Blackbody

Ambient Field Conditioner

The **Blackbody** is unlike any other filter or conditioner. All power filters and conditioners address noise found on wires, but there's another type of noise altogether. Until now, this inconspicuous type of noise has been largely unacknowledged. It is caused by constant electromagnetic interaction between gear and immediately surrounding objects: stands, racks, nearby signal wiring, enclosures, and other objects containing circuitry or not. This type of radiated noise is not confined to wires. The **Blackbody** works by changing the spectrum of these stray reflections, effectively solving the problem. Being the only conditioner of its kind, it offers a level of performance previously unattainable.

Ambient field conditioning A new approach

Until recently, the audiophile community has underestimated the relevance of near field electromagnetic (EM) interaction to audio reproduction quality, specifically to the coloration of sound. While audiophiles generally agree that objects like racks, stands, and equipment feet influence sound quality, it is also widely believed that this influence is only vibrational (mechanical) in nature. According to our own research, a significant source of that coloration is actually not physical in nature, and is due instead to near field EM interaction. After we explain what kind of tests we carried out which led to this conclusion, we'll go on to postulate that indeed any object in the vicinity of your gear's circuitry influences the resulting sound quality to some degree, even without making physical contact with it. We'll then segue into the basics of electromagnetic radiation and how this relates to high end audio. By that point, the problem of EM interaction will be obvious and we'll then explain what makes the **Blackbody** a uniquely effective and elegant solution—one that offers audiophiles a new level of accuracy in audio reproduction.

? Nearby objects and sound coloration: what's the connection?

How can it be that physical objects, just by being in proximity to your gear's circuitry, influence audio reproduction? How can the mere presence of a component's lid, equipment feet, or rack and the like, audibly color the sound—especially if the circuitry is not directly involved?

The standard audiophile answer:

To find the link between your circuitry and nearby objects causing sound coloration, an obvious place to start looking would be the influence of speaker vibration. First, through airborne sonic vibration (sound pressure levels in the air produced by moving speaker cones cause nearby objects to resonate like a microphone), as well as structurally coupled vibration through the floor (when your speakers play, their movement also transmits vibrations directly through the walls of the speaker cabinet, through the floor, into your rack, and from there to your components and their circuitry). In both cases, your gear is influenced by speaker vibration that permeates sensitive operating circuitry, creating unwanted microphonic signals there. These parasitic signals are then amplified and degrade the resulting sound quality in an acoustical way from speaker to electronics and back again through the speaker. A simple light tap on any tube of a tube amp will instantly show this.

Naturally, then, we do all we can to deal with these physical vibrations, hopefully without at the same time introducing objects that degrade audio fidelity in some other way.

Myriad solutions now exist to influence acoustic interaction. The embarrassing thing is, when listening through headphones, they're just as effective. This makes one wonder: is it really just acoustic interaction?

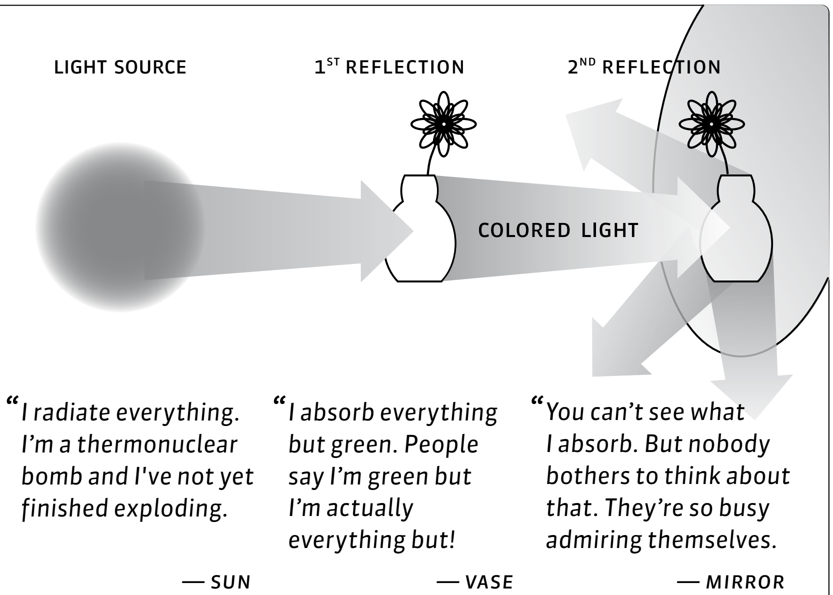
Something we audiophiles have been missing:

While LessLoss acknowledges the role acoustic interaction plays in sound coloration, we also know that this cannot be the entire story. The idea that all of this is due to acoustical microvibration alone is false, because, when the equipment is acoustically isolated, the problem still persists. The headphones test proves it. Using headphones instead of loudspeakers brings the equipment and any vibrating surrounding objects into complete acoustic isolation from one another. (If there's a buzzing transformer in your gear, then this becomes a more complicated story of course). Testing under these isolated conditions makes it obvious that while manipulating the objects around the circuitry, and without even any contact between the circuitry and the objects, the varying coloration in sound persists. This can only be due to something inherent in the physical surrounding objects' proximity to the gear. To understand how this works requires a short discourse on the topic of electromagnetic radiation.

EM radiation: the basis for this interaction

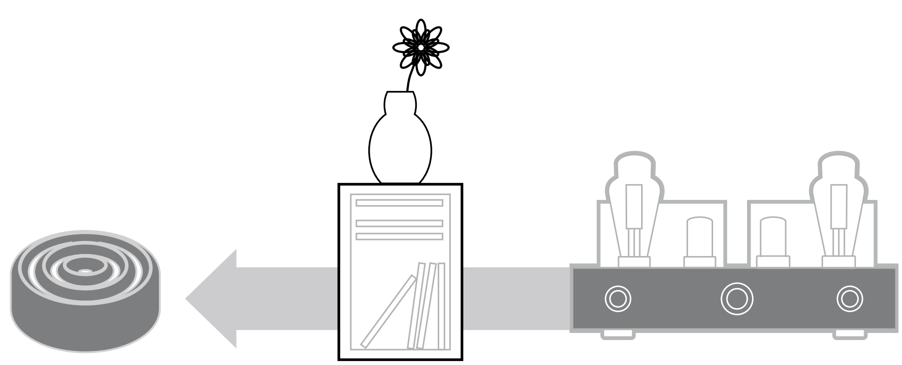
EM radiation is energy with electrical and magnetic properties that travels in waves. These waves are produced by moving charged particles. Since all things are made up of charged particles, every object radiates EM energy (unless at absolute-zero temperature). Matter also selectively absorbs and reflects EM energy, and each material's EM absorption and reflection pattern is distinct. All matter has its own fingerprint, a type of pattern called a spectral signature of radiation. These patterns are so distinct, scientists can identify the elements of nature from these unique spectral radiation patterns alone. Even the atmospheric composition of distant planets reveal themselves in this way.

The mirror's own absorption spectrum is at frequencies which we can't see. Everything else, including what we can see, is reflected. The color we see in the mirror turns out for our eyes to be the color which our own body has not absorbed. Another name for this is the absorption and re-emission of EM energy.



Taken in perspective, we live in a world full of complex EM interaction. Objects absorb and reflect EM energy twenty-four hours a day, and the vast majority of it we don't even see. The things we can see, we see only because the objects in question reflect EM energy at frequencies our eyes happen to be tuned to. Even more peculiar is that EM waves don't always travel in straight lines. Your cell phone, for example, can still communicate with a cell tower, despite the large building standing between your cell phone and the tower.

In our world, where EM radiation permeates the physical domain, objects constantly interact in ways we're often completely oblivious to.

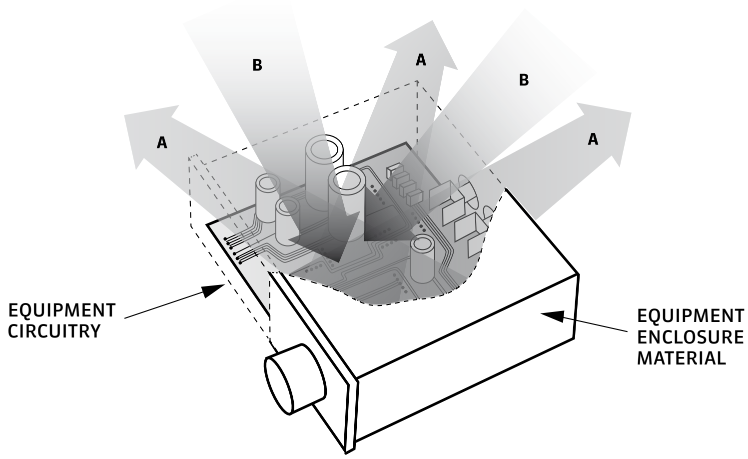


So what does EM radiation have to do with hi-fi?

Quite simply, different materials proximate to your circuitry will affect that circuitry. Your component enclosures, equipment rack, scattered CD collection, and all other objects in the room—including the chemical composition of the air surrounding your circuitry—are active participants in the shared EM ecosystem. In this mutual network of interaction, the EM radiation emanating from your gear interacts with all other objects' absorption and reflection patterns in a complex fashion, much like the complex echo and diffusion of sound waves from various objects in a church, only much more quickly, to the point of occurring practically instantaneously.

RELATIONSHIP BETWEEN CIRCUITRY AND ENCLOSURE

Electromagnetic energy interacts differently with each material which is proximate to the radiating circuitry. Absorption and reflection patterns result as a function of the unique qualities of these materials.



A — initial radiation of EM energy

B — re-emission (reflection) of EM energy

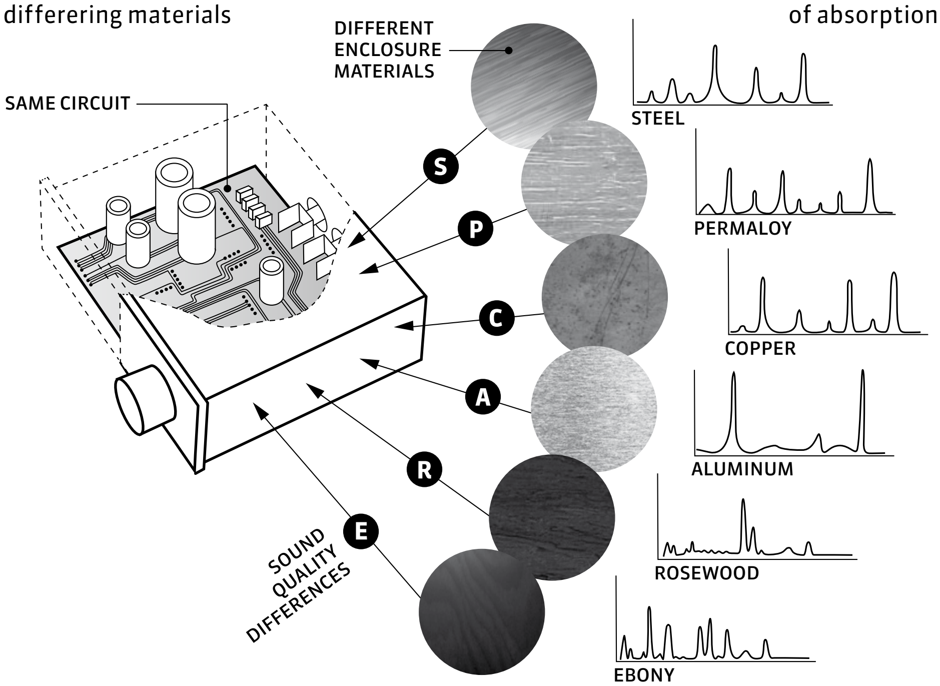
Since objects always selectively absorb and reflect EM radiation, leaving their own spectral signature in the reflection, they affect your component even if its circuitry doesn't directly "see" these colored reflections. The coloration we speak of is low level: it does not cause grave distortions such as data-fallout errors (although this can occur with the introduction of too much near-field UV light, for example). But its presence is palpable even with nearby objects which electromagnetically interact with the gear in only a passive way by means of their own distinct reflection pattern. The easiest way to convince yourself of this is to take your entire CD collection and place it all around your system, as close to your electronics as possible. Have a listen. Then remove them as far away as you can. Listen again. When they are moved away, the sound substantially clears up due to the absence of multitudinous and haphazard EM reflections from the metallized discs which were placed all around your gear.

Matter in proximity to audio gear smears the timing and focus of delicate audio signals, raises the perceived noise floor, and adds a distinct coloration which manifests itself as a sort of sonic sameness which simply doesn't go away from recording to recording.

DIFFERENT ENCLOSURE MATERIALS RESULT IN DIFFERENT SOUND COLORATION

The Test: Create six identically sized enclosures from six differering materials

Different sound coloration is due to different spectra of absorption and reflection



This explains what the audiophile community has for the longest time found very puzzling: circuitry enclosures of equal design, but made of different materials, somehow manage to cause undeniable differences in playback quality. Much emphasis is placed on build quality in high-end audio because all aspects of equipment design influence sound quality. Now, armed with our working theory, we can see that this difference in sound is due to EM interactions between signals and enclosure materials with different spectral signatures. We now have a good explanation for why we have felt the need to introduce talismans, or tweaks of mahogany, tourmaline, smoky quartz, and other such items placed in strategic locations throughout our systems. Typically, this specially balanced configuration in a highly tweaked out listening room takes years of trial and error to achieve. No wonder: there are so many complex EM interactions to account for.

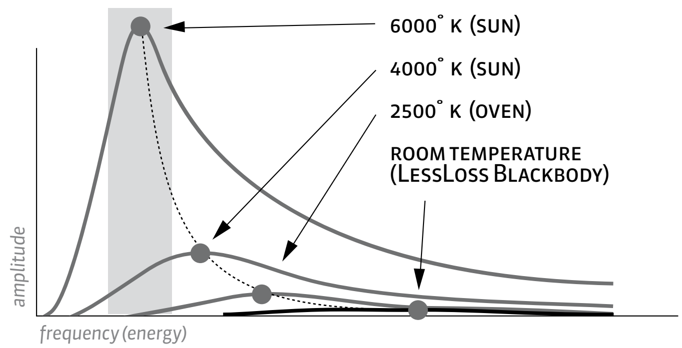
Faced with a clear problem that manifests in such complexity, shouldn't there be a more elegant, more accurate way to control this ambient EM labyrinth of interaction?

Our solution The Blackbody

Now that we have a clear description of the problem, it is not difficult to say what the ideal solution should do. It should prevent EM reflections from interacting with component circuitry signals, just as in our previous example the use of headphones prevented acoustic interaction. This is precisely what the **LessLoss Blackbody** does. It is modeled after the perfect blackbody—a hypothetical object from physics. A perfect blackbody would be an object that perfectly absorbs any EM frequency.

BLACK BODY RADIATION

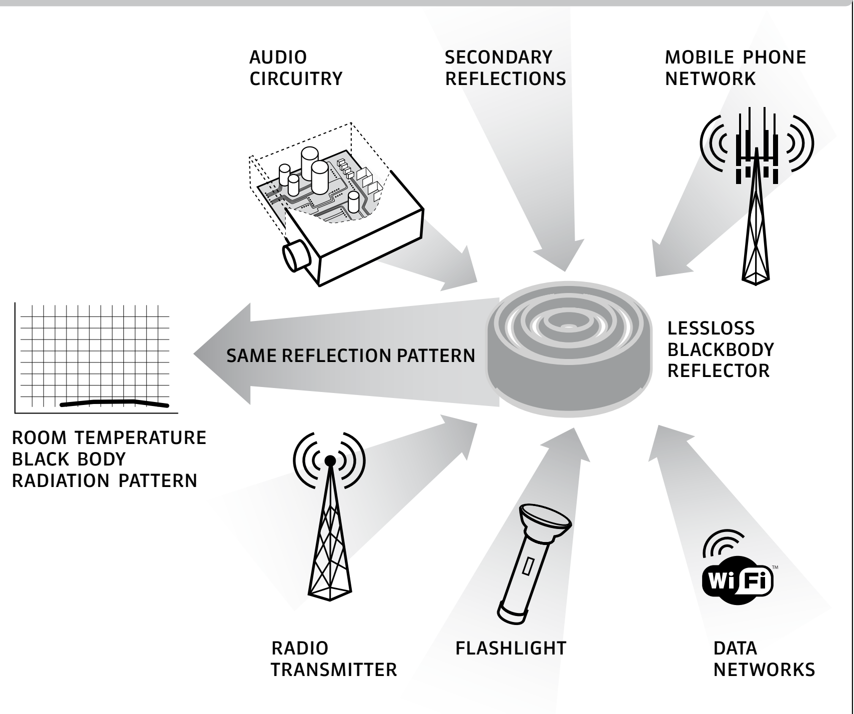
Black body radiation is a special case of thermal radiation, in which the spectral radiance of electromagnetic energy depends only on temperature. Thus, at room temperature, black body radiation portrays no discernible spectrum.



You can see how the blackbody got its name: by absorbing any EM wavelength, and by radiating none in our visible bandwidth, the device is as black as black can be; you might even say it is blacker than black, since it'd be the absence of light radiation altogether. Our version of the blackbody contains no power source or circuitry of its own; instead, the device itself is a specially formed array of concentric reflectors whose emission pattern in total approaches that of the ideal blackbody radiator. By creating this near perfect blackbody, we've created a device that, simply by being placed in your gear's proximity, will absorb a substantial portion of radiation at that location. There, gear will no longer be able to bounce EM radiation off proximate objects, only to have it return to influence its delicate signals and degrade sound quality. The **Blackbody's** EM radiation pattern lacks a distinct spectral signature.

DIFFERENT PATTERNS OF RADIATION RESULTING IN THE SAME SPECTRUM OF REFLECTION OFF OF THE BLACKBODY

The special thing about the **Blackbody** is that no matter what wavelengths you throw at it, the reflection will always be largely the same. This type of blackness is highly desirable in the proximity of sensitive audio signals, where the most minute coloration is appreciable. Considering the large bandwidth thus influenced, the electromagnetic background noise as a whole is effectively reduced. This purifies the resulting audio.

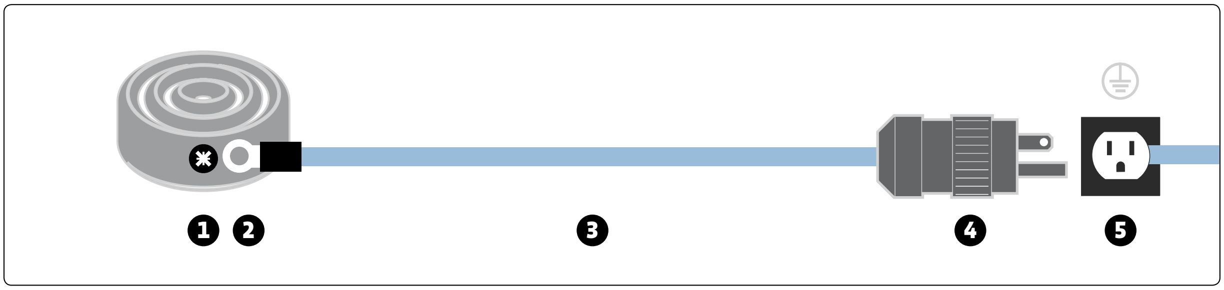


This is not your typical "talisman" tweak. Such tweaks are accompanied by diminishing returns once coloration sets in. The **Blackbody**, on the other hand, is the only object that removes the influence of near-field EM reflections. Unlike other tweaks, it lowers the system's noise floor, yet at the same time does nothing to introduce its own color the sound.

Positioning the unit For top performance

Grounding the Blackbody

The **Blackbody** comes with a grounding option. See image below.

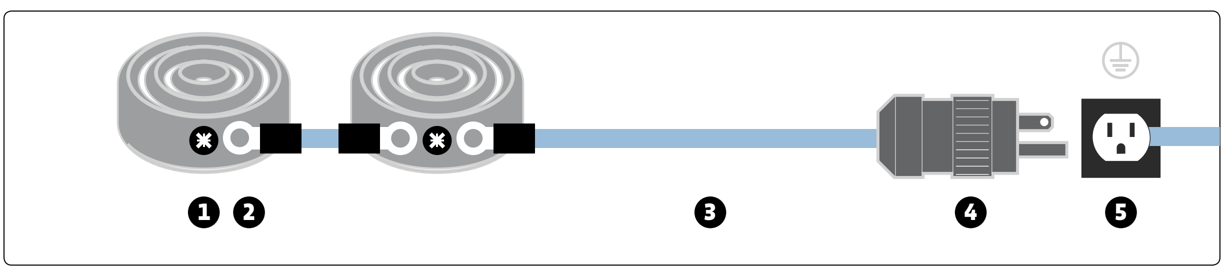


On the side of each unit is a small mounting screw [1]. LessLoss makes custom length grounding cables out of C-MARC™ wire [3]. These are terminated on one end to an M3 size silver plated ring terminal [2] and to the other with a high quality wall plug [4]. The grounding wire is connected only to the ground pin of the wall plug [4]. The other two power pins of the wall plug are not connected electrically. In this way, one can easily ground the **Blackbody** using any available grounded wall outlet [5].

The ground wire is very lightweight and extremely flexible, making its installation very easy under any circumstances. The **Blackbody** grounding cable comes in two sizes (Large and Small) and in various lengths.

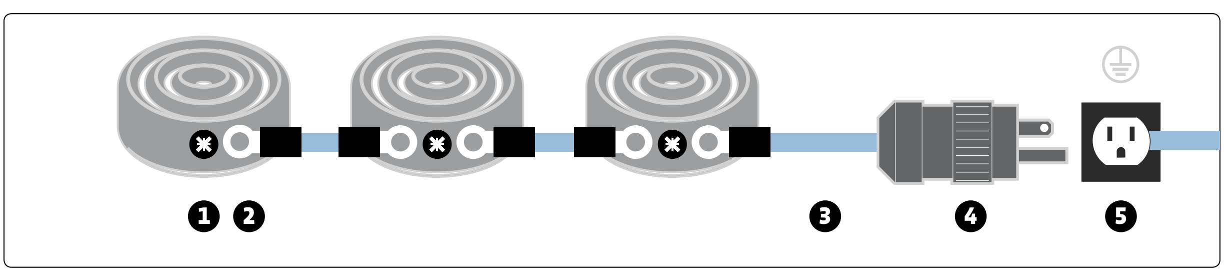
Grounding multiple Blackbodies

A ground wire option with ring terminals [2] at both ends is available in order to chain two **Blackbodies** together.



In this way, only one ground wire with wall plug ending [3] is necessary and only one wall socket [5] is thus used.

Additional **Blackbodies** can be chained together using additional ground wires with ring terminals at both ends.



Some pointers on installation

One uses the tool above (pressing the "SHOW ME HOW" button) to determine the angle of the stand needed at any specific place on earth. It is very easy to use.

? How many Blackbodies v.2 should be used in a given system?

Please note that it is far more important exactly how you set up the **Blackbodies**, rather than exactly where you set them up.

The advised "mathematics" of getting one unit for each specific piece of gear is only a general rule meant to exemplify that the larger and more complicated the system, the more **Blackbodies** should be used in order to get more profound results. So once you have these on location, there is nothing to keep you from trying different combinations or numbers of them near each of your specific components.

The most important thing to consider is the placement direction and the stand angle. In the northern hemisphere they should point towards the North. Of subordinate importance is the actual physical location of these units regarding their height and distance from the gear. Imagine viewing your system from an airplane. There will be far greater influence if the **Blackbodies** are facing the airplane rather than whether they are a half meter here or there. The whole house is just a speck on the radar, but the direction from plane to house is very exact, and in fact, the further the plane is from the house, the more exact the direction has to be. So in this way, consider the placement of the units throughout the system in a visually aesthetic way rather than considering some crucial distance. Remember: direction and angle are paramount. And grounding them is also audibly beneficial, though not entirely necessary.

Don't consider the Blackbody "assigned to a specific piece of equipment"

These are beneficial for the whole system. Think of a Christmas tree with ornaments on it. You don't put on a single ornament by counting the branches, or counting exactly how many ornaments you have on each branch. On the contrary, you look at the whole picture and try to spread out the ornaments in a visually appealing way, so that the result is a decorated tree as a whole. In the same way, think about spreading out the **Blackbodies** over the whole system. If you have more units, it will only get better. Even if your system is made up of only a single DAC/Amp combo and two speakers, if you have 5 **Blackbodies** there, and then you add 5 more, the results will certainly get even better! There is no doubt about it. So the general rule to be considered is that the more spread out a system is over the space of a listening room, the more **Blackbodies** are recommended in order to provide maximum effect. Hence the recommendation of starting with 1 **Blackbody** per component of the entire system. It is recommended to count speakers as 2 components and to also include power distributors in this calculation.

The Blackbody's Black Body

A Comparative Experiment Using Photographic Analysis

All objects absorb electromagnetic radiation to some degree. Some do it better than others, and most do it selectively, hence the various colors of the objects we see. Conventional black paint, for instance, reflects a full 5–10% of the light which strikes it. Black objects do not absorb all the light that falls on them, for there is always some reflection. If there was no reflection, you wouldn't be able to see them at all.

The colors of most objects around you are due to the way the objects reflect light. An object that absorbs all radiation falling on it, at all wavelengths, is called a black body. This is a hypothetical object. At room temperature, a black body's emission spectrum is thus blacker than black, blacker than pitch-black. The **LessLoss Blackbody** ambient field conditioner approaches this ideal. In this experiment, we wanted to try and show just how close.

The problem Too much dynamic range

Light intensity varies in unimaginable proportions. From a single photon to the overwhelming power of radiant sunlight or plasma, there is a magnitude of billions and billions of times. The human eye has the ability to adapt to this, but only over time. At high noon, we can still discern subtle shades of high mountain snow, and at night, we still manage to find our way around by moonlight – though not instantly. We must wait for our eyes to adapt. Capturing both these contrasting scenes in a single snapshot is even more of a challenge – the dynamic range would greatly exceed the maximum resolvable dynamic range of any image capturing device known to mankind. And, even if we could capture such data, displaying it on any known device, such as a computer monitor, in print, on film, etc. would simply be impossible.

The quest Displaying the impossible

So this is what we're up against – how can we display or illustrate the true blackness of the **LessLoss Blackbody**? It is estimated that the human eye can identify around 10 to 14 EV [Exposure Value] of dynamic range in a single scene (without adaptation), or around 24 EV considering the eye's ability to adapt. A color photograph may have 6 EV of dynamic range. A cheap 6 bit laptop monitor can only show 64 shades of grey, from lightest to darkest. The vast dynamic range of natural light intensities does not fit into such a limited scale. As mentioned above, even in nature, we need time to adjust to new brightness scales, otherwise we are effectively blinded for a time. We must therefore improvise and move those hidden bits to a comfortable zone, keeping relative proportions intact.

Get ready Calibration

It is important to remember that your monitor provides only very few discreet steps of what in reality represents innumerable fine shades of light intensity gradations. We have to make it all fit into our monitor’s 8 bit range of light intensity per color channel.

8 bits in binary = a maximum of 256 (from 00000000 to 11111111, which is 0 to 255 in base ten for us 10-fingered humans).

To make sure you see the following data correctly, we first ask that you make the proper adjustments to your monitor's brightness and contrast settings so that you would see eight shades of shadows (on the left) and eight shades of highlights (on the right) in the following graphic. Once you have done so, it is safe to assume that you will be able to see everything that we are showing here in this test.

The magnitude of dynamic range from 0 (pitch-black) to 255 (completely white) is shown below.

On some monitors it is not possible to display all the shades, so the range is not as smooth as should be. Banding results. If the above and below images appear similar to you, it suggests that your monitor is struggling.

Remember that this scale represents the limitations of the viewing equipment, with which we are viewing the represented data. In reality, there is much more data lurking in the raw data files, as we will see. The viewing scale would need to be much, much larger, in order to directly show the depth of the blackness reflected by the Blackbody in accurate proportion.

The setup Equipment used

LENS

Carl Zeiss Makro-Planar ZF 100mm/f2. At f22 aperture, at 0.68m focusing distance.

CAMERA

Nikon D3 professional. Shutter speed 1/250 s, “Neutral” picture control setting (smooth, unexaggerated, low contrast tone curve). Custom white balance set at ~5350K, 200 ISO sensitivity, AdobeRGB colour space.

PROCESSING

Adobe Camera Raw 4.4 camera profile. ProPhotoRGB colour space, 16 bit depth data, White balance 5350K temperature, –6 tint.

LIGHT SOURCE

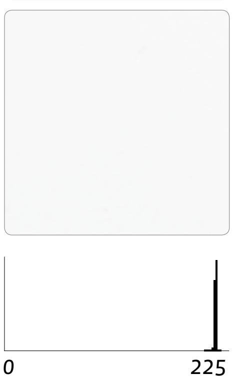
Multiblitz Profilux 400 monolight studio flash head, ~50 Joules/Watt seconds of light energy, with honeycomb grid to reduce spill-light reflections from nearby objects. Color temperature — 5500K (+/– 150K). Flash duration — 1/700 s, ~1m distance from object.

Gathering raw data Controlled conditions

Using the equipment setup described above, we took carefully controlled photographs of all five of our test objects. The “Black Graphite” paper was the darkest of all of all the dark paper we could find in a specialty art store. For an even darker object, we chose the portion of a vinyl record which contains no more music, the ‘lead-out’ groove between the final track and the label. Please note that the label itself is black. This shows you how intense the flash was when we took these control pictures. It is common knowledge that one can change the apparent darkness of a vinyl record or a piece of paper by simply changing the angle of incidence. Indeed, at certain angles, a record can appear light grey or even white. We therefore want to emphasize that we chose an angle as to maximize these objects’ darkness. For the **Blackbody**, this means well within its 35 degree angle of effectiveness. In the case of the record, the ‘lead-out’ portion was chosen because that represents the darkest spot on the record.

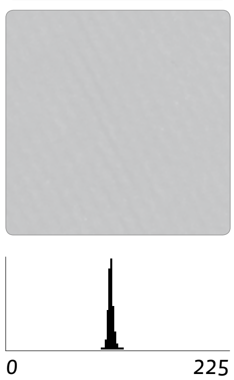
Beneath each picture, we show the corresponding intensity plot for each brightness gradation from 0 to 255, representing the entire dynamic range we can show on screen. The plots show how much of each gradation is represented in each picture (how many pixels of each brightness level are present).

WHITE



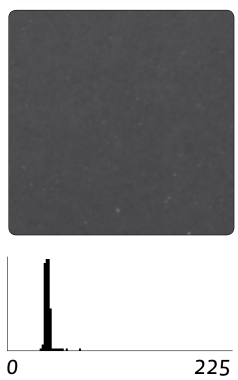
Callibrated White Target („Lastolite EzyBalance“ — used for colour correction, exposure control, accurate colour rendition)

GREY



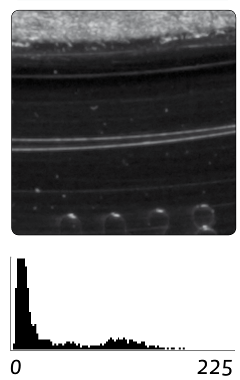
Callibrated Grey Target („Lastolite EzyBalance“ — used for colour correction, exposure control, accurate colour rendition)

BLACK GRAPHITE



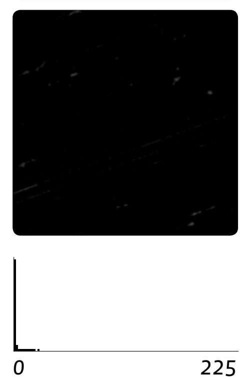
“Black Graphite” paper sheet, satin finish. Darkest paper available in art supply store

VINYL RECORD



Black vinyl record, lead-out groove, black paper label, some studio master numbers visible

BLACKBODY



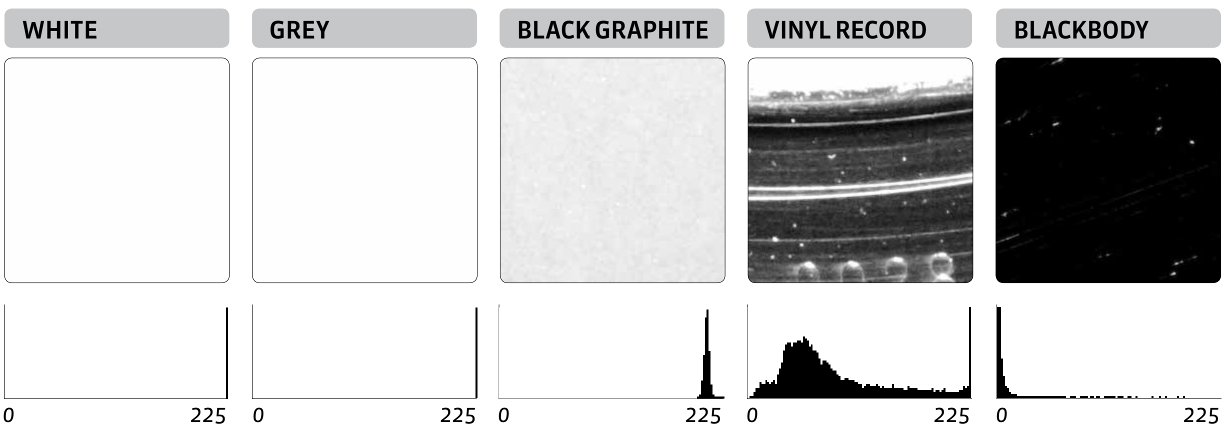
“LessLoss Blackbody” radiator

Now we take the raw data and do some processing to it. We run a digital exposure magnification algorithm set at +4 EV on each one of them. This is the same as though we had set up 15 more of the same flash sources around the objects, all at the same distance. With this amount of light, some of the photographs would have become overexposed. We can see that not only the white target, but also the grey target are now completely white in appearance, while the blackest of all available papers still has some small traces of data left. The black paper of the record label is also now hopelessly overexposed, going over the limits of our dynamic range, but the **Blackbody** is still very dark, with only a few visible signs due to imperfections and dust particles.

Interpreting & analysis 16x brighter

DIGITAL EXPOSURE COMPENSATION SET AT **+4 EV**

By increasing the exposure we begin to expose data otherwise invisible to the human eye, which lies buried within the 16 bit RAW files. Other bits of data which no longer fit within the dynamic range settings are now thrown off the scale.



Completely white, all information is lost

Completely white, all information is lost

Some traces of information left, approaching total whiteness

The dark black vinyl is becoming lighter. Some color casting is now visible. Black paper label is completely overexposed and off scale

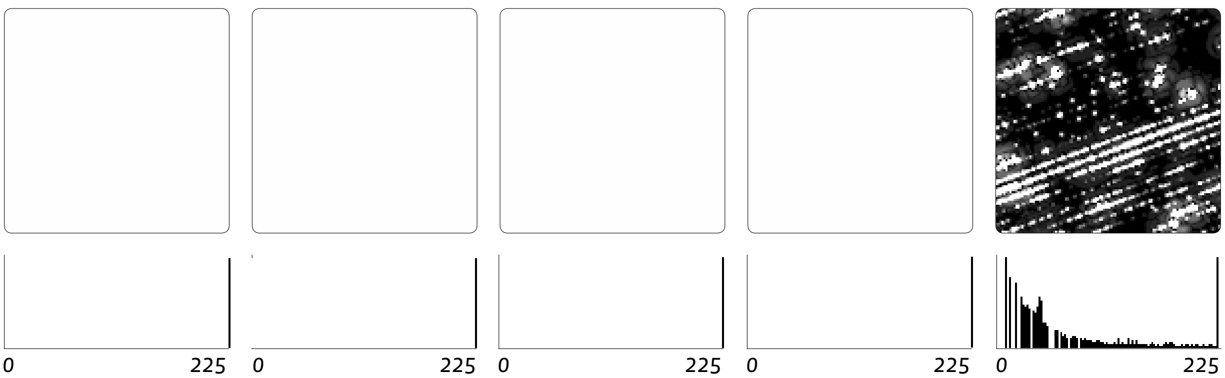
The Blackbody is still black. Only small traces of reflective surface dust are visible

Now we take the original data once again and raise the virtual light source all the way up to 65,536 times brighter. This emulates something like a football stadium of light sources in our studio, all 0,6 meters from the object! Well, it is not surprising that now, the emission from all of the paper types is blindingly bright, but take a good look, even the record surface itself is brighter than all of our dynamic range allows. And yet, even so, the **Blackbody** is still essentially black, with some imperfections scattering light in unpredictable ways. Where, you might ask, is all of this intense light going? Nowhere. It is largely being turned into blackbody radiation, which, at room temperature, has no spectrum.

Interpreting & analysis 65,536x brighter

DIGITAL EXPOSURE COMPENSATION SET AT **+16 EV**

Taking the exposure now to an extreme brightness, we expose and make visible the very last bit of information lying within the 16 bit RAW files.



WHITE	GREY	BLACK GRAPHITE	VINYL RECORD	BLACKBODY
Completely white, all information is lost	Completely white, all information is lost	Completely white, all information is lost	Completely white, all information is lost	The Blackbody is still essentially black. Overexposed surface dust particles emit some light pollution

Photonic sponge "Soaking up noise"

This experiment shows how effectively the **Blackbody** captures photonic energy and transforms it into blackbody radiation. It is not a perfect blackbody, as one can see above. However, it is close to this ideal, such that the principle of electromagnetic absorption is in strong effect.

This experiment shows that, as a proximate object, the **LessLoss Blackbody** shields sensitive electronic playback equipment from surrounding objects in a novel way. Whereas traditional shielding must also influence the shielded electronics via emission of the shield's own spectral fingerprint, the **LessLoss Blackbody** achieves this from a distance, acting as an absorber of spectral energy, and a reflector of blackbody radiation. And, because blackbody radiation has no spectrum at room temperature, no static coloration of the sound ensues.

Blackbody v.2

Probably, everyone will at first find the **Blackbody v.2** a strange item. And, probably, everyone will be asking what purpose it serves in the first place. Its goal is to mitigate some of the sources of low level distortion which plague the advanced audiophile's listening experience. If you do not consider yourself an advanced audiophile, you may not expect it to be possible that there can be much to be gained. The **Blackbody v.2** brings enhanced functionality to an already performing system. The better and more sensitive the performance of the system, the more evident will be the performance of the **Blackbody v.2**.

Do I need it?

You can liken the need for the **Blackbody v.2** to the need of a musician for a choice instrument. Only the insider is truly interested in nuance. The level of musicianship presently achieved will determine the ultimate level of need for a better, more nuanced and capable, instrument. When you hear an experienced luthier speak of how an antique master's instrument seems to have taken on some qualities of all the musicians who have played it in the past, if you have no direct experience with such sensitivities yourself, you will inevitably be bewildered how this can even be. Your object-oriented view of the world is limited such that this realm of discussion will have no direct meaning to you. But an experience-oriented view of the world can put you in a position to appreciate it along with those who also share in the experience. It's not that everybody is insane; it's merely that their sanity is fortified with direct experience, so the conversation is now esoteric in the sense that it is only comprehensible to those who have direct experience.

At this point I refer you to this video where some classical guitars are compared and contrasted by people with various levels of said experience.

The entire video is interesting. Relevant to our discussion, though, I'd point out these two moments:

03:22 "Therefore, they never really sound all that great because they're pristine, untouched and never played."

18:48 "One of the things that we found about these old instruments that have been played a lot, especially been played by great players, is the instruments learn the music. The better the players that have had it, the more times it's been taught to play it."

An experienced musician will wholeheartedly agree, and not only agree, but also relate to this while playing the revered instrument themselves. You can see this and perhaps relate to it in the video.

This is all to say that there is an audience for certain experience-based sensitive subjects. They will already be on the cusp of personal discovery, eager to know more, will delve in, and reap benefit from the nuance in question, whereas there will be others who begin as inexperienced skeptics, want nothing of it, and remain skeptical.

Who is this for?

This material is intended for those who have already made considerable advance in their personal audio playback journeys. It is not intended for those who are still questioning such fundamental aspects such as the seeming impossibility of cable design to influence sonic outcome after conversion of electromagnetic energy to acoustical energy through a motor driver. In our luthier example from before, they would be the ones still learning to hold and tune the instrument and to grip their first chord combinations. Many years of practice later they may come into intense confrontation with sublime notions such as tonal quality, balance throughout the range, details of string and wood composition, and the highly specific and daily changing structure of their own fingernails.

So, in this way, I hope to have informed the disinterested public and am left with those who may find interest in this (to us experienced audiophiles) exciting new realm of discovery with regard to audio performance. If you are not one of those experienced audiophiles, you may nevertheless find it interesting to follow the mental struggle of discovery as you see how we seek to connect the dots.

As we advance in this art, the more we care about it, the more we realize, eventually, that every little detail of an audio system has some influence on the resulting sound quality. In our own quest towards the perfection of audio playback, we have gone through many experiments and considerations. Some of these processes and considerations are depicted in summary form below.

Beginnings: some pre-history about earliest experimentation

Around the year 2003, after development of the highly effective DFPC Skin-filtering power cables, we turned our attention to signal cables. What I will very briefly describe here are rough categorizations of experiments carried out over the course of over 6 years. There were many additionally explored branches and sub-branches to these experiments. To be brief I am focussing only on the major categories which relate to the distillation of the main concept which lead to the establishment of the first **Blackbody** product in 2009.

At the beginning it became obvious that the most transparent tools were required in order to minimize influence from colorations born of the transducer. It is known that less moving mass leads to less transducer-influenced coloration. This lead us early on to use electrostatic headphones for cable experiments as they have almost no moving mass, do not have crossovers, and thus provide good conditions to more clearly hear the subtle differences we were seeking to uncover, describe, pinpoint and manage. Using these transparent tools, we considered every audible difference while varying clearly defined aspects of audio signal cable design.

While experimenting with various cable material compositions and geometries, one experiment in particular baffled us to no end. In a test devised to consider only material differences, a static geometry throughout all experimental cables of this series was used. Any other sonic difference would have had to do with material differences of the cables under test. After all, cotton is not PVC is not Teflon is not Mylar is not fiberglass, and solder is not copper is not silver is not gold, etc.

But here in this particular test, we changed nothing at all in the cable design except the color of pigment used in the plastic insulation. We used the same insulation material, thickness and geometry, with a difference only in its color. A difference in sound was observed. It was confirmed to be undeniable and repeatable.

That left a big question lingering in our minds. Many subsequent experiments led to our ultimate understanding of this phenomenon, which paved the way towards development and release of our first **Blackbody** product. (Today we'll refer to this original **Blackbody** as “Version 1,” then not yet so named because we never dreamed at that point of any second version).

Experiments:

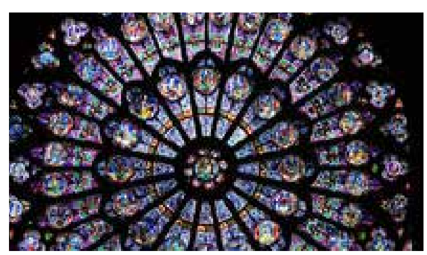
But why should the color of dielectric plastic in a cable have any perceivable influence on sonic outcome? This intriguing and undeniable 'crack' in our common knowledge led us down one path where more and more sonic relations where discovered by influencing only the surrounding objects around the playback equipment. We ruled out any sort of acoustic vibrational influence by never allowing these test materials to touch any of the playback equipment, cables or even stands. We were diligent and careful to make sure this was always so.

Remember that these are empirical in nature. We did not log distortion using software. You can read all you want about the theory of acoustics but until you pick up the actual instrument to play it, you will have only theoretical knowledge. Active participation hones the senses and provides an even broader perspective.

The mind-boggling color-only experiment led to investigating the sonic influence of strong industrial pigments in large quantities (liters). These are toxic and highly concentrated chemicals, unlike hardware store paints which contain a very small amount of pigment. These chemicals are strong EM filters at differing wavelengths.

The clearly audible experiments with industrial pigment led to ideas about the strong narrow-band absorption and emissivity of various crystals. There was an "Aha" moment when we realized how much blind tinkering was in effect in the greater audiophile world around such crystal "talismans" and their critical placement in a system. Of special note was Tourmaline's large popularity in Japan's audio scene.

Experimenting with differing colors of glass led to a series of experiments with crystal glass. Normal crystal glass is around 24% lead. We also obtained crystal glass containing 80% lead.



Crystal glass is about 24% lead. Lead is conductive, but not crystal glass. Still, we could hear the benefit of electrically grounding the crystal glass via copper wiring. This was accompanied with experimentation using pure lead. The absorption of X-rays is a well known feature of lead.

This lead us to re-examine carbon fiber. This material was already known to us and used by us as part of the resistive surface material for our DFPCs (then still classified as a military strategic material which required us filing official declaration of usage paperwork to even obtain it! As an aside, years before, dropping an engaged cell phone into a bag of carbon fiber snippets resulted in its instant loss of radio coverage; this was the moment of birth of the idea that was later to become the original DFPC power cable!) :)

Having established that it is always a sharp and specific spectral absorption of high electromagnetic energy that creates the sound coloration, we once went so far as to change the atmospheric conditions in and around a well set up sound system by spraying pure oxygen in and surrounding the electronics, which led to about 10-15 minutes of radical change in sound quality before the higher concentration of Oxygen dispersed in the air back down to its regular level. We learned through this experiment that even something as rarified as the atmospheric makeup of elements influenced the spectral content of the signals. Further supporting our ideas was the fact that space telescopes provide spectral imagery which shows molecular makeup of far-away stars and space clouds. It was now obvious that it was the same sort of absorption and emission fingerprints of various materials which were in effect here coloring the sound, even if it was in rarefied gas form.

Lessons learned:

To summarize: too much of any one specific spectral filtration material was always perceived as an obvious and undesired coloration of the sound, and even that which we would normally consider “neutral” sound was actively being colored by the fingerprint spectral absorption/emission of the very elements in the atmosphere surrounding the gear. This was the “base state” which we experienced all the time, while being oblivious to it.

The various absorption spectra of these high frequency filtering materials were showing us a tendency. They should converge towards one ideal thing. The traits of this thing would be defined as accepting all frequencies, and reflecting no fingerprint of its own. To be perfect, we should find something that could never be considered “overkill”. The more of it present, the merrier should be the result. This pure blackness, this absorption of all frequencies, should have no EM reflection whatsoever. But what was that perfect thing? It had to be better than paint. In fact better than any physical material.

A pigment? There were no simple paints that did that, except special applications that need very complicated heating and controlled cooling procedures (vertical carbon nanotube structures as in the original Vantablack). These were incredibly sensitive and delicate, brittle, and expensive. But we are not primarily interested in the visible spectrum exclusively, which is a very narrow bandwidth in the scheme of things. For our purposes, we seek a solution that will be equally effective at any frequency, visible or not.

But another solution presented itself in arrays of reflective mirrors which when positioned properly would accept any light frequency and return them as room temperature blackbody radiation through countless inner reflections before their ultimate emission.

Indeed, this 'blacker than black' solution was adopted and developed and in 2009 we released the Blackbody product.

As seen by the general consensus of the independent reviews, with increasing direct experience, many could now easily appreciate the **Blackbody's** performance without skepticism. It was becoming as natural for an audiophile's ear to miss the Blackbody's presence as it was for the eye to visually appreciate that everything has its own shade of color. The two went hand in hand, and there were, and still are, many happy users of this first **Blackbody** around the world today.

The unexpected 'damnation' of the Blackbody: North.

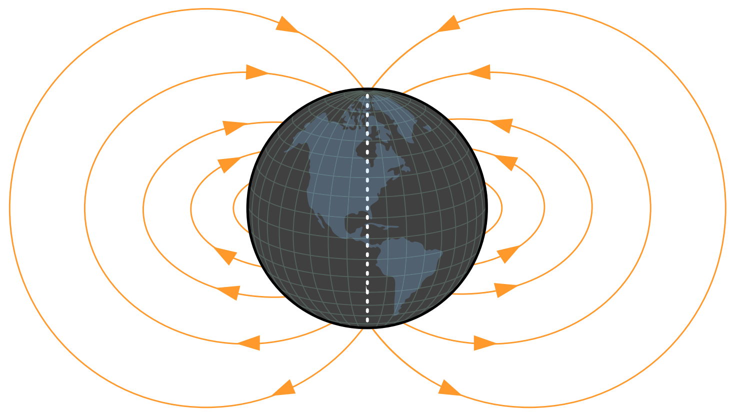
As if the Blackbody weren't already too subtle a concept for most audiophiles to easily embrace, in the following years of investigating different positioning scenarios for multiple **Blackbodies**, an even more unexpected revelation began to emerge. For some reason, it seemed not always to be true that adding more **Blackbodies** guaranteed the very best results. It became clear that what direction they were set up was as influential as the number of them.

(Please take note: we are in the northern hemisphere and have never experimented in the southern hemisphere.) We, along with the experience of many other audiophiles, established that for the most effective results, the **Blackbodies** always had to be positioned towards the North. They could even be placed further from the equipment, but the rule was that they had to be facing North. Many experiments in many places revealed that no other direction gave better results.

We took on the mental challenge, trying to establish why this Northern direction would be of significance. Well, what is North? North is a faraway magnetic pole of the Earth. One might surmise that, because audio is based on electromagnetic alternating signals, this might somehow play a role. After all, the spectral neutrality of the **Blackbody** was based in terms of the electromagnetic spectrum. Various forms of filtration of EM energy through pigments, crystal lattices, material shapes, and their interaction with the gear's stray fields had at least some magnetic component to say the least. But so what? People had their systems set up in many cardinal directions in many places, and in all cases the North-facing **Blackbody** functioned best. (Again, we don't have data form the southern hemisphere.)

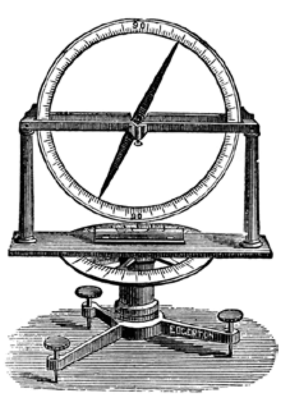
To delve further, we consider that the Earth is a large magnet. The small compass needle which shows us the North-South line at our standing position points towards the North because the needle is balanced and rotates freely to align with the Earth's magnetic field. It is a gravity balanced needle, so it is always parallel to the Earth's surface.

The Earth has a large magnetic field. At every position on its surface, depending on distance from the equator, the flux angle from this field is different. A gravity balanced compass does not show the field's local inclination, which differs with latitude.



But in 3D, seen from space, the magnetic field does not run along the surface of the sphere of the Earth. The actual magnetic flux which we call “direction North” from our perspective is actually directed at an angle to the horizontal surface. This angle is clearly not the same everywhere on Earth. It changes with varying latitude on Earth, from the North pole to the Equator, and from the Equator to the South pole. At the Equator the magnetic flux is largely horizontal, but at the North pole it is vertical. Everywhere in between, this angle varies. The standard horizontally flat compass is not enough to show us the real flux direction in 3D. It shows us only the 2D component of the actual direction. This 2D component is the one tangential to the Earth's local surface.

To find out this other component, the local angle of incidence of the magnetic flux, a dip needle compass is used. It is first placed to show the Northern direction, and then it is turned 90 degrees on its own axis. Now the needle will settle at an angle piercing the Earth's surface, and this will correspond to the actual flux angle of the magnetic field at that location.



But positioning the **Blackbody's** face at this local magnetic flux angle did not give better results. However, what did give obviously better results was when the **Blackbody's** face was placed square to that local angle. It worked fantastically, and it worked every time, everywhere it was tried.

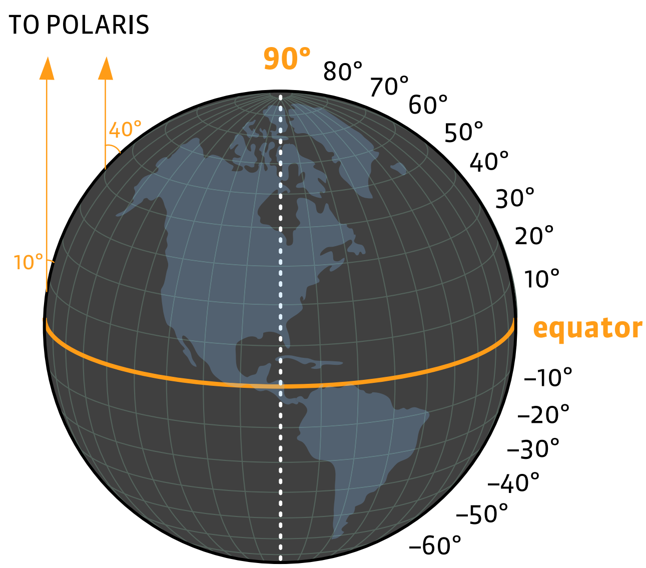
However many times we tried, regardless of system, location, time of day or night, this position proved itself in practice to be most effective. The very best sonic results were to be had when the **Blackbody's** front face angle was not only pointing towards the Earth's North, but also normal to the angle of incidence of the local magnetic field.

Mind you, we are not anywhere near the two extremes: the North pole (magnetic flux would be entirely vertical) or the Equator (magnetic flux would be horizontal). We are somewhere between those two.

What all of these angle calculations mean, in other words, is that at all of our trial locations, the best sound quality was always to be had when the **Blackbody's** face was in effect placed normal to the Earth's very axis of rotation. At the same time, this also means that the **Blackbody's** face was now always pointing directly towards the North Star, Polaris.

This information got through to our customers, many of whom said that they simply did not have the room and luxury to manage this physically. Some had gone so far as to build custom stands to hold the **Blackbodies** in various difficult places. Still, this strange angle issue was an impenetrable obstacle for some. It did not mean their **Blackbody** was not effective. It just meant that we revealed that there might have been more to have been had, yet they may not have been reaping the greatest possible benefits from their existing unit(s) due to the physical limitations of their setup (no shelf space, wrong angle).

It turns out to be a pure coincidence that pointing the Blackbody 90 degrees to the local inclination angle of Earth's magnetic flux lands us at the star Polaris. The real reason had nothing to do with the Earth's axis of rotation and situation towards celestial North. This was to be revealed later, as you will see.

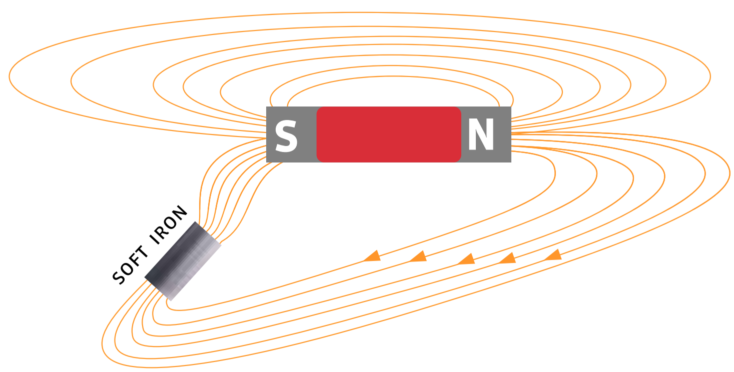


Two steps forward, three steps back!

But now we are at a point where we have no working theory as to why placing the **Blackbody** 90 degrees from the local flux angle of the Earth's magnetic field should be so effective. The only thing that presents itself is that we are in effect pointing the **Blackbody's** face towards the direction of the star Polaris. This is the non-rotating portion of the sky when viewed from the constantly rotating Earth's surface.

Also, as steel is used internally in the **Blackbody** product, it came to our disappointment to realize that, though the **Blackbody** is in fact very effective in its unique spectral reflective traits, if it contains steel, which has high magnetic permeability compared to air, and if it's best possible placement is along the natural magnetic flux lines, aren't we in effect just setting up some small amount of additional magnetic flux concentration somewhere near the system?

Soft iron concentrates and distorts the naturally occuring kidney shaped magnetic field lines. Little did we know then that even this distortion had nothing to do with the effectiveness of the Blackbody. This was to be revealed later as you will see.



Does not compute...

Thus, regardless of effectiveness, this presented three major challenges:

(1) Challenging for most to set up physically in the known best possible configuration.

(2) A newly suspected dual function as **Blackbody** radiator as well as nothing more than a magnetic flux concentrator, which any piece of iron does.

(3) Forcing us to inform customers that buying multiple units means they will not be able to be used in the most effective way possible unless they rearrange their domestic sound systems, often times requiring new furniture. WAF in seriously foreboding territory.

This led us in 2013 to eventually end production of this product and to devote our attention to other matters of sonic performance. For the time being.

We let this journey of discovery rest for a while. Sometimes the pot must be left to simply simmer on its own. Something told me that some day new answers may come. After all, the effects are powerful and weird! Obviously there was something we did not yet know.

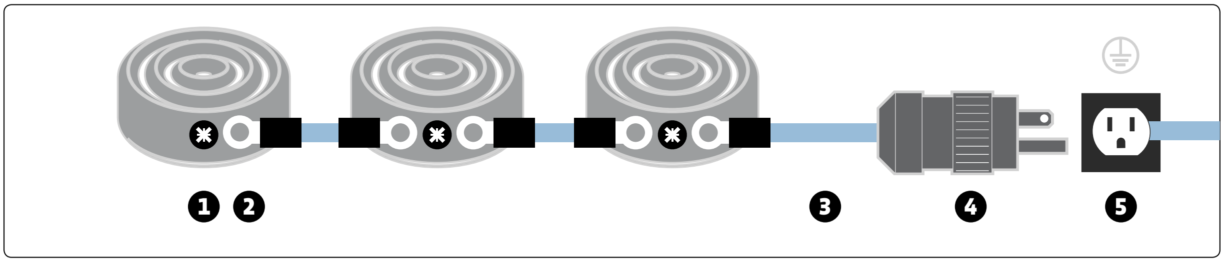
New concept!

Now, 6 years later, we come back to all the seemingly contradictory, or at least misunderstood, aspects of the **Blackbody's** strangeness with regards to placement.

The first thing we tackled was its angle of effectiveness. We did this through re-design. The original **Blackbody** was effective at about 35 degrees due to the narrow angle of mirror surfaces within. It was highly directional in this sense. When set up, the 35 degree angle was limiting. How do we get more angle of effectiveness without requiring multiple units? In real world applications, placement was often forced to be too close for best angle coverage. This meant the device was limited in its effectiveness given the small angle of effectiveness.

We solved this by making this second version round. Now, EM energy entering at any angle or polarisation would be treated the same way. We could now also have an effective cone angle approaching 180 degrees from all sides.

This was very effective. At least it would be easy for the user to simply set it down somewhere on the rack and be done with it. The idea was that the angle of effectiveness was now so large that it really wasn't crucial to aim it anymore. In this way we could release the product successfully as a “place-and-forget” device. It truly does outperform the original **Blackbody** even when placed willy-nilly on its back. Its smaller footprint is also much more user-friendly. Anybody will find room for this small disc even if it means just setting it down on the lid of some piece of gear. As it is not tall (18.5mm), often times it will even be possible to simply slide it under a piece of gear which rests on equipment feet. In this way we gained a lot of real world user flexibility in the new design.



Being stripped down to the essentials with no additional frame or glass cover, the v.2 unit is fully exposed. Knowing it is conductive, and recalling our crystal glass grounding experiments, we tried grounding it. This gave an obvious positive effect. So we are including a grounding bolt at its side where you can connect a grounding wire and run that to some common ground in your system. We'll include ready made C-MARC grounding wire options with ring terminals attached which fit the **Blackbody's** grounding bolt perfectly. It will be possible to neatly chain the grounds of multiple **Blackbodies** in order to reduce the cable mess many of us endure already.

Let's just try this one thing...

Remembering the lingering unanswered questions from years before, being the inquisitive audiophiles that we are, we figured we'd try the once-proven angled position with this new **v.2 Blackbody**. After all, this one is different. This one contains no steel, and its magnetic permeability is just as low as air's, so this test will show us something at the very least. To our amazement, low and behold, the angle still revealed itself as being more effective, and by an obvious degree. Playing any track with the **Blackbodies** lying flat, then again being angled toward the North direction at normal the local flux angle of the magnetic field, instantly led to significantly better results. Undeniably and repeatedly so. Day/night/hour did not matter in the least.

By carrying out this angle test with the new **v.2 Blackbody**, we learned for sure that it was definitely not the **v.1 Blackbody's** partial magnetic shielding effect which was at play here. That had nothing to do with it! The **v.2 Blackbody** contains no iron, no steel. Steel, which was creating a partial shielding of the magnetic field just by being there, was now eliminated as being influential in this effect of angled placement. Now we knew it had to be something else.

That 'something else' must be revealed

At this point, much further experimentation was carried out with this phenomenon. We have developed a working theory as to why this angle is so effective. It is a theory which may serve not only to explain this phenomenon regarding the **Blackbody's** effectiveness at this angle; it may also explain many of the day-to-day sonic differences all of us audiophiles hear. I am not talking about things related to equipment and cables burning in, etc. These day-to-day fluctuations in sound quality seem to have no rhyme or reason. Even very well settled systems reveal these changes, and they are arguably even better at doing it. These fluctuations in quality seem to have no connection to day/night rhythm, and it must be acknowledged that all of us have experienced superb sound in the daytime as well as horrible sound during the night. These are those times that we realize “this is just not the level at which I know this system is capable of playing. Today is simply not the day.”

The theory in as few words as possible: Solar Wind

After developing and experimenting exhaustively with the new **Blackbody v.2**, and after much contemplation, it is becoming increasingly evident that it is the Sun's activity which causes these day-to-day and even hour-to-hour fluctuations in sonic quality. Solar activity, as it turns out, has profound influence on the Earth.

It isn't as far-fetched as it sounds

Even though all I can do here is show as clearly as I can the mental paths which point us to this conclusion, true conviction will come only from direct experience. Just as it was unexpected that the experience when we changed the atmospheric constitution of the air surrounding the electronics in our experiments caused us to realize every particle's interaction with all signals is of audible significance, so, too, will it be difficult without having the **Blackbody** on location to realize the plausibility of our theory.

Hot Hands as an almost free experiment

There is, however, a very inexpensive way for you to get some inkling of the effect we are speaking of here. You can try this in your own system. There is a consumer product in North America called Hot Hands. In german-speaking countries it may be called Thermopad Handwaermer. It comes in a small bag containing iron powder, activated carbon, salt, and vermiculite (to contain water). When activated by the user by puncturing a moisture containing element within, it produces heat for about an hour when the ingredients are mixed up and the oxygen in the air then produces a controlled, accelerated exothermic oxidation of the iron powder within. In effect, because the iron powder rusts so quickly, you can feel the thermal radiation through the bag as your hands warm up. Activate multiple bags and place them all around your gear. Try next to your crossovers as well and you will get a clear picture of what it is we are talking about here. The idea is not to warm up your equipment. Do not make contact of the bags with your gear. Place them a small distance from your gear. When you clearly hear the effect we are alluding to, then you will find the following far more relatable since your real experience will be the backdrop.

Summary of the working model

In a nutshell, the main logic which describes the working model of the **Blackbody v.2** can be summarized in the points below. Later we will elaborate on the theme in more detail.

▪ The **Blackbody** does not care what frequency of energy is thrown at it. Regardless, it will always reflect **Blackbody** radiation from it. The wavelengths involved are small. We are talking about very high frequencies, both including, and extending far beyond, the light spectrum.

▪ The **Blackbody** does not care whether you consider the energy being thrown at it to be in EM wave form or in particle form. From its perspective (because it is not doing math or chemistry but is just a material thing) all it is doing is instantly converting orderly energy to entropy. Hot Hands does the same thing, but more slowly in a chemical reaction.

▪ Cosmic wind comes from the Sun. A fantastically complicated and grand interplay between Sun's gravity, magnetism and charges, creates solar flares and Coronal Mass Ejections. Sometimes the solar wind picks up in stronger bursts of ionic shockwaves. The ebb and flow of the ejected solar wind is largely unpredictable, except just before the most major solar events. As the accuracy of the science is growing, we gain more and more predictive capability.

▪ There is some rhythm to the solar activity causing solar wind, and there is some rhythm in the interaction between the Earth's magnetic field and the Sun's magnetic field.

▪ The Earth's magnetic field, when confronted with incoming charged particles (solar wind), guides most of them towards the Earth's poles. The poles are where the highest concentration of magnetic flux lines pierce the Earth perpendicularly. The magnetic flux lines converge and bunch up there.

▪ The Aurora in the sky occur when the cosmic wind from the sun acts up strongly enough such that we can see the interaction of solar wind ions with elements of our atmosphere. The solar wind particles originate mostly from the sun, and are guided by the Earth's magnetic field such that they primarily impact the Earth at its poles. It is this focussing towards the poles which causes them to have a seemingly constant source of direction from our perspective.

▪ However, every day, all the time, the cosmic wind is in effect, and if it is not strong enough to cause the visible Aurora display in the North, it does not mean it is not there.

▪ When the strength of the solar wind is average or low, no Aurora is to be seen in the sky in the North. Normally, even while the Aurora are visibly active in the North, no Aurora is to be seen closer to the Equator. We do not need to see Aurora to know that ionic precipitation is occurring. It is occurring all the time and it is just a matter of intensity and velocity that makes it visible in the sky.

▪ There was an historically documented major solar wind shockwave in 1859 in which Aurora could be seen all across the world. This shows that the solar wind ions do not remain only at the poles. The entire planet's atmosphere is constantly penetrated and experiences some amount of ion precipitation. The Earth's magnetic field guides most of it to the poles and it is only a matter of solar wind density and speed which make the Aurora visible or not.

- Because we (LessLoss) are closer to the North pole than the South pole, we receive more direct cosmic precipitation from the North pole than from the South pole. (Australians, for example, will have it the other way around.)

- Most high energy particles enter one's listening system from the North, regardless of whether these come from the Sun or from events in the greater Cosmos. Most will come from the Sun, some 8 light minutes away. NASA has detected many known particles and elements in the solar wind. The solar wind travels slower than the speed of light.

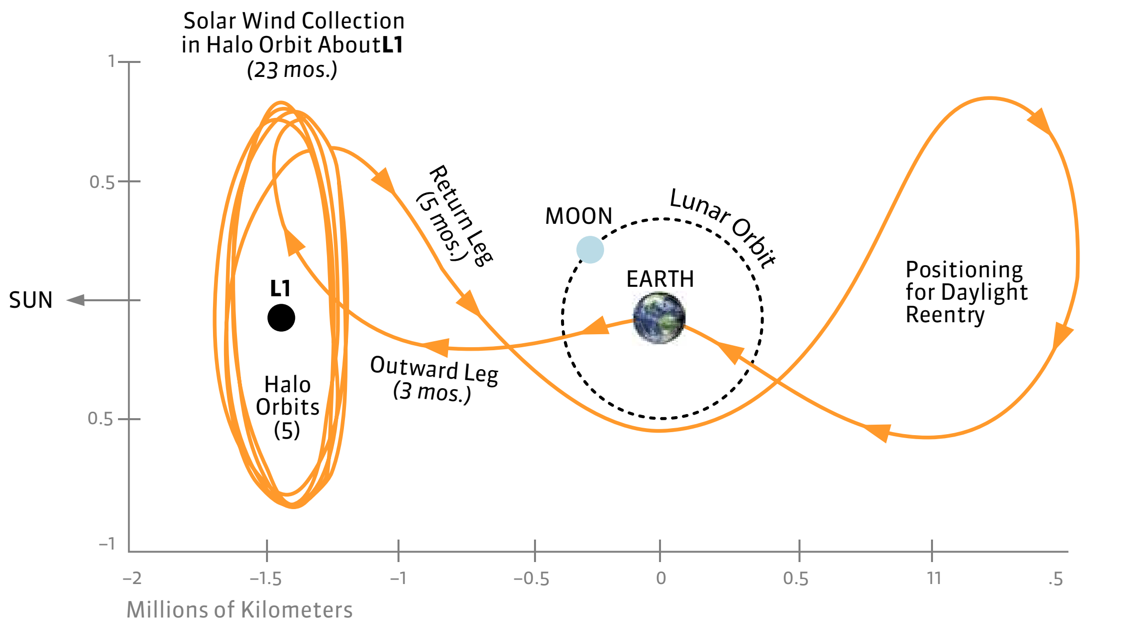
- When the **Blackbody** is situated towards the North at the angle of local inclination normal to Earth's axis of rotation, this creates maximum exposure of the **Blackbody's** face to the direction of local high energy particles coming from the solar wind, and this is when the sonic performance of the sound system improves most. The instantaneous taming of this energy into entropy is the key to understanding the **Blackbody's** effectiveness.

Solar Wind

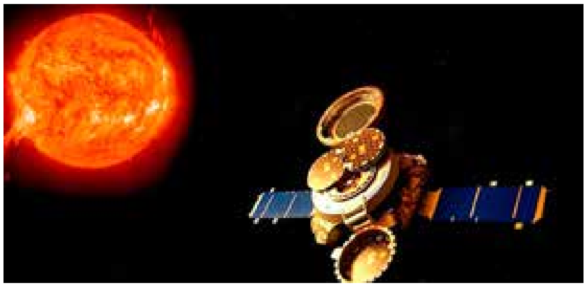
Other than the most obvious relationship of Sun to Earth, which is gravitational pull, another no less meaningful interaction is the so-called solar wind. While gravity is constantly pulling the sun together, just as it does the earth, there is also an outward force to the sun, and it fluctuates. It affects charged particles, called ions, in and around the atmosphere of the sun. This force pushes these tiny particles out in all directions. They travel from the sun all the way out past the planets, even farther than Pluto. There is nothing in our solar system that is not touched and affected by the solar wind, Earth included.

So what is the solar wind made of?

The solar wind is mainly made up of Hydrogen ions and other charged particles. There is also a small amount of neutral Hydrogen, combining from the smaller particles as they race through space. Helium ions and neutral Helium atoms are also found. Nasa's Jet Propulsion Lab carried out the Genesis mission through which scientists detected almost every known element of the solar wind. The Sun is not only a source of light. It is also a source of charge in the form of charged matter.



L1 is the location between the Earth and the Sun where their gravitational fields balance perfectly. It is possible to orbit such a location as if it were a virtual planet.



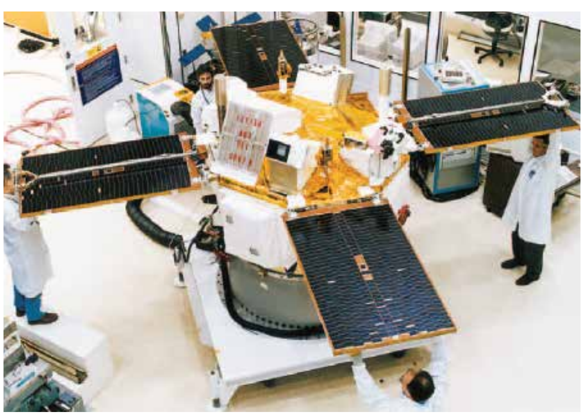
Genesis mission's trajectory and flight path.

The Concentrator on Genesis which collected space dust for analysis.

This is Genesis in 2004, landed in a desert in Utah.

Auroras seen from space.

It is the solar wind's interaction with Earth's upper atmosphere that creates the famous Auroras. The charged ions in the solar wind hitting atmospheric oxygen and nitrogen, and the exchange of energy between them, create the beautiful displays in the sky.
The Ace satellite monitors the solar wind, and it has been doing so for decades. It measures numerous data points about the solar wind, including the density of the particles streaming from the sun, the speed of those particles, and their temperature, as well as determines aspects about the wind that affect the Earth more than others.



The ACE (Advanced Composition Explorer) satellite

The Goes-R satellite fully assembled

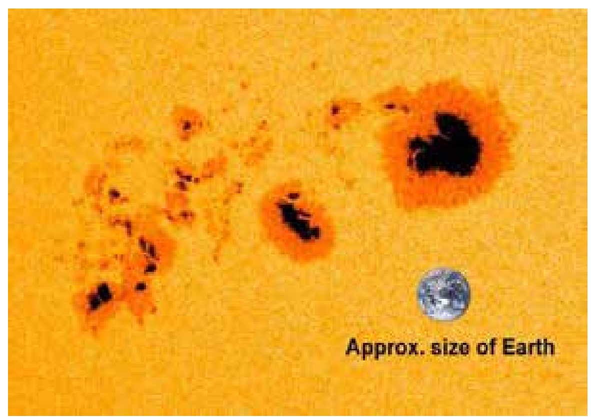
Since 2016 the Goes-R (now known as Goes-16) satellite launched and delivered even better monitoring of the solar wind and more data from the sun.

Much has been learned about how events on the sun affect the solar wind, and how the solar wind affects our life on Earth. From our electrical grids, to the daily weather right above our heads, it is today undoubted that the sun has influence.

What types of solar events influence the solar wind which reach and affect the Earth?

The solar wind is constantly changing. It is known as space weather. Specialized cameras are orbiting the sun which deliver impressive detail of the massive solar events that end up being important for humans living on the earth. There is even a special magnetic imager on NASA's Solar Dynamics Observatory satellite which lets us peer right down into the sunspots. We can even detect the polarity of the magnetic force of the ever changing sunspots. A specialized satellite called Iris was launched and began using its super zoom capability to bring us unprecedented images of the Sun close up, revealing never-before-seen details of how our Sun works.

NASA's Solar Dynamics Observatory satellite



A 211 angstrom imager reveals coronal “holes.” These dark patches called sunspots are not really holes in the Sun. They are open fields in the atmosphere that eject charged particles out as solar wind at a faster pace than at other locations. The specific particles found there register black by the detector. These sunspot regions are often larger than the entire Earth itself.

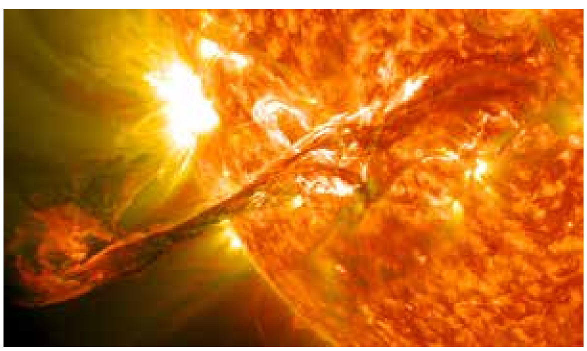
High above the surface and often far above much of the corona we can see plasma filaments defying gravity for extended periods of time, suspended by magnetic forces. An important influencer of space weather is when such filaments sometimes violently release into space.

What causes space weather?

Snapshot from the same video linked to above.

Sunspots appear, disappear, grow, decay, morph, all seemingly with a mind of their own. Bright loops of plasma leap up from sunspots in smooth arches and come back down and connect directly to other sunspots, into their very center known as the Umbra. The intermediate regions surrounding the dark central sunspot Umbras are called the Penumbra. An electromagnetic phenomenon is observed here. Those loops are actually magnetic fields that contain plasma (charged particles) and probably much of the rest of the solar wind material.

The loops only connect at oppositely magnetized sunspots or those having opposite polar force. For scale, these sunspots and loops can easily grow to many times the size of Earth.



A gigantic solar flare.

Equipment on observation satellites show us whether the sunspot is positive or negative. Loops come out one sunspot and dive down into one of the opposite charge.

There are known energetic oscillations between 2 and 3 minutes apart associated with sunspots, while other oscillations have been recorded about 5–6 minutes apart. It turns out there are many rhythmic aspects to the Sun's activity, and much seemingly random activity as well.

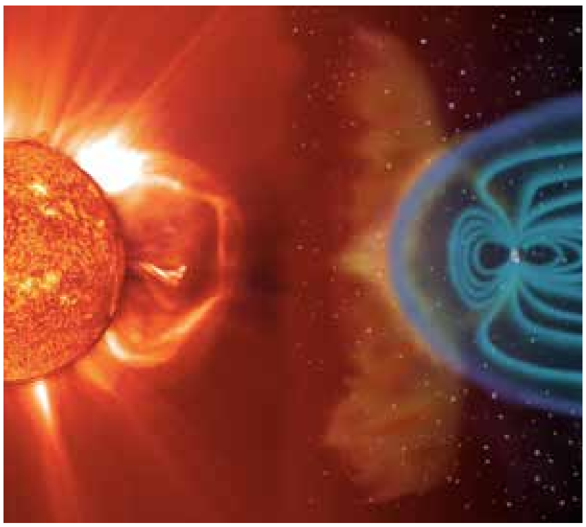
Every looping magnetic field arc of charged matter has two corresponding sunspots to which it connects to the Sun. Every sunspot has magnetic fields that extend up into the corona. They shift and interact constantly. This causes their fields to interact to where sometimes the separate flows of plasma entangle. Charged matter gets accelerated to near the speed of light, unleashing a solar flare. This is a violent burst of extreme ultraviolet, x-ray, and gamma ray radiation.

The energetic release caused by solar flares occur as the charged particles controlled by the magnetic field loops coming out of sunspots interact. While the sunspots are constantly moving and shifting around, so are the loops. These fields interact such that you have fast-moving plasma whipped into changing direction and is accelerated to near the speed of light.

These solar flares are one of the causes of space weather that affect our theory. Another is a phenomenon known as coronal mass ejection (CME).

Solar flares and coronal mass ejections (CMEs) are very high energy

These flashes of high energy EM shockwaves and charged mass ejections are often, even at their source, larger than the earth itself. Upon impact with Earth they create excited states in the Earth's atmosphere.



Artistic rendition of Sun's flare, solar wind and Earth's magnetic field

Now, beyond just providing light, the solar energy always excites the atmosphere of the earth where the Sun is directly overhead at the time. When the Sun's activity is calm, its influence on Earth's atmosphere is at its weakest and has normal heating effect, but during strong solar flares the area of the earth that is facing the Sun is splashed in extreme ultra-violet, x-ray and gamma ray radiation which can excite the ionosphere. The ionosphere helps bounce our radio signals across the world. When it gets supercharged like this it causes what is known as a radio blackout.

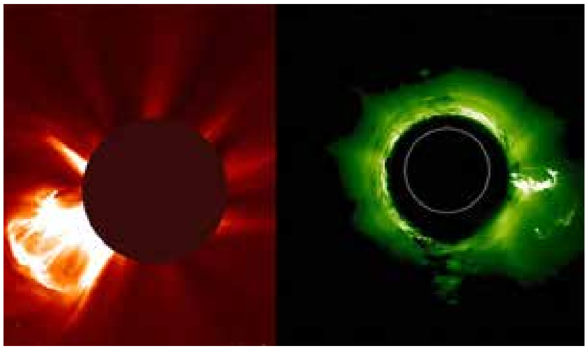
Radio blackouts occur about 8-10 minutes after the plasma flare event on the Sun because the EM energy moves at the speed of light. These cannot be predicted because even the act of our observing the sun is delayed by about 8-10 minutes due to the distance involved and the finite speed of light. On the other hand, Coronal Mass Ejections can be foretold because the charged particles move slower than the speed of light. We can see the flare before we receive the particles which have mass. Think of the familiar lightning and thunder. Or, even better, first lightning (flare of light), and then rain (charged ion particle precipitation).

Again, the sunspots themselves are often bigger than the entire earth, so consider just how powerful these eruptions can be.

Snapshot from the same video linked to above.

Solar flares are not the only makers of CMEs. The plasma filaments that hover above the surface can release as well, and these usually do not have an associated flare event. They simply erupt.

For another idea of the size of these things, consider that within hours of the initial eruption, the cloud of ejected particles can be big enough to house multiple suns. Through satellite imagery it is possible to determine the direction the CME is heading and often how much charged material has been ejected.

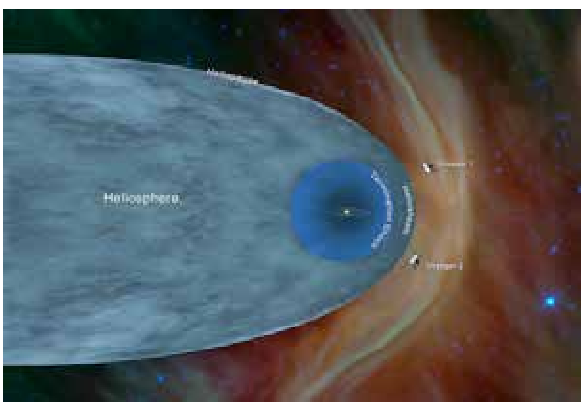


Satellite imagery with sun blocked out to reveal the size of the flare and ejected cloud of charged matter.

This is important because these clouds of charged particles are the primary thing that influences the solar wind or what we call space weather. Especially in an earth directed CME which can intensify the solar wind to the point it creates the colorful Auroras. If the CME is big enough, it can do a lot more than make pretty lights in the Northern and Southern sky.

Magnetic portals, “highways” for ions to travel

Just as Earth has a magnetosphere, a magnetic field that protects our planet from solar and galactic radiation, the solar system itself has a larger magnetic field of its own. The Sun produces this magnetic shell known as the Heliosphere. It extends out past Pluto, the Kuiper belt, and the Oort cloud. It protects the entire solar system from yet other Stars' charged projectiles and radiation.



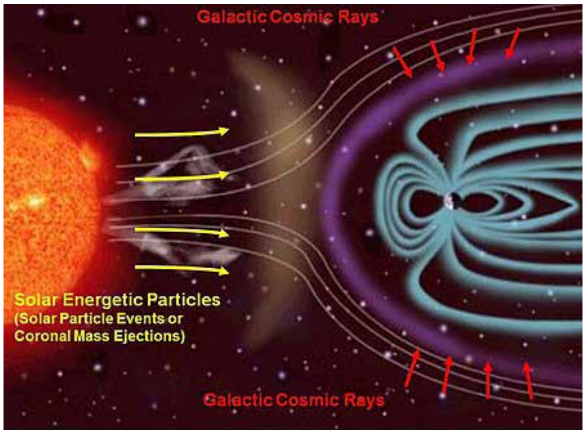
The Voyager satellites have ventured out past the Sun's Heliosphere to report back data on the greater cosmic material found there.

Clearly the Sun's Heliosphere encompasses Earth and Earth's magnetosphere, and they both interact on a regular basis approximately every eight minutes, in part cancelling out, creating what NASA calls a magnetic portal where charged particles from the solar wind enter freely into Earth's system. This is called a flux transfer event. There is incredible variation to these events and during the severe ones many agencies and individuals go on alert.

Heliospheric current sheet out to the orbit of Jupiter

We know that solar flares cause radio blackouts that last as long as the flare does, but when these magn etic portals are surged by a solar eruption, the influx of particles can be severe enough to cause a radiation storm at Earth's polar regions.

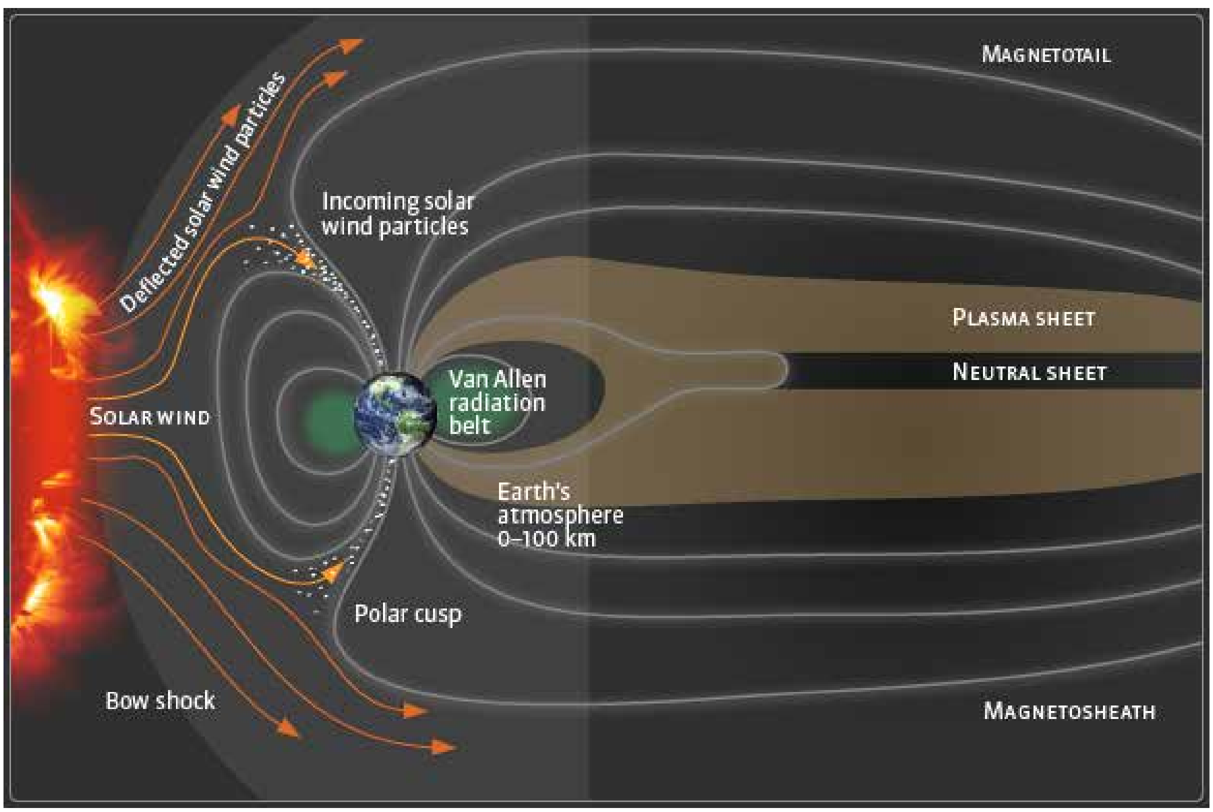
These strong connections can cause multi-day storms. The most severe storms require astronauts to enter safe rooms aboard spacecraft. Air traffic control begins to reroute high latitude and polar flights to avoid exposing passengers to increased radiation. If one of these events was big enough it could theoretically be dangerous to even stand on the ground near one of Earth's poles.



We have a fairly good way of detecting these connections which scientists calculate using advanced field simulation software.

The dominant connection point where solar activity is most likely to cause increased flux events is monitored. Currently the Goes satellites monitor the radiation specifically in terms of proton influx. There are both proton and electron events. Major events are rare.

No person has ever been directly harmed by a space radiation storm. These events range on a scale from S1 up to S5 with S5 being the strongest, when satellites and spacecraft are under significant threat along with some airline passengers. To be in danger on the ground would require an event off the charts like an S6 storm that humans have never seen. Solar energetic particles in these radiation storms can arrive within minutes of an observed solar flare and last for days. But the most significant space weather events come from Coronal Mass Ejections, CMEs, the most prolific makers of the Aurora's.



The earth directed CMEs send particles towards Earth that impact Earth's magnetosphere, compact it and energize it causing disruptions in Earth's magnetosphere that can cause electrical disruptions from satellites all the way down to ground level transformers and electrical grids.

Scientists are beginning to understand that all major solar events have effects on Earth's atmosphere and how these strong events create geomagnetic storms, where Earth's magnetosphere becomes unstable during the CME shockwave. In the wake of the impact, in the worst case scenario, these solar events could cause disasters here on planet earth.

The next big storm

It has been a hundred and sixty years since the last mega solar flare. Back then it was not very dangerous to our way of life, but times have changed.

Humanity has experienced countless challenges by the brutal forces of nature in the past. Earthquakes, volcanic eruptions, and severe weather are but some of the natural hardships endured.

But when it comes to CMEs aimed at the Earth, we must consider that it is our new way of life based on electromagnetic power and signals which is causing us to become vulnerable as never before.

The last time a very powerful solar storm hit Earth was in 1859, at the very dawn of our electric age.

Known as the Carrington event, it set fire to telegraph offices all over the world. The colorful Aurora in the sky was visible from the polar regions all the way down to low latitude areas such as south-central Mexico, Queensland, Cuba, Hawaii, southern Japan and China, and even at lower latitudes very close to the equator, such as in Colombia.

Since then, we have been largely spared save a few incidents such as the 1989 geomagnetic storm when power went out in Quebec and all trading was halted in the Toronto Stock Exchange, as well as some cases of satellite damage.

Artist's rendition of 1989 Quebec power outage

Our planet forms a complex magnetic field around itself. It is our protective interface with energy from space. Many sources, including the world center for geomagnetism in Kyoto, Japan, have shown it weakening over the last 400 years. As of just a few years ago the field had decreased 10% since the 19th century and it's shift is hastening.

This makes earth more vulnerable to flares from the Sun and galactic radiation.

Evidence does suggest that humans have endured such events many times in the past. Complete pole shifts are registered many times in the geological solidification of volcanic magma.

These mega flares happen anywhere from a hundred to a few hundred years apart so 160 years after the Carrington event, consider just how lucky we've been in our present electric age and just how important it is that we be mindful of the Sun.

The Sun releases a lot of CMEs. Most are nowhere near large enough to cause technical failure but there are varying levels of geomagnetic storms that can occur from those eruptions and they are happening all the time.

An earth directed CME is known as an interplanetary shock wave. Earth's magnetosphere is our protective shield against these eruptions and in all but the largest blast you really wouldn't notice any difference unless you live at high latitude and can see the auroral effect of geomagnetic storms. The level of the storm, the effect on satellites and electrical grids is largely dependent on the density and speed of the CME. The stronger the solar flare, the stronger the solar wind effect, and the stronger the solar wind, the stronger the geomagnetic storm.

Starting to connect the dots with the audiophile experience

For us audiophiles, where system sensitivity is very revealing, it begs the question: why does the sound quality seem to fluctuate haphazardly, just as the previously described solar activity? There are days where the sound seems godly, and then only a few hours later sounds unattractive.

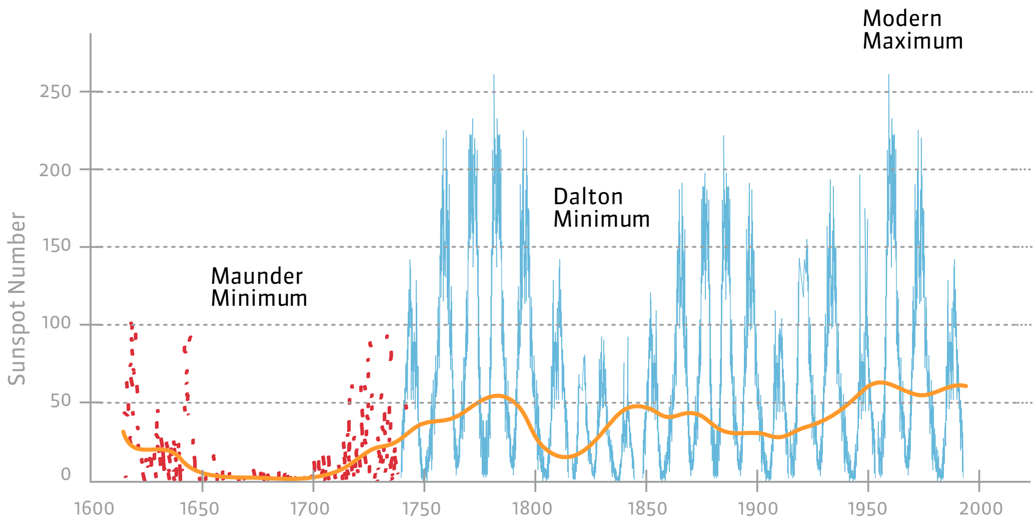
There is something to it and the North facing **Blackbody's** effectiveness is showing us a tie here.

Many Sun cycles

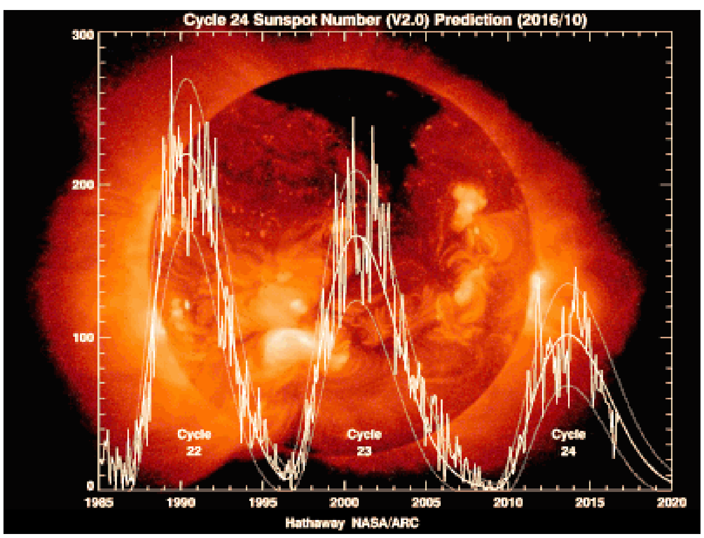
Let's step back and examine some cycles of the Sun. Some are very short others are quite long. There are the two to three minute pulses and other three to five minute oscillations involved at the sunspot level. Let's look at the star as a whole. The Sun does not rotate the same speed at different latitudes. The equator rotates about ten days faster than the polar regions with a majority of the Sun having an average of about 28 days. (Coincidentally the same as one lunar cycle for Earth's moon, which begs the question: has some people's alleged sensitivity to lunar cycles been in fact a visual confusion with the unseen solar activity cycle?)

The most commonly discussed cycle of the Sun is the sunspot cycle. NASA's official sunspot numbers show an approximately 11-year cycle of high and low sunspot activity. The high activity periods are called sunspot maxima while the periods of low sunspot activity are called sunspot minima. During the minimum there are few sunspots and therefore generally fewer solar flares. The amount of light the Sun gives off weakens slightly and the coronal holes are mostly confined to the polar regions.

400 YEARS OF SUNSPOT OBSERVATION



The Sun's 11-year sunspot cycle is the most famous of the the cycles of the sun. As we learn more about the sun, many more cyclical events have been established.



Contrast this with sunspot maximum where sunspots and coronal holes pepper the lower latitudes. The 11-year cycle is seen in terms of maximum and minimum sunspot activity but there's a matching simultaneously occurring cycle that follows an opposite pattern. The strength of the sun's polar fields is weak when sunspots are active. The solar cycle could be considered more as a function of polar field strength than sun spots. The Sun actually reverses its magnetic poles every 11 years. When this happens the polar forces move their way towards the equator and then to the opposite pole. While the magnetic fields are working their flip they form active sunspots at lower and lower latitudes. This leads to the counter-polarized sunspot groups periodically forming close to one another, causing the most violent flares.

Bringing it together: summary about locally occurring cosmic precipitation

To summarize, the main points about cosmic weather and its local influence on our sound systems are:

- The high energy particles arrive in mostly unpredictable waves and ebbs of showers.
- They arrive mainly from the poles.
- They have therefore a main direction.
- They are of super high frequency. Alpha rays are Helium Nuclei, Beta rays are Electrons, Gamma rays are Photons
- They can be of sufficient energy that they can free and scatter electrons. (Ionizing radiation.)
- When strong, they are responsible for signal degradation. (Radio Blackouts.)

That would be a description of them on the common days. The rarer and more severe case of exactly the same phenomena will blow out our transformers and cause our power stations to catch fire (1859 on steroids). On a biological level the influx of ionizing radiation has implications for the random gene mutations we see throughout the history of life's evolution.

Summary of the theory

Here is a succinct video which summarizes the thoughts above. It shows how ongoing exploration has provided data on the Sun's Heliosphere, the Earth's magnetosphere, various forms of Sun radiation, including flares and the ionic solar wind. How this activity leads to the often occuring Aurora near the poles of the Earth, as well as provides an overview of other solar objects which pass by us from time to time.

What all this means for audio quality

Given all of this, it really does not require any mental leap to see the clear connections to our high performance audio systems. On a bad listening day, we can be consoled that we, through our audiophile art, are sensitive to and can appreciate first hand the echoes of faraway events of the Sun's tremendous power. These bad listening days, according to this theory, are in fact induced remnants of the Sun's ongoing fierce battle of the forces between its large scale gravity and magnetism in constant flux, resulting in flares and Coronal Mass Ejections of unimaginable scale.

When we set up a Blackbody, tune it to the parallel of our closest pole's axis, and ground it, we do our small part to tame the subtly disturbing effects of the Sun's activity locally, in order that the music be liberated from unwanted noise coming in from the cosmos. In fact it is more likely that the direct influence of gentler daily, non-destructive cosmic weather on our local circuitry is more influential to sonic quality than that induced by vast stretches of the city's power supply wiring. Knowledge about the natural attenuation of high frequencies over a distance of any wire supports this train of thought. It's the same well established “last meter is most influential” argument, just transposed to include the immediate local atmosphere.

Seen in this way, the **Blackbody** can be considered a type of highly specialized umbrella to protect our sensitive circuitry from the continuously varying subtle cosmic shower of particles and rays.

[Bonus speculation:] Here we come to the horizon of our train of thought, beyond which we step into the realm of speculation and wonder. Think of this: the Heisenberg uncertainty principle dictates that when we know a particle is fast, we can't know exactly where it is. Delocalization might be playing some role in the mysterious functionality of the **Blackbody**. What's clear through experimentation is that the **Blackbody's** effectiveness spans multiple times its relatively small diameter, even though the general placement angle stipulation holds in every case. Furthermore, it remains unclear what role more fundamental particles such as quarks, leptons, bosons, and other hypothesized particles play in all of this. What's clear is that there remains much to discover and much sonic integrity to achieve!

One customer's feedback

A customer with related experience wrote back to us the following:

I think there is some merit to your working theory. It explains why sometimes the system sounds like crap (even late at night) with nothing on in the house. Sure clean AC is part of this, but why then can the system sound great at 5:00 pm when it should sound its worse....

A little story about my personal experience below:

I work in the tech industry for a large software company. About ten years ago, my job was leading the north american support escalation team... Well we had a customer who had a massive data-center outage, and nobody could figure out what happened or why. During one of our conference calls with the hardware vendor, the customer, and the CPU manufacturer (not going to name names, but you can probably guess who), one of the lead CPU architects was on the call mentioned that they believed the causation of the software crash, with resulting outage was due to an increase in solar flares.... They believed this based on how the random the CPU was behaving at the time the server software crashed. At the time, we sort of laughed it off. Interestingly, the server-hardware manufacturer agreed with the theory, and added evidence based on other customers who during the same period of time had experienced similar random outages.

Later on, in discussions with the CPU architect, I learned that many of their critical data-centers are buried deep into the earth or mountain sides to mitigate the effects of solar flares on sensitive servers. So this is absolutely real! I think you may be onto something in terms of the effects of solar flares on the perceived quality of our hifi!