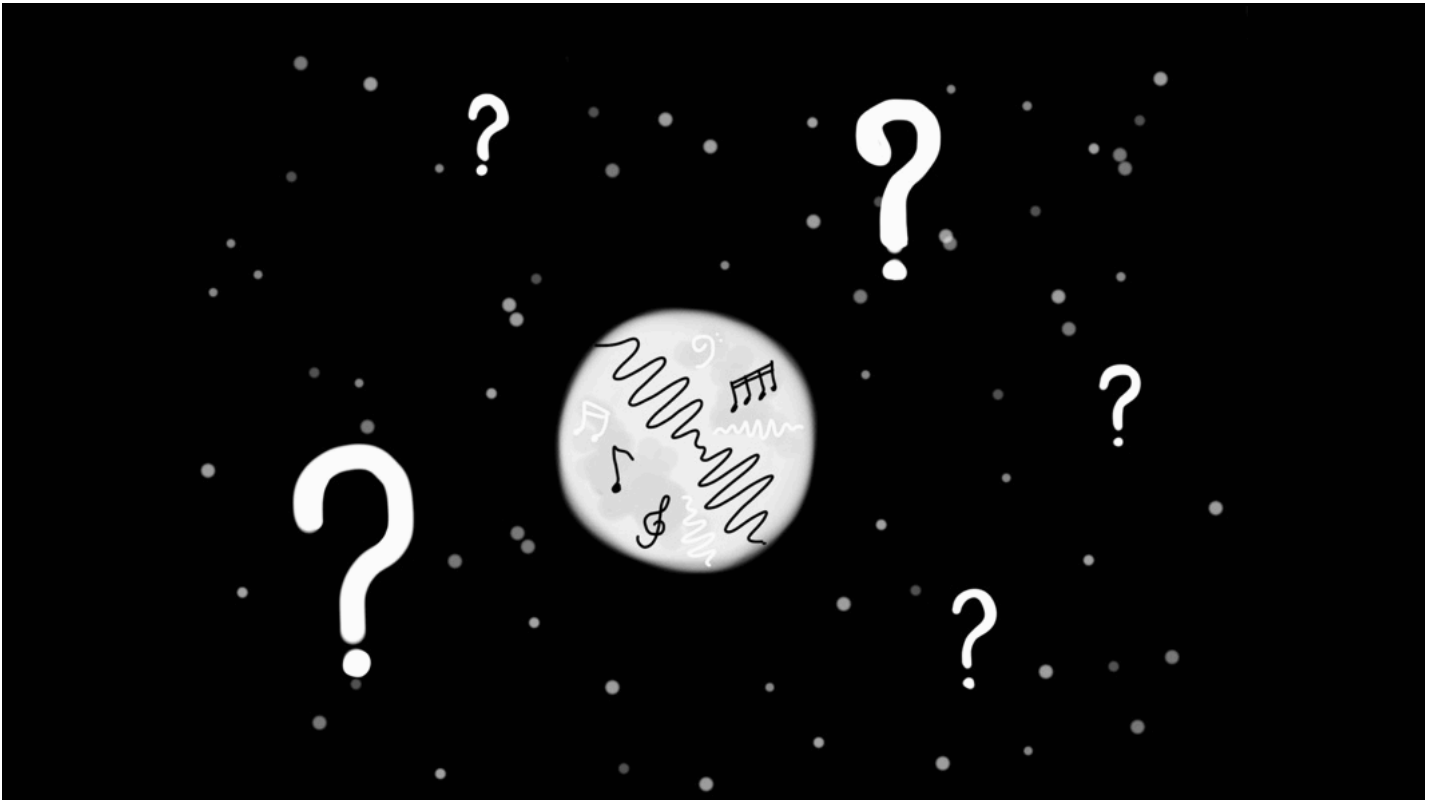
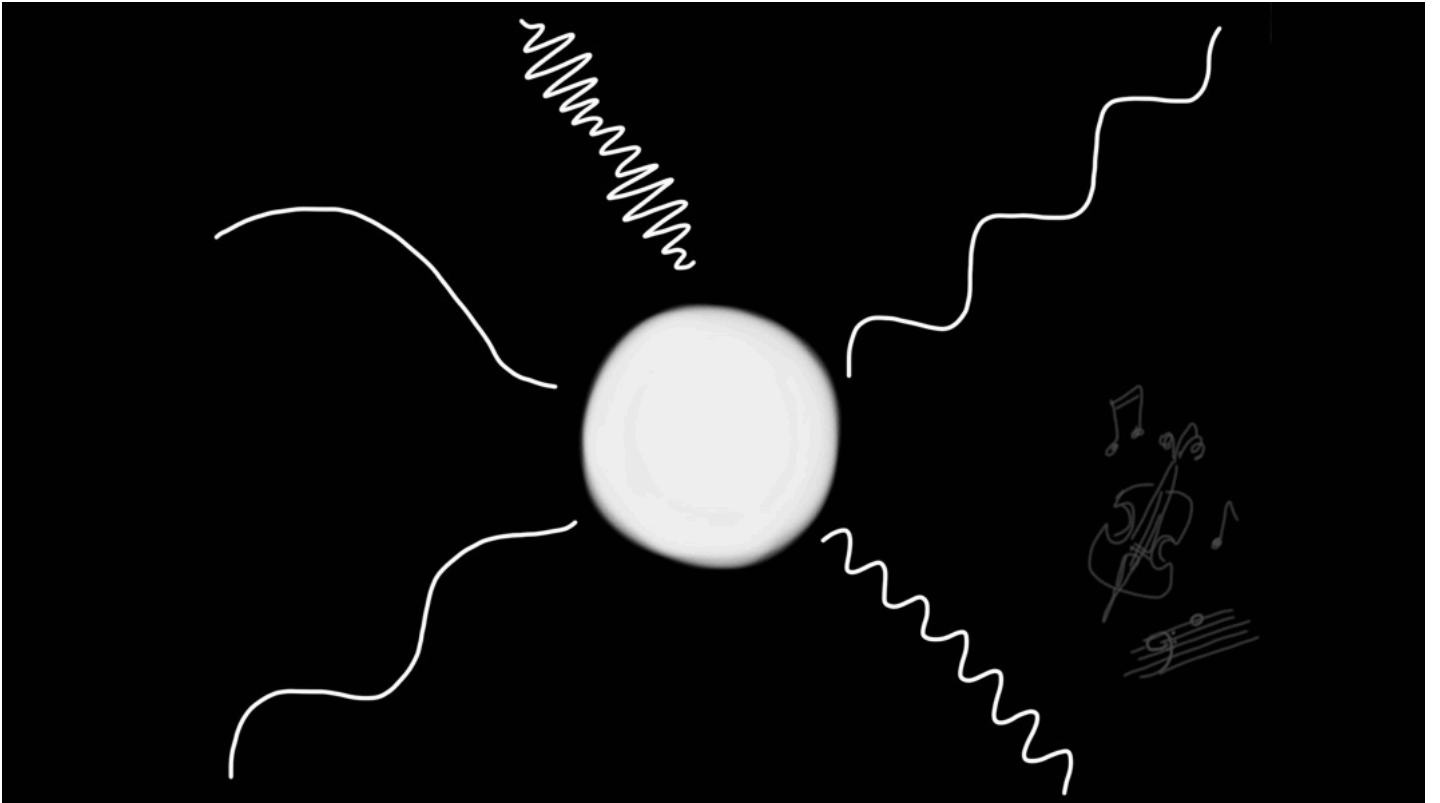
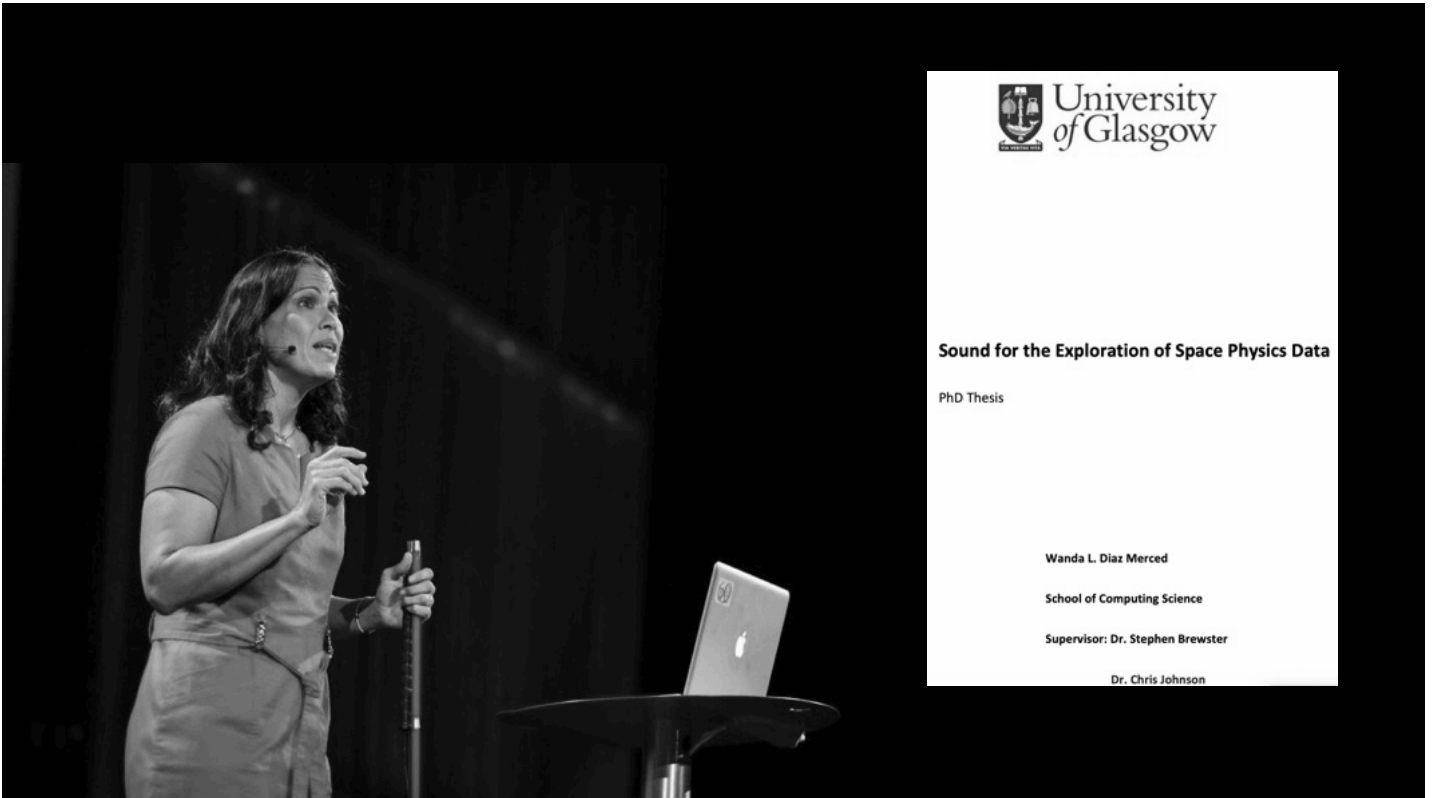


Light





Sound



Sound for the Exploration of Space Physics Data

PHD Thesis

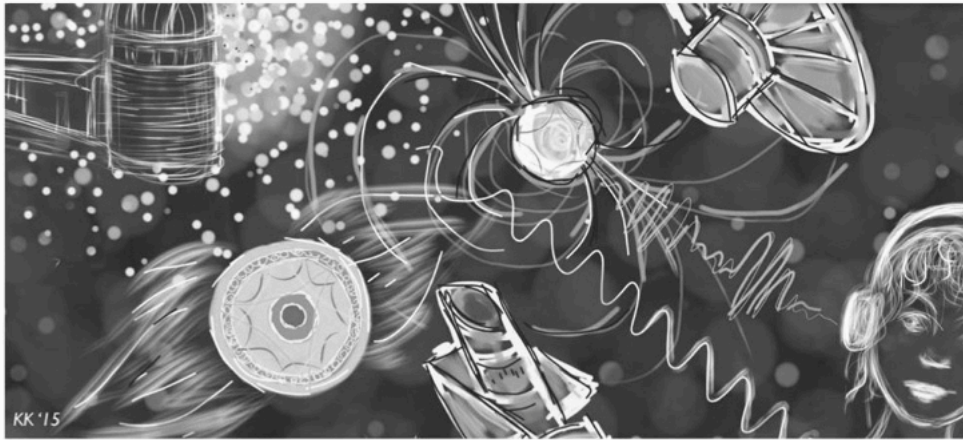
Wanda L. Diaz Merced

School of Computing Science

Supervisor: Dr. Stephen Brewster

Dr. Chris Johnson

Sound to See Better



Participate in ground-breaking experiments at the IAU GA!

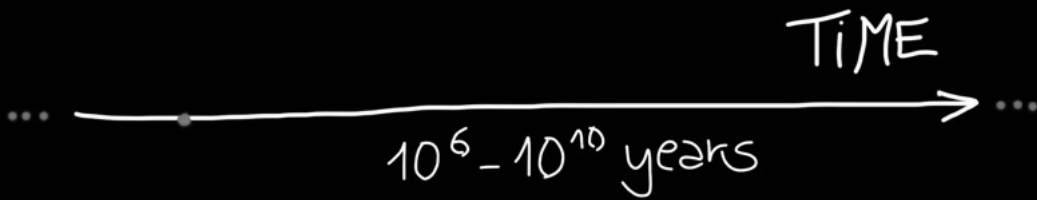
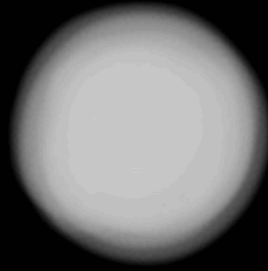
Stars

↑
Earth

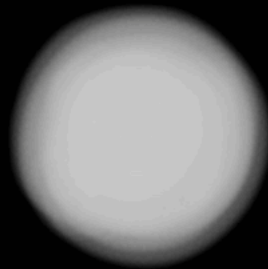
Sun

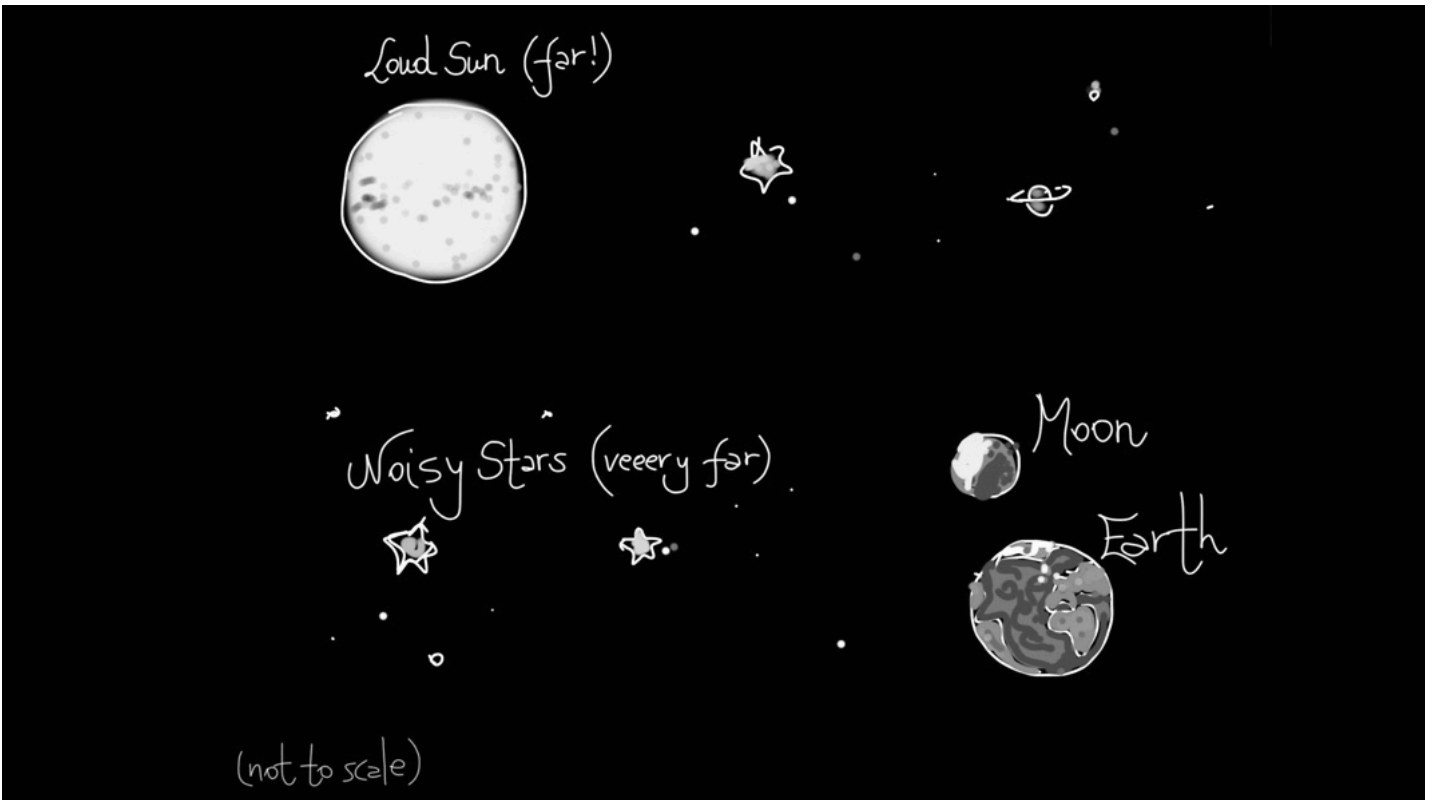
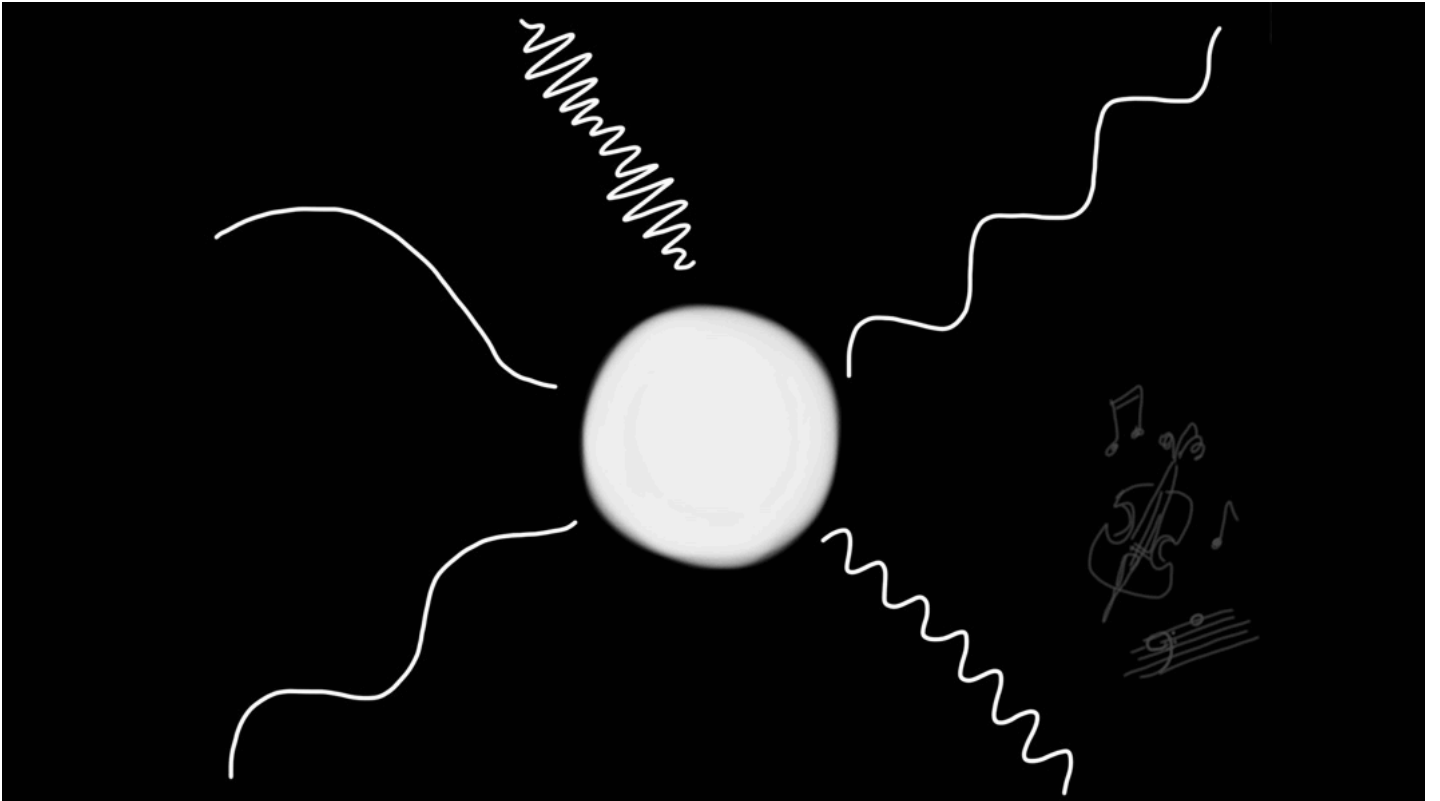
Red
Giant

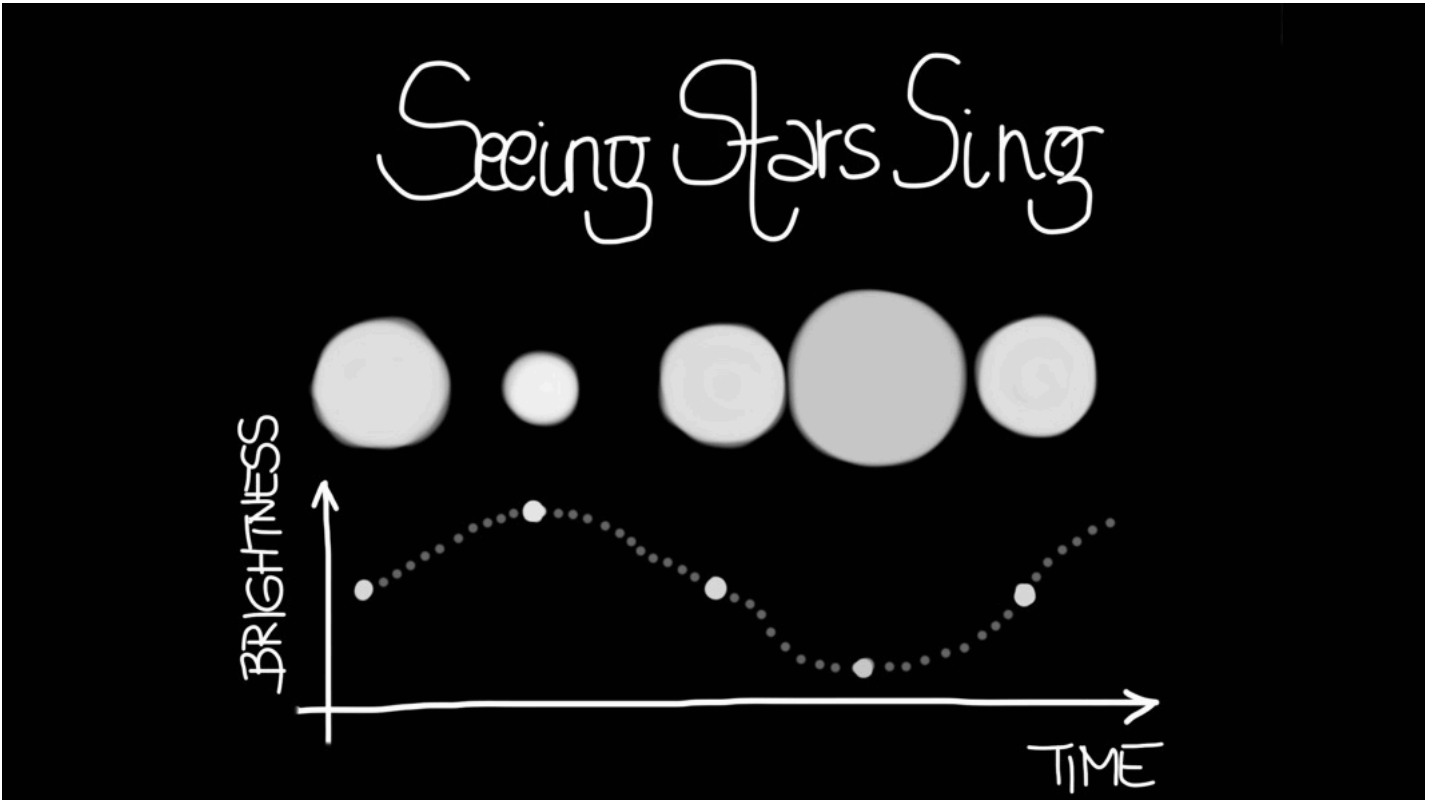
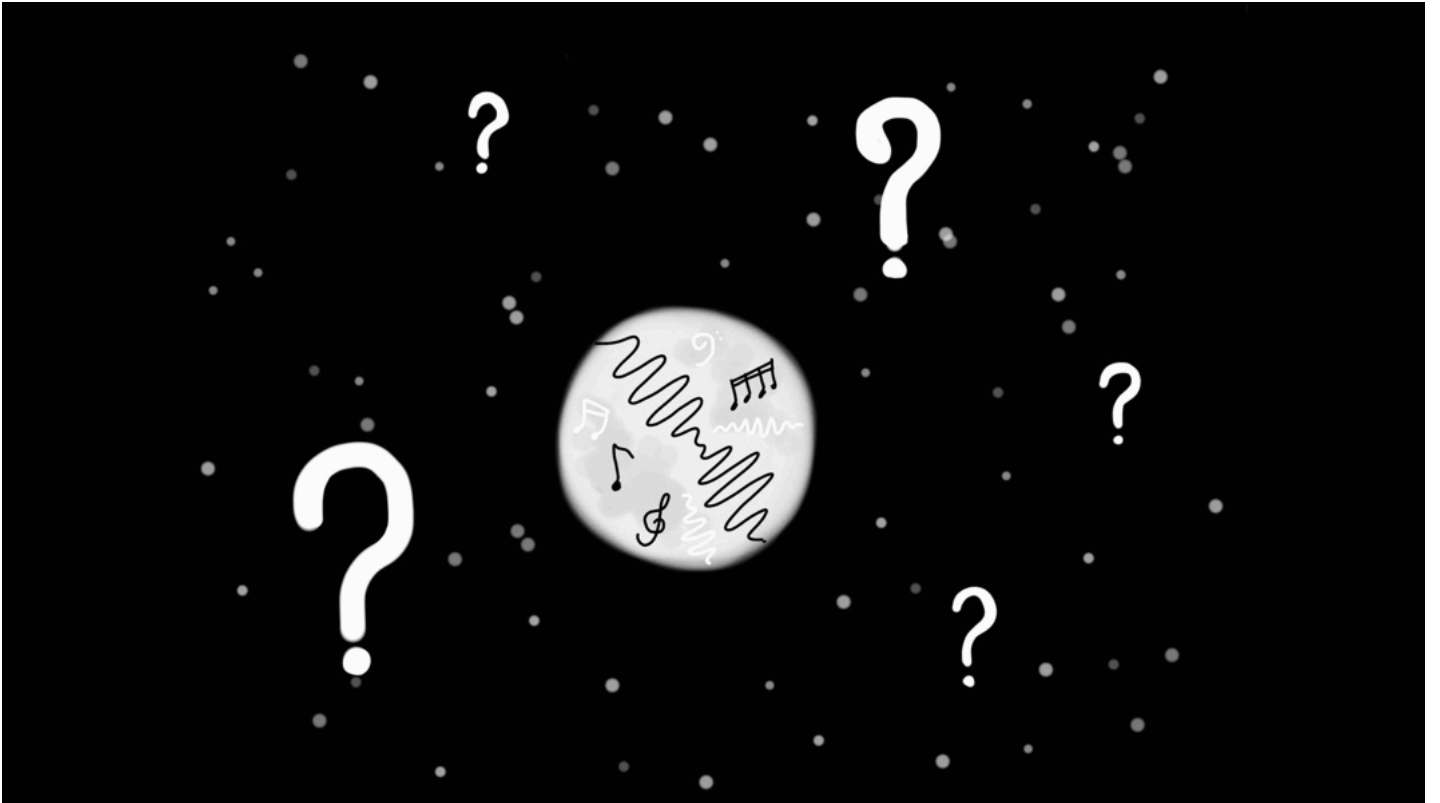
Stars



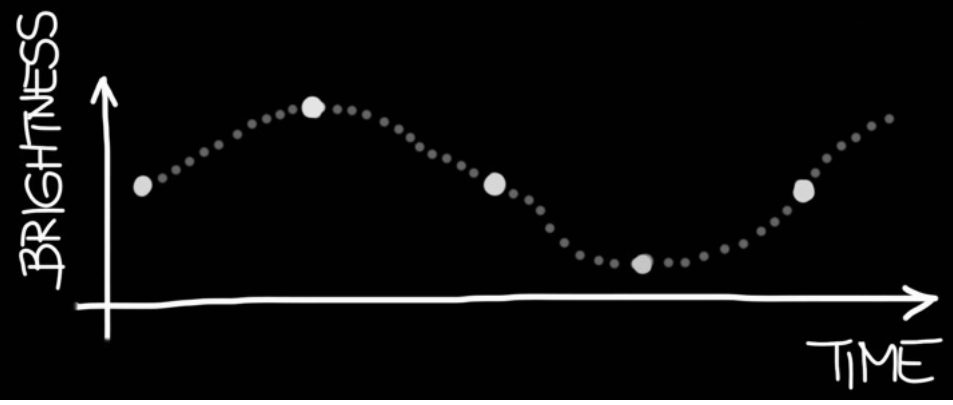
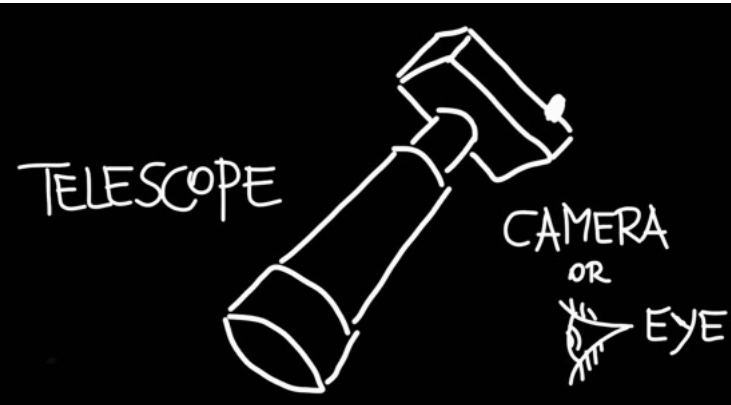
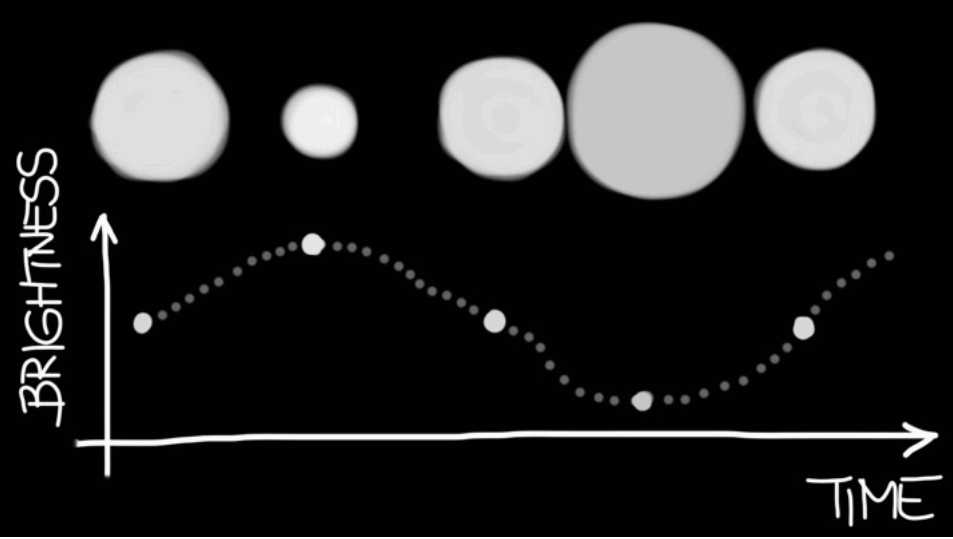
Stars



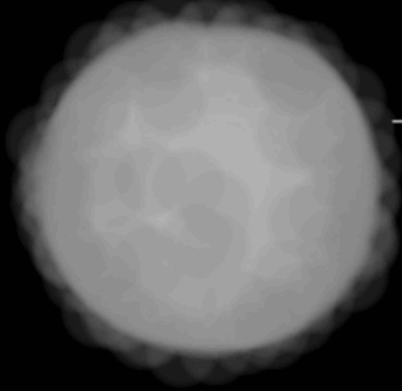




Seeing Stars Sing

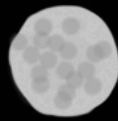


Big,
fluffy
star



LOW PITCH

Small, dense
star



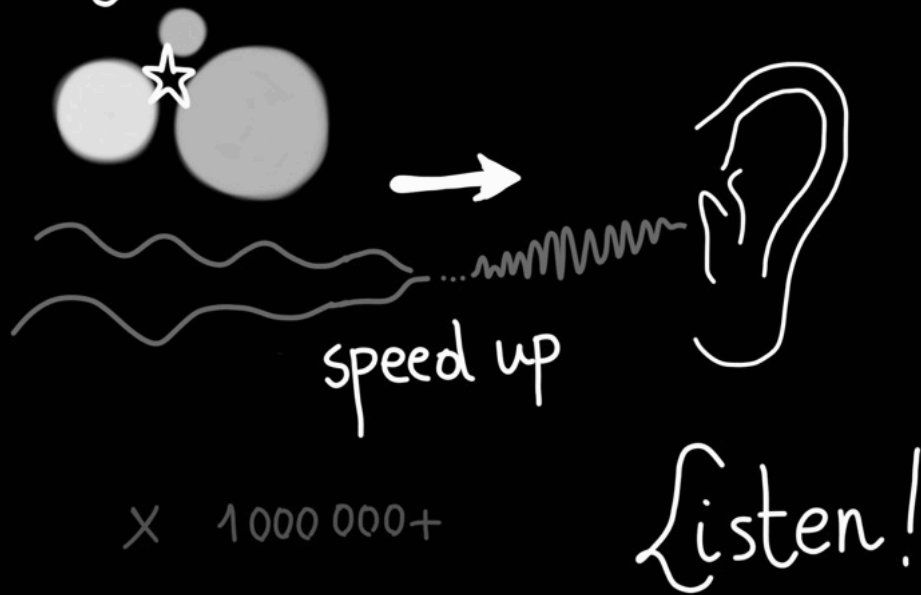
HIGHER PITCH

Humans



20-20000 / second

Stellar Sound



How to Sonify?

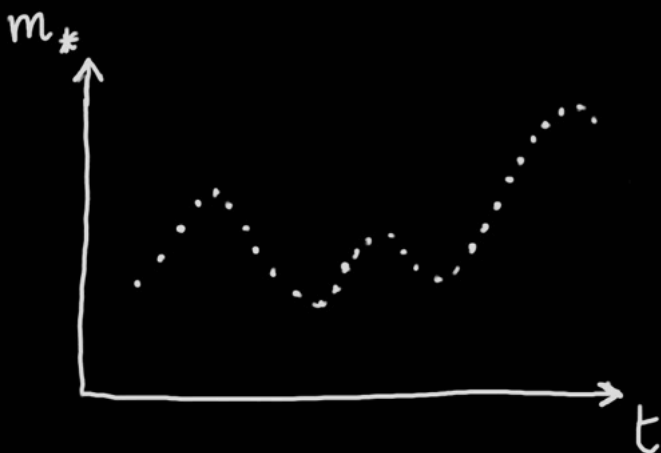
How to Sonify?

Time Domain

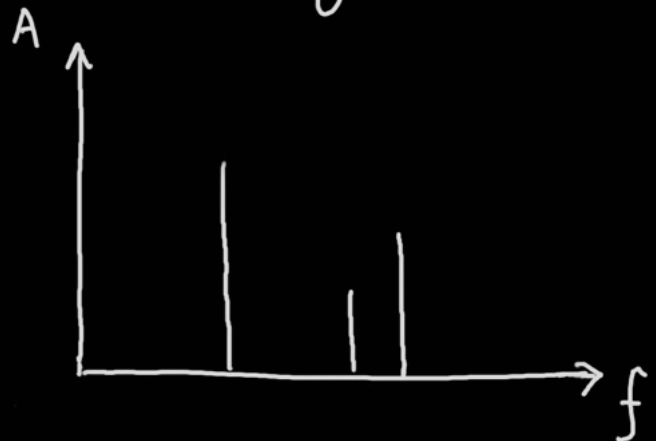


How to Sonify?

Time Domain



Frequency Domain



How to Sonify?

Time Domain

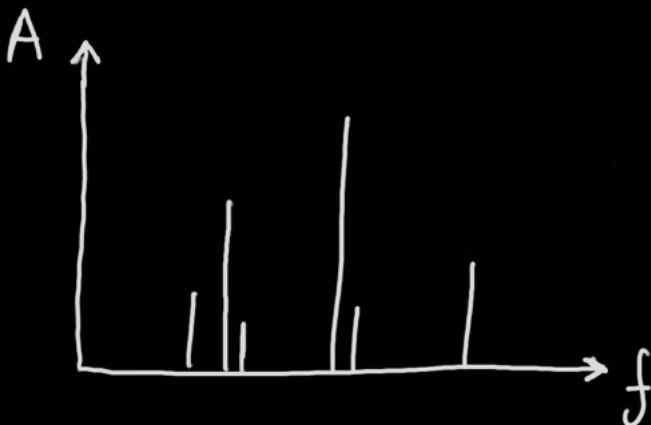


Frequency Domain



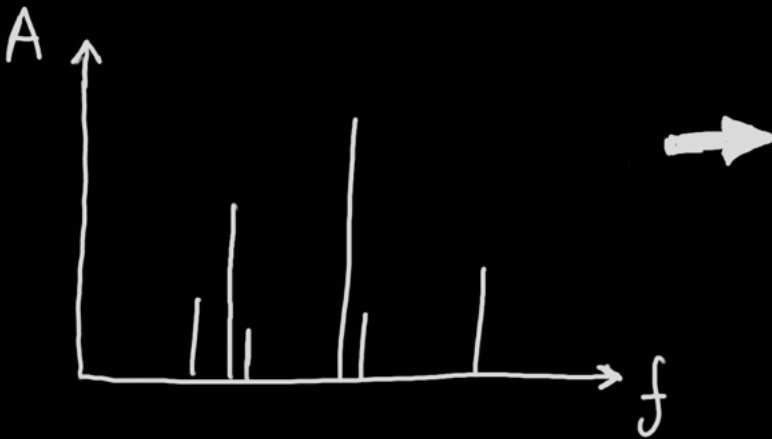
How to Sonify?

Frequency Domain



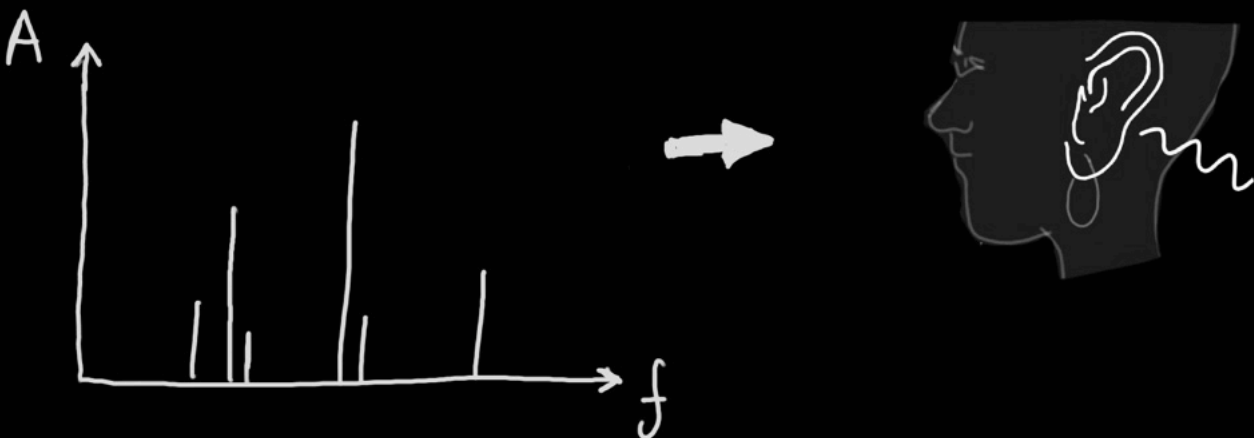
How to Sonify?

Frequency Domain



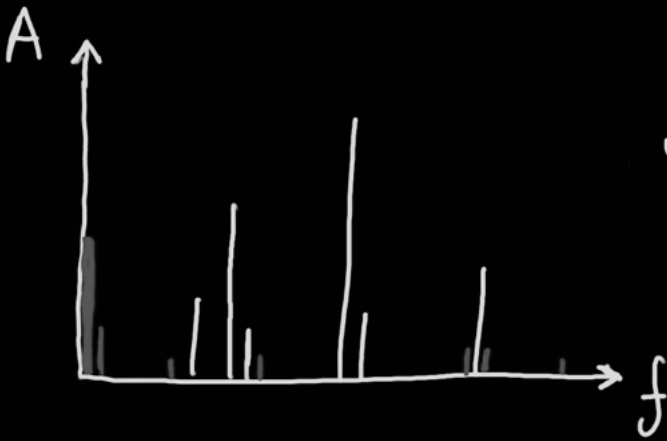
How to Sonify?

Frequency Domain



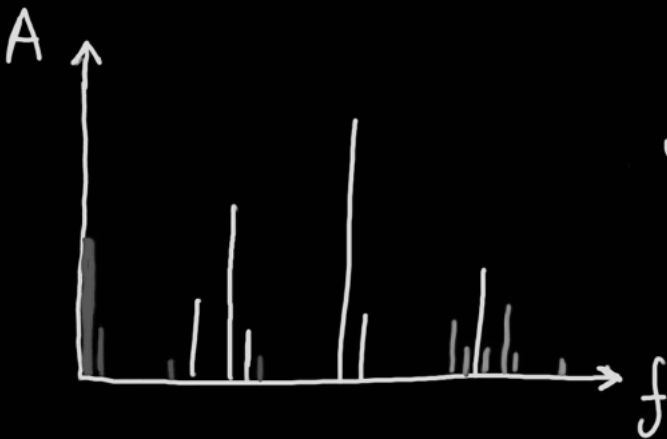
How to Sonify?

Frequency Domain



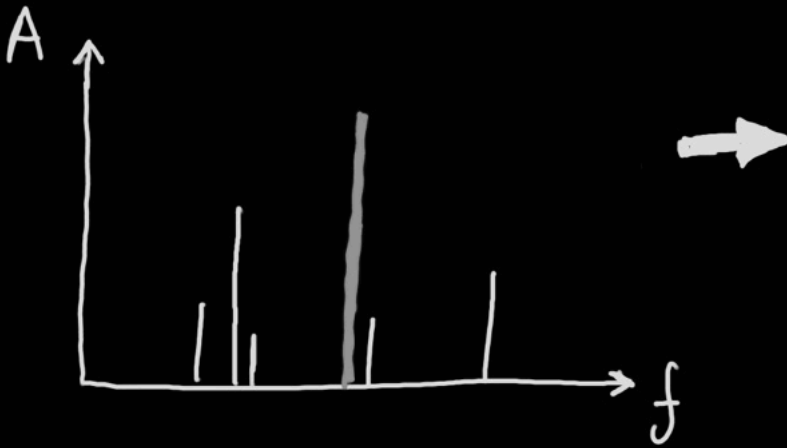
How to Sonify?

Frequency Domain

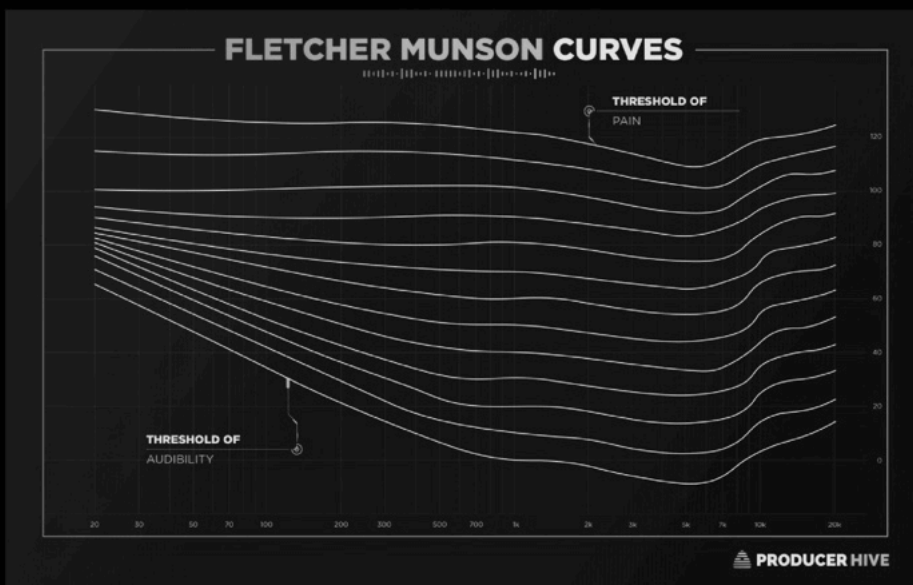


How to Sonify?

Frequency Domain

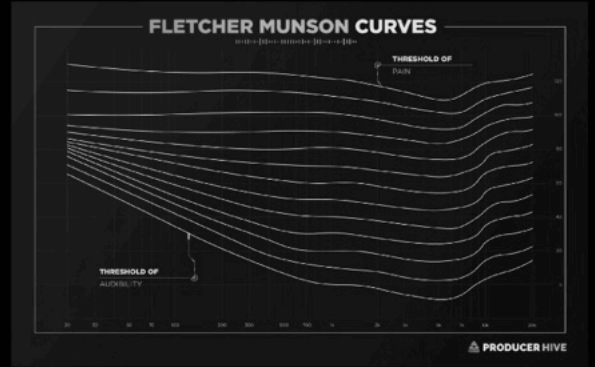
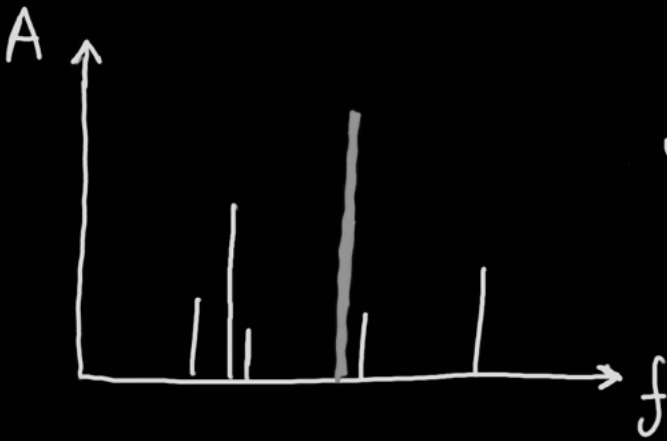


How to Sonify?



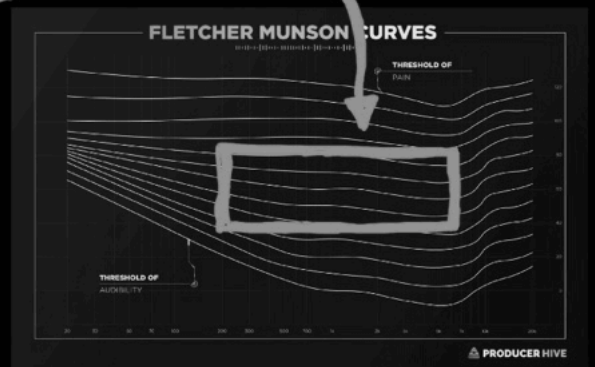
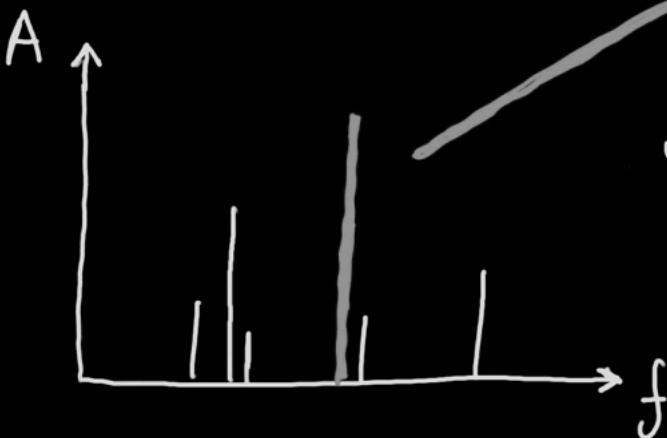
How to Sonify?

Frequency Domain



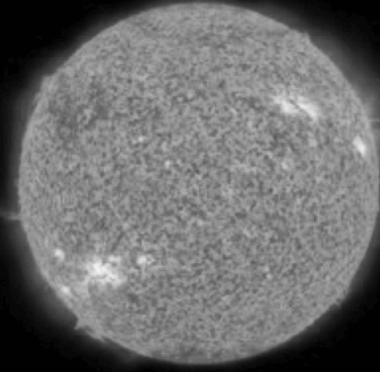
How to Sonify?

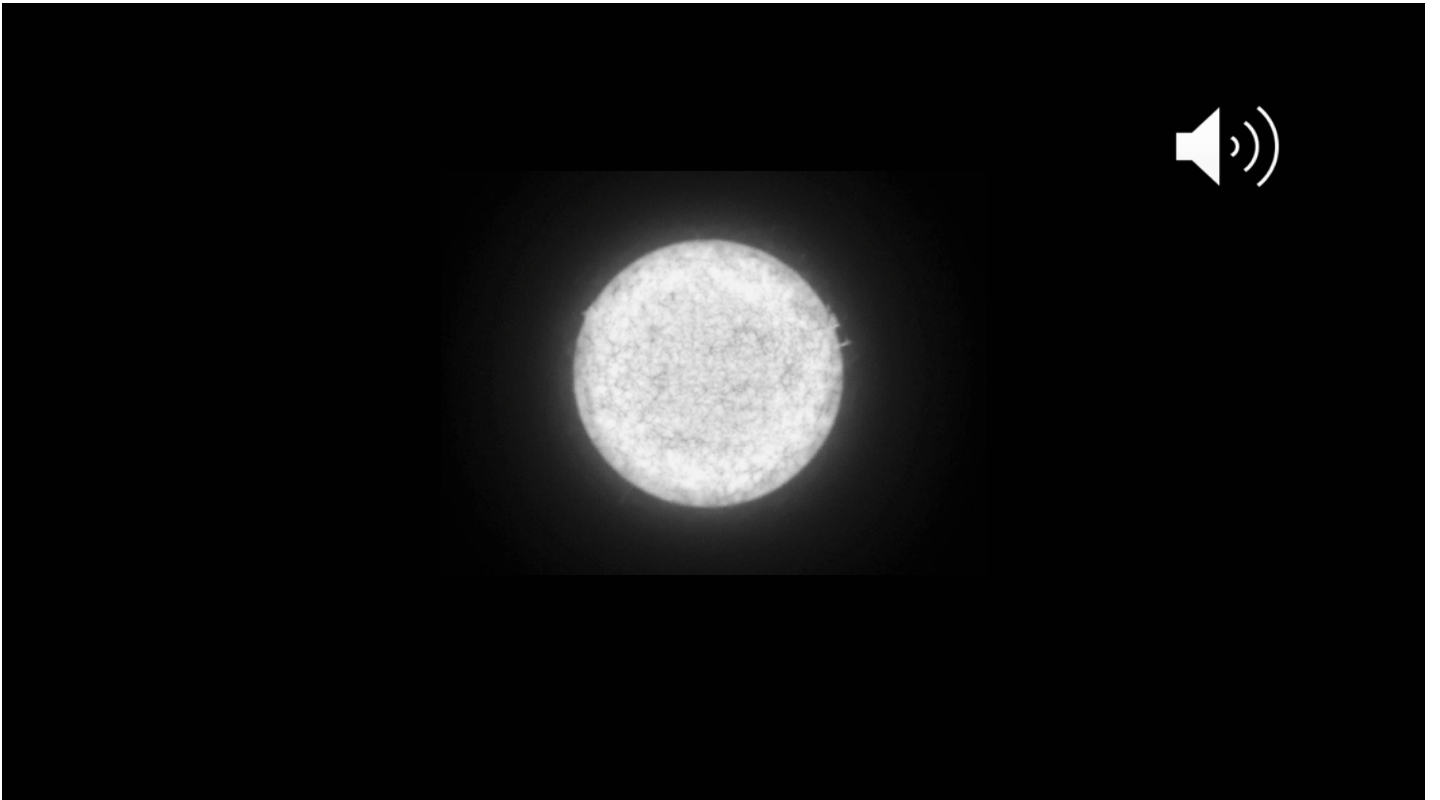
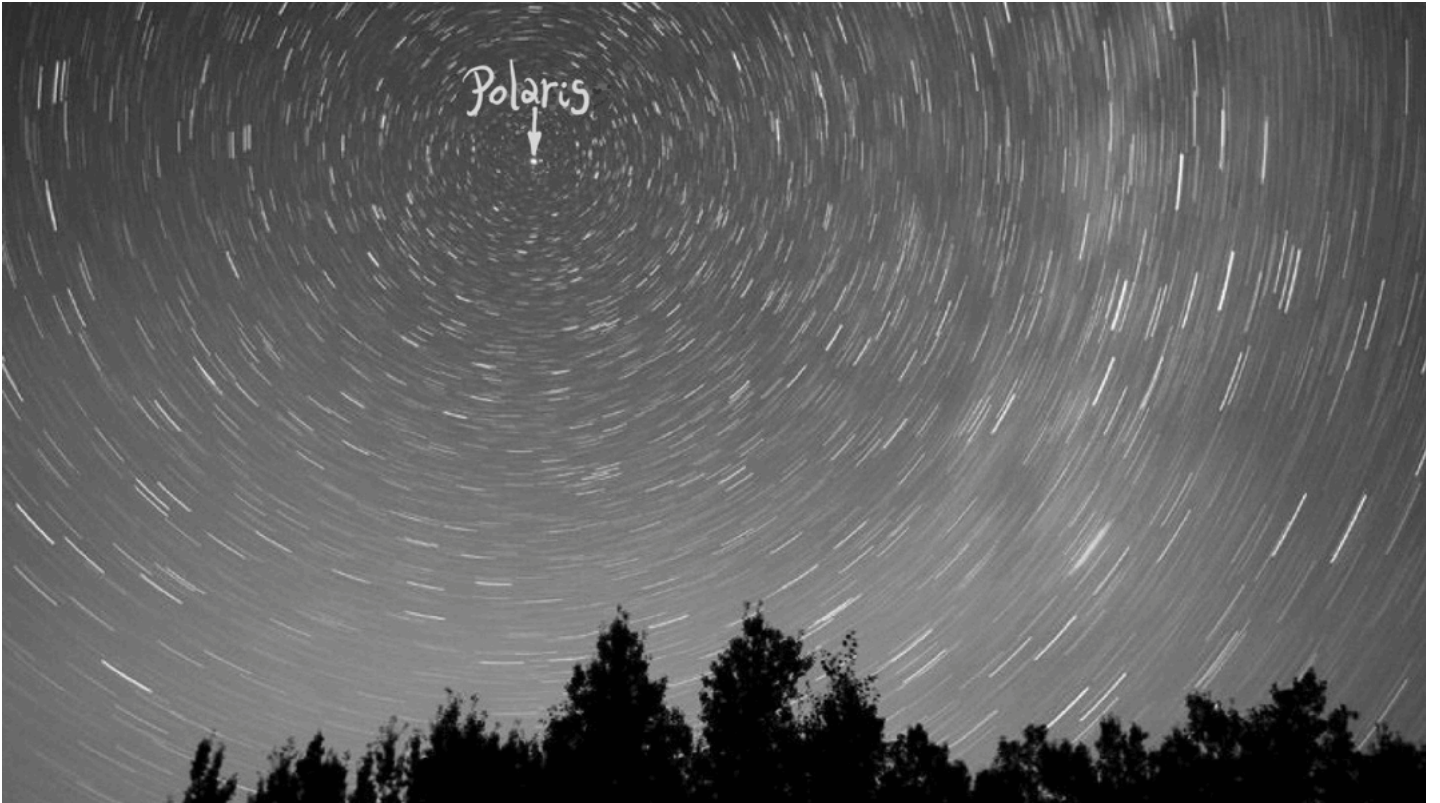
Frequency Domain





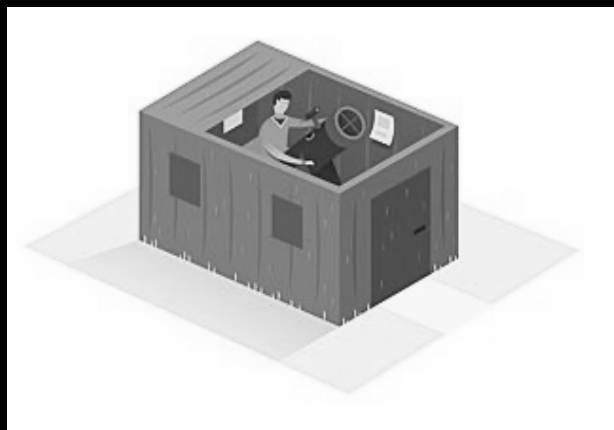
Sun











<https://www.iau.org/public/themes/citizen-science-projects/>



<https://www.iau.org/public/themes/citizen-science-projects/>



AstroSounds

Listen to the stars!

Start: 20/01/2020 - End 31/08/2023



AstroSounds

www.astrosounds.be



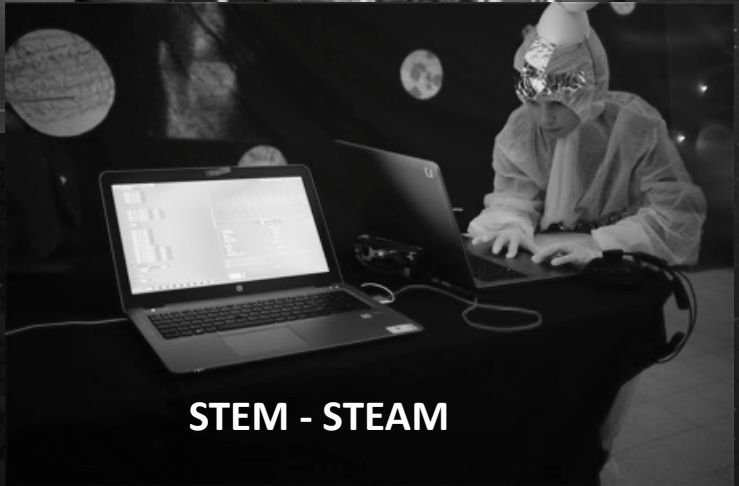
Astro Sounds

ASTROSOUNDS
- LUISTER NAAR DE STERREN!

05:21



SDG 4, SDG 5, SDG 9, SDG 17 (met icons)



STEM - STEAM

Timbreherkenning - AstroSounds

* Required

1. luisterfragment *
(1 Point)

Select your answer

2. luisterfragment *
(1 Point)

Select your answer

3. luisterfragment *
(1 Point)

Select your answer

Experiments

App / online

Luister eens 1

Hier zie je 4 verschillende personen die dezelfde zin zeggen. Kan je ze van elkaar onderscheiden?

Klik op ledere foto en luister goed, je mag ledere persoon zoveel beluisteren als je wilt. Het is de bedoeling dat je hierna de juiste stem met de juiste persoon kan verbinden.

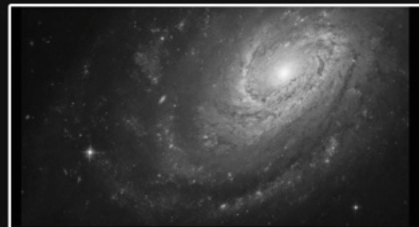


Denk je bovenstaande stemmen van elkaar te kunnen onderscheiden?

[Bewijs het in ~ Test Jezelf !!](#)

Sterteaser

Klik op onderstaande afbeelding



Ditmaal hoor je een RR Lyrae, heel anders dan de vorige toch? Je zal snel nog meer over RR Lyrae te weten komen, nog even geduld!

Na deze instrumentale inleiding, richten we onze blik op de mens. Mensen van elkaar onderscheiden lijkt je makkelijker dan instrumenten? Wie weet... De gemiddelde mens herkent 5000 gezichten! Maar kunnen jouw oren ook de juiste stem linken aan het juiste gezicht?

[Ga verder met de "Vocale Training"](#).


Oorwarmers

Luister eens 1
 - Test jezelf 1
 Luister eens 2
 - Test jezelf 2
 Luister eens 3
 - Test jezelf 3
 Luister eens 4
 - Test jezelf 4
 Quiz
 Startlesser

Aan het begin van deze luisterervaring willen we weten hoe goed je verschillende instrumenten kan herkennen. Sommige instrumenten zullen moeilijker zijn, geen probleem! Daar werken we later aan. Nu bepalen we jouw startpunt.

Vervolgdig de quiz hieronder.

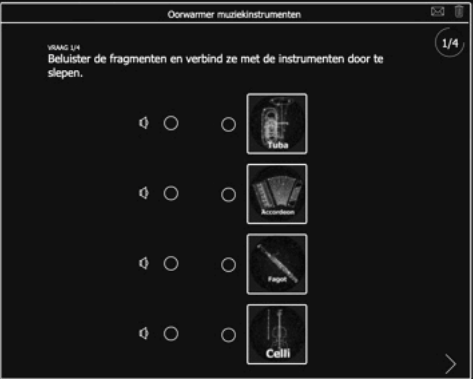
Klik op het "audio-icoontje" en luister naar de fragmenten. Sleep de cirkels van links naar de cirkels voor de juiste instrumenten, zoals op onderstaande foto. Aanpassen kan door de lijn opnieuw te trekken van links naar rechts.




Gebruik het pijtje onderaan rechts om verder te gaan.

Oorwarmer muziekinstrumenten 1/4

VRAG 1/4
 Beluister de fragmenten en verbind ze met de instrumenten door te slepen.



Ga verder naar "Luister eens 1"



Oorwarmers

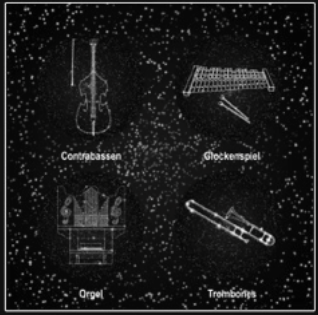
Luister eens 1
 - Test jezelf 1
 Luister eens 2
 - Test jezelf 2
 Luister eens 3
 - Test jezelf 3
 Luister eens 4
 - Test jezelf 4
 Quiz
 Startlesser

Luister eens naar instrumenten 4

Welkom op training 4. Na dit level veranderen we van decor. Maak je klaar en veert succes!

Klik op een instrument om de te beluisteren. Luister naar alle 4 de instrumenten. Je mag ieder instrument zo vaak als je wilt beluisteren totdat je denkt ze goed van elkaar te kunnen onderscheiden.

Zodra je zeker bent, mag je verder naar onder om je kennis te testen.



Ben je klaar voor meer? Test jezelf 4 in de laatste oefening van de geroerde instrumenten, ga ervoor! Klik op het tabblad 'Oefeningen', of op de link.

Ga verder in Test jezelf 4

ISTEM

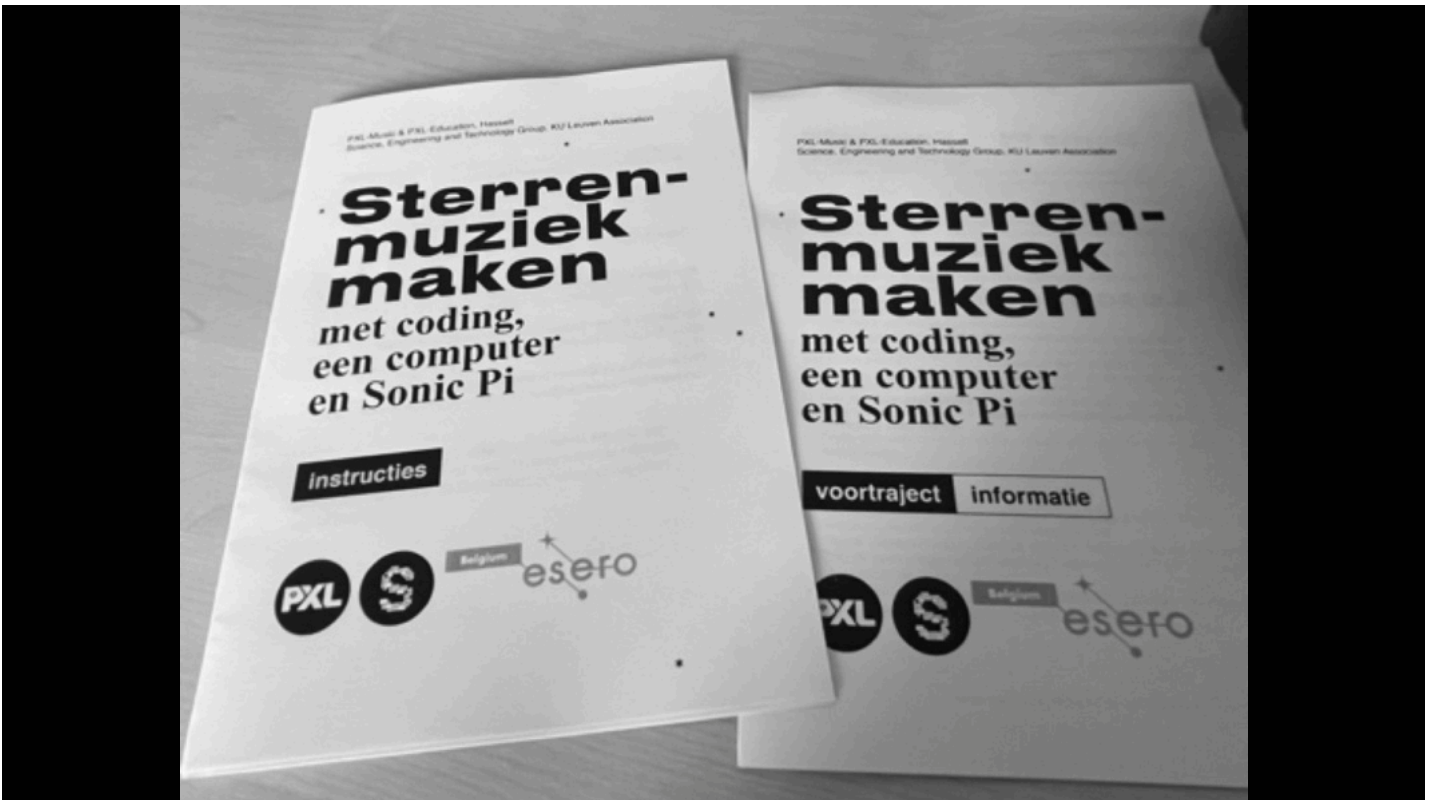
STEM voor Leerkrachten

SDG 4, SDG 5, SDG 9, SDG 17

Belgium **esero**

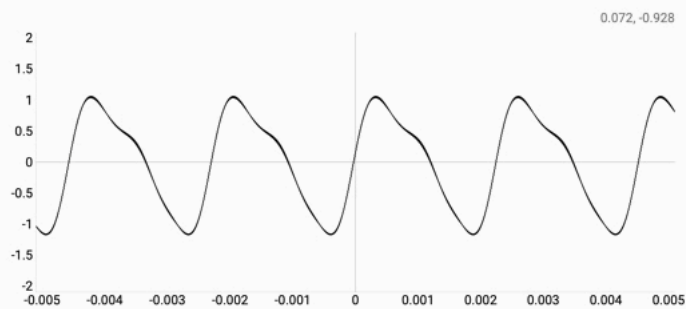


STEM - STEAM

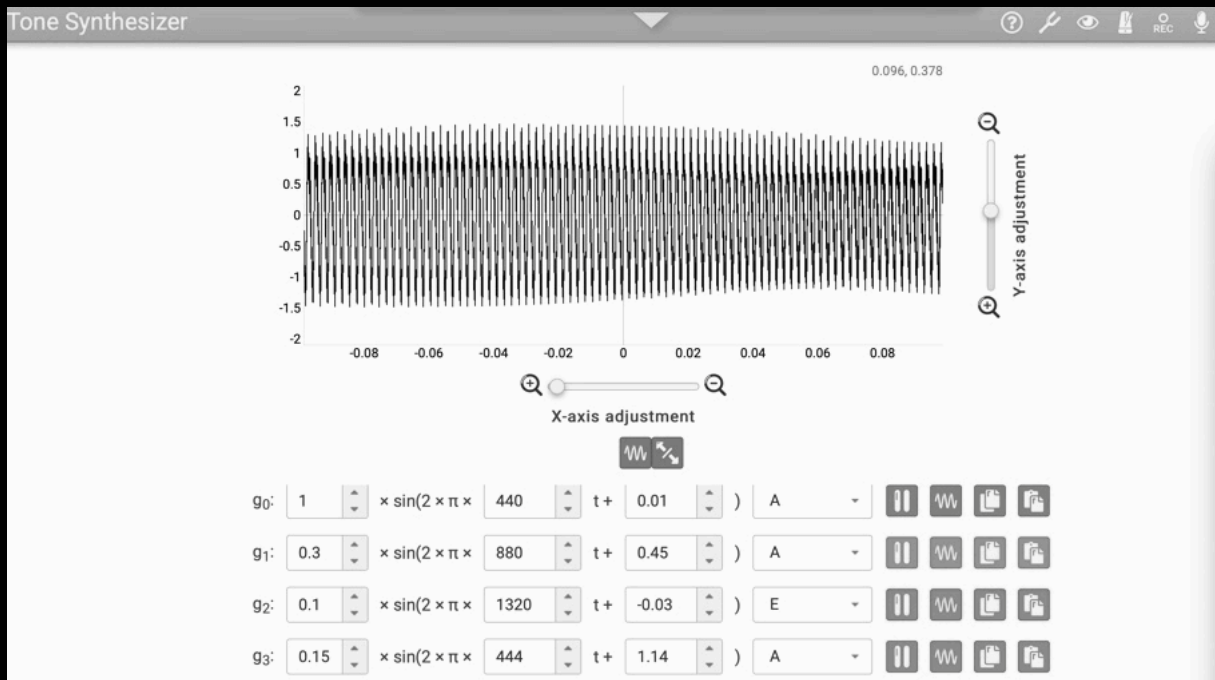




Music, a smarter way to learn math and science



- | | | | | | | | | | | | |
|------------------|------|---------------|------|-----|-------|---|---|--|--|--|--|
| g ₀ : | 1 | × sin(2 × π × | 440 | t + | 0.01 |) | A | | | | |
| g ₁ : | 0.3 | × sin(2 × π × | 880 | t + | 0.45 |) | A | | | | |
| g ₂ : | 0.1 | × sin(2 × π × | 1320 | t + | -0.03 |) | E | | | | |
| g ₃ : | 0.02 | × sin(2 × π × | 1760 | t + | 1.31 |) | A | | | | |



Sonic Pi

Experience the sound of code.

Sonic Pi is your free code-based music creation and performance tool.

Powerful for professional musicians and DJs.

Expressive for composition and performance.

Accessible for blind and partially sighted people.

Simple for computing and music lessons.

Learn to code creatively by composing or performing **music** in an incredible range of styles from **Classical & Jazz** to **Hip hop & EDM**.

Free for everyone with a friendly tutorial.

Brought to you by Sam Aaron and the Sonic Pi Core Team.

Windows

macOS

Raspberry Pi OS





https://hogeschoolpxl.eu.qualtrics.com/jfe/form/SV_bDZ1WbmDbUvcVqC

Welcome.

This questionnaire aims to understand how people describe unfamiliar sounds resulting from data sonification.

You will hear four different sounds and will be asked eight questions. The questionnaire typically takes 5 to 10 minutes.

All the data is anonymized, and its use is restricted for this purpose only. For more information, please get in touch via Frank.Duchene at tuni.fi.

Please beware of the loudness of the sounds. Check the setting on your device and start with a low volume.





Inclusive Science

- Gender en STEAM – SDG5

http://www.scientix.eu/documents/10137/752677/Scientix-SPNE12-Gender-Innovation-STEAM_Final.pdf/e907b19e-0863-4502-a396-9ad6a5184be0

Gender and Innovation in STEAM Innovation

- STEM and its effectiveness for education: – SDG4

Students' engagement in different STEM learning environments: integrated STEM education as promising practice?

May 2019

[International Journal of Science Education](#) 41(2):1-21

DOI:[10.1080/09500693.2019.1607983](https://doi.org/10.1080/09500693.2019.1607983)

Projects: [STEM@school](#)

- Inclusive astronomy: event in Planetarium (April 2019) – precursor AstroSounds – SDG10

Inspiring Stars Initiative

<https://sites.google.com/oao.iau.org/inspiringstars>

<https://www.iau.org/public/images/detail/KH9A2391-180822-CC/>

<https://www.iau-100.org/inspiring-stars>

- SDG9: Power of sonification <http://theses.gla.ac.uk/5804/1/2014DiazMercedPHD.pdf>

Sound for the exploration of space physics data, PhD thesis Wanda Diaz Merced

Astro Sounds

www.astrosounds.be

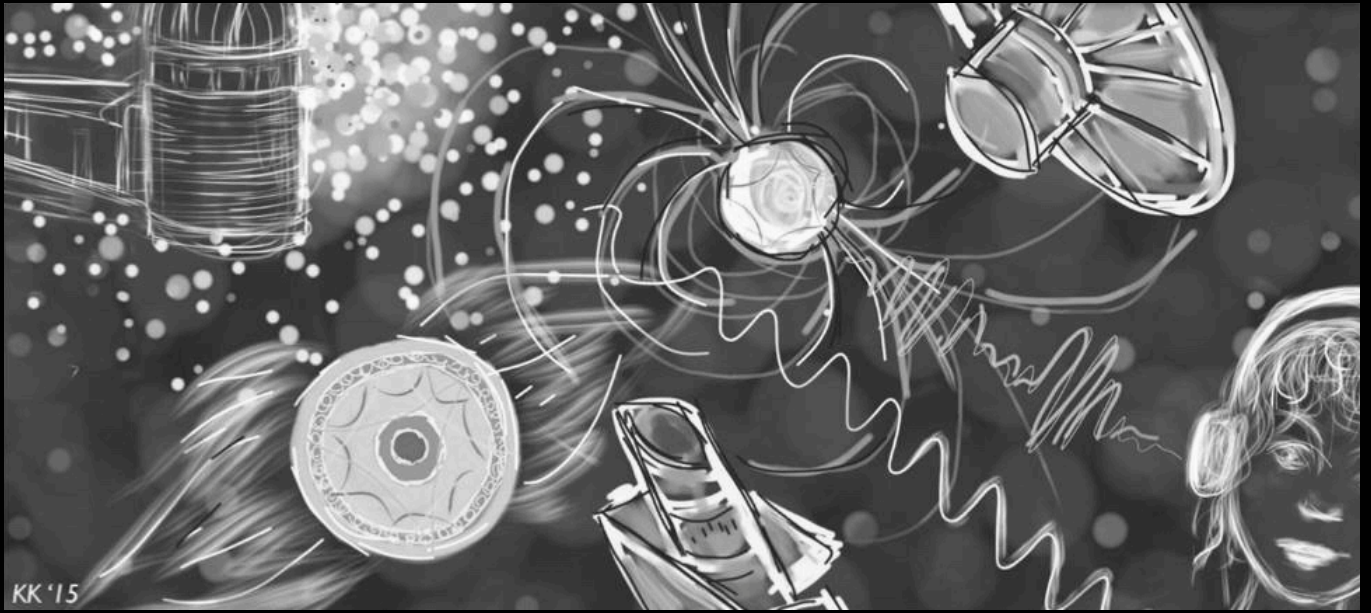
katrien.kolenberg@kuleuven.be

© FA 1981 KK

Stay Tuned!

katrien.kolenberg@kuleuven.be



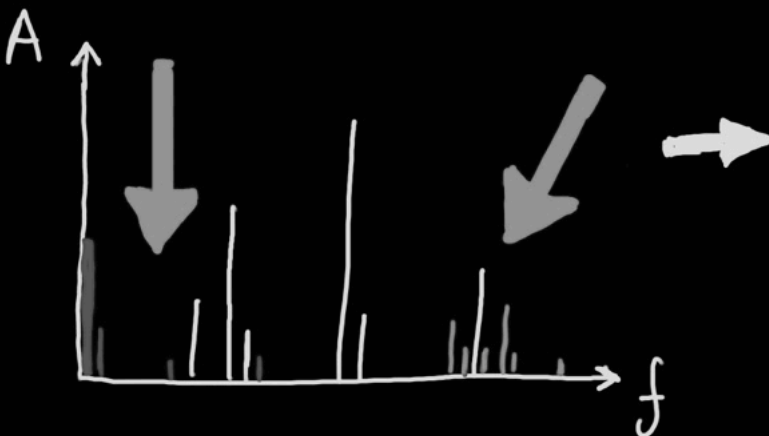


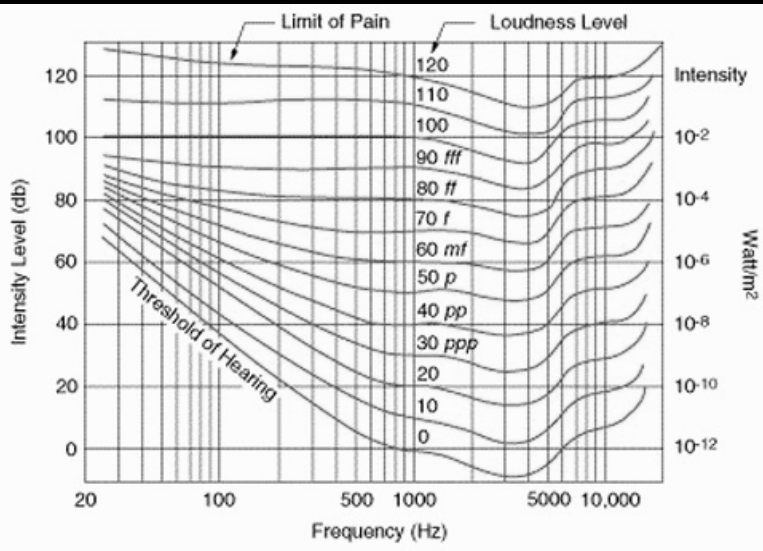
katrien.kolenberg@kuleuven.be

www.astrosounds.be/en/

Frequency Domain

Input?
Ideas?





<http://sonic.u-aizu.ac.jp/chapter2.htm>

- Fletcher-Munson curves
- Harvey Fletcher and Wilden A. Munson, and reported in a 1933 paper entitled "Loudness, its definition, measurement and calculation" in the *Journal of the Acoustical Society of America*.^[2]