest theremin performances known.

By Peter Pringle of Canada. His special sound uses the Millennia STT-1 processor.

Samuel Hoffman RCA Theremin – <https://www.oldtemecula.com/+aranjuez.mp3>

About 25 years ago Peter Pringle was a newbie, so frustrated he met with Lydia Kavina to get a better understanding of how it all worked.

The Theremin Phenomenon that Lev Sergeyevich Termen discovered is like finding a sizable raw diamond in the ruff and then comes man-made or imitation simulating it.

There is no right or wrong way to play just a method that works and is physically comfortable for you. The precision will come with time. I think a bigger hand is advantages as finger movements have more precision than arm movements.

Forget where zero beat shows up and adjust the pitch field and two octaves to match the size of your hand with finger movements.

Again it is the “distance” your hand/fingers are from the pitch antenna, not the shape of your hand and fingers making peace signs or “O’s”. The body position adds or subtracts from the linearity on the low end.

It is the rapid hand/finger movements using “less” volume control that creates a proper flowing theremin performance. If you want to pop individual musical notes then stay with a keyboard.

One secret is that a beautiful theremin sound is easier to play, as if she finds joy in expressing herself, not the muffled fluty/whistle sound like the EWS and most theremin imitations. The use of reverb is more or less a Band-Aid to hide a poorly shaped theremin sound.

I could never play the theremin as I do not have the gift of coordination, could never even hit a baseball no matter how hard I tried.

“My purpose has always been a messenger”

A modern authentic theremin design has not yet arrived as of **February 2025**. It is the understanding of the remarkable phenomena of how “*ideal pitch field linearity*” comes about that makes it even possible to play the theremin accurately. The theremin will attract more professionals who will reveal the beauty of precision playing.

They will bring the theremin into the main-stream. “People will come” as it is a part of our past. It reminds us of all that once was good, and so again it will be appreciated reminding us of before *Artificial Intelligence & Digital imitation* became normalized . . . “People will come” and they will discover:

- The Theremin Musical Instrument . . . this Miracle of St Petersburg, Russia -

