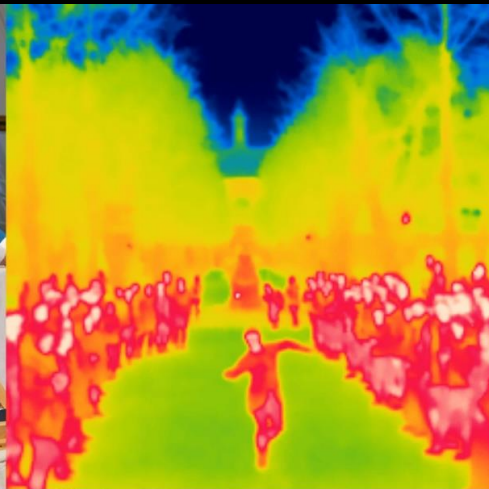


Herschel and the invisible end of the rainbow

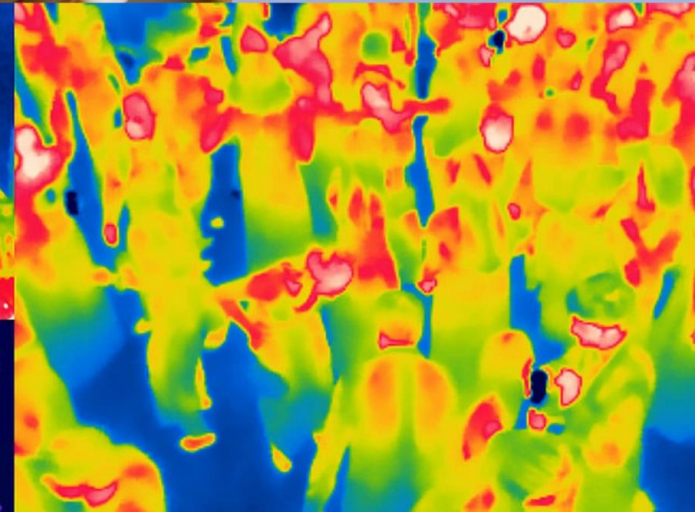
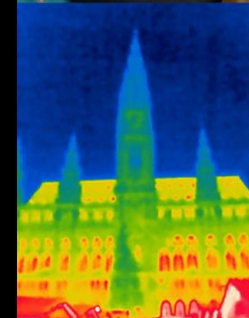
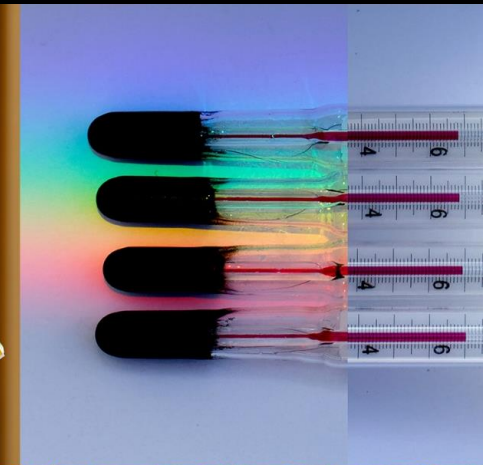


Franz Kerschbaum
&
Magdalena Brunner

 institut für
astrophysik
UNIVERSITÄTSSTERNWARTE WIEN

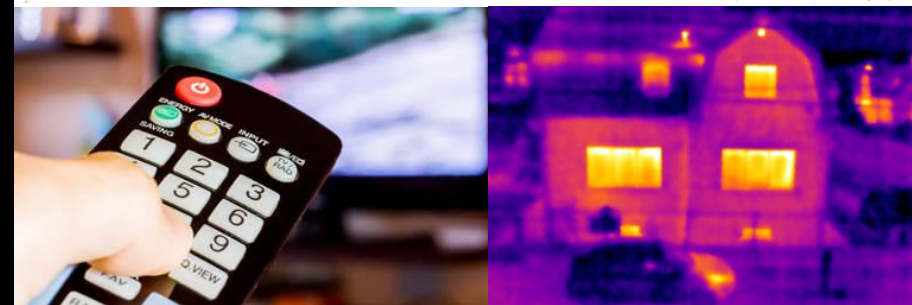
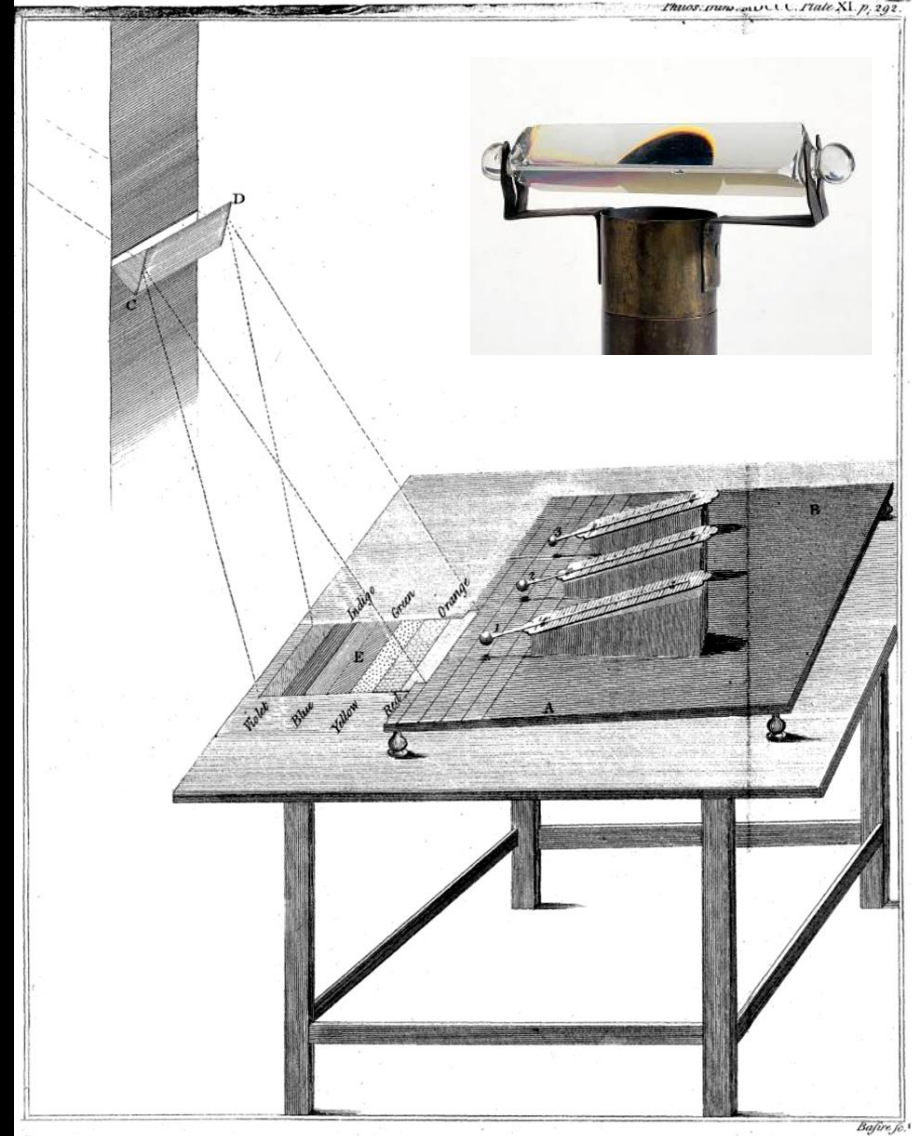
FWF

Der Wissenschaftsfonds.



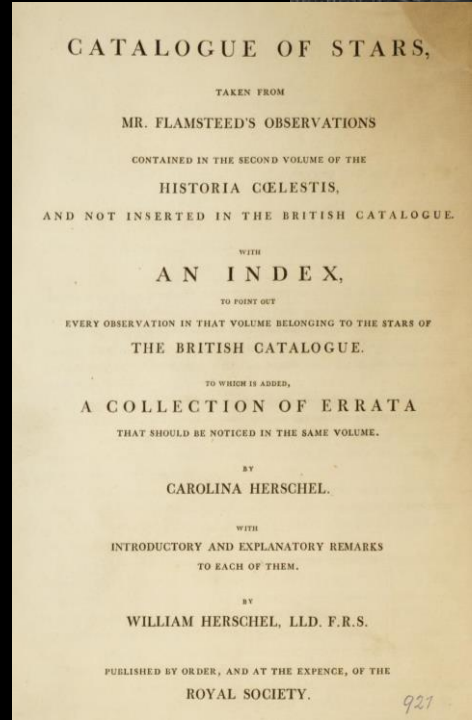
The 1800 discovery

- While studying heat and colours **William Herschel** discovered infrared radiation by chance in already 1800
- It was the first „invisible“ radiation that was not pure „magic“ but was probed in a systematic way
- Other forms of invisible light followed only much later - e.g. radio waves (1886) or X-rays (1895)
- Today infrared light is widely used for science and technology



A dream team

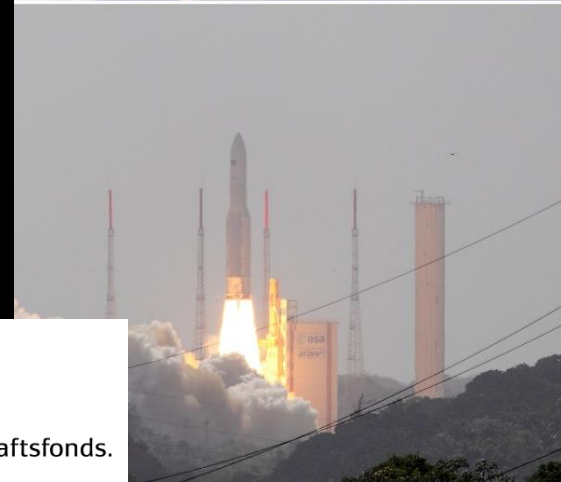
- **William Herschel** was not working alone. Over most of his career his sister **Caroline Herschel** was a congenial partner!
- Caroline started as assistant but over the years developed her own projects and published independent papers on e.g. comets, stellar clusters, nebulae or double stars
- From 1787 on she got **paid** for her work by the crown, in 1828 she received the **Gold Medal** from the RAS of which she became **honorary member** in 1835!



Our outreach project

Complement our scientific work with ESAs **Herschel** Space telescope and our technical developments for its instrument **PACS**:

- Give the historical perspective on the **original discovery** of infrared radiation
- Provide **Hands on experience** with infrared radiation and spectroscopy
- Highlight the **teamwork** of the Herschel siblings and the pioneering role of Caroline Herschel for **women in science**
- Use a wide range of means to communicate – **from art to experiment**



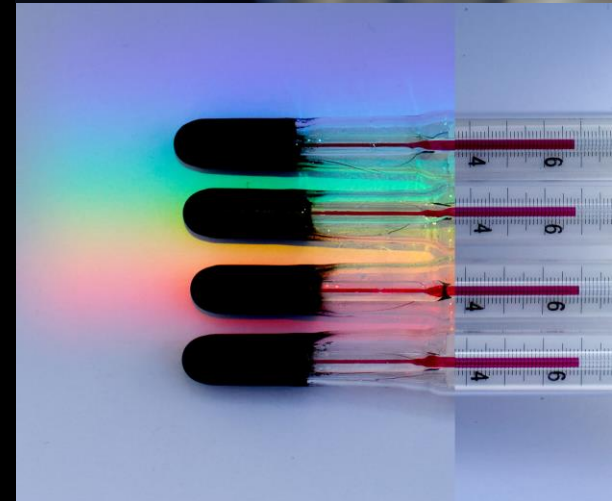
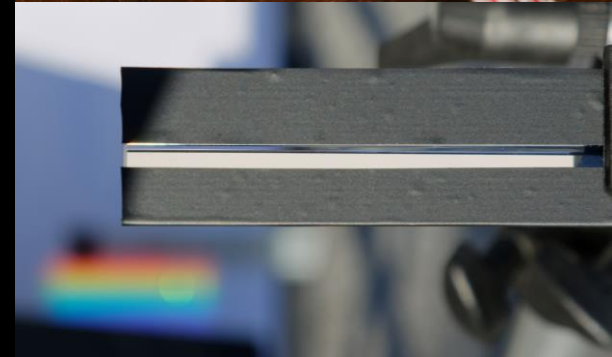
FWF

Der Wissenschaftsfonds.

The experiment

Redoing the **original Herschel experiments** was the starting point of our activities:

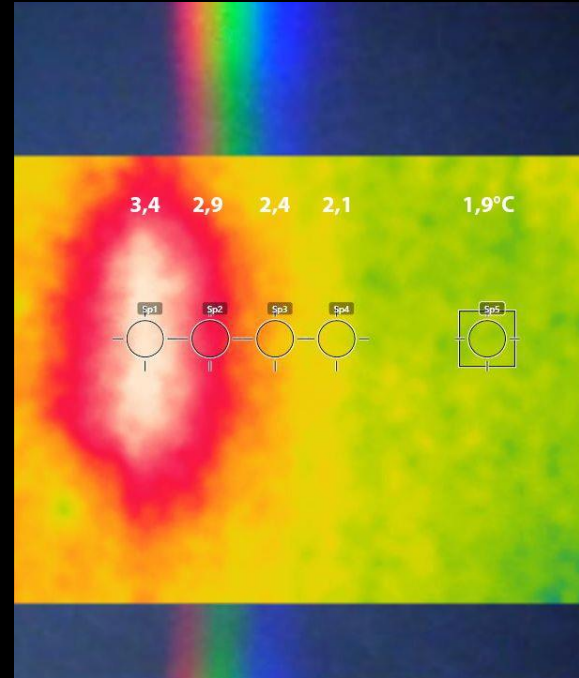
- Research on cheap and accessible materials like thermometers and prisms
- Finetuning to make it repeatable also in warmer environments
- We were actually quite impressed how the Herschels made it happen when trying to redo!
- Finally, because of its relatively tricky setup it was not used further for our give away experiments, the Aha!Boxes



Technology the Herschels were missing

Today we have other means to detect IR radiation!

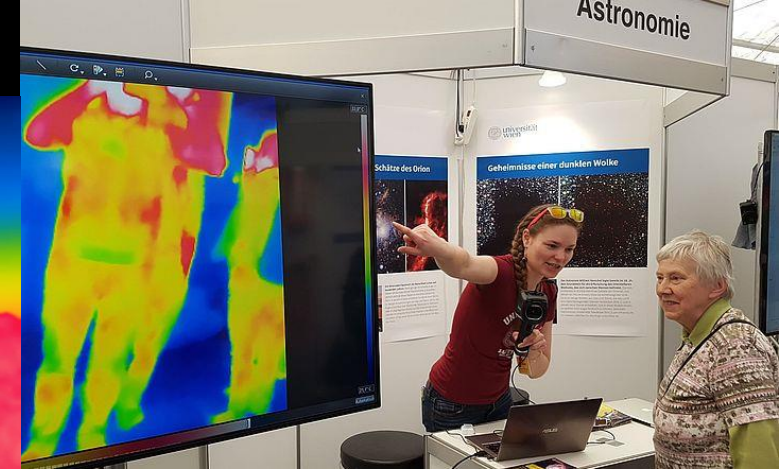
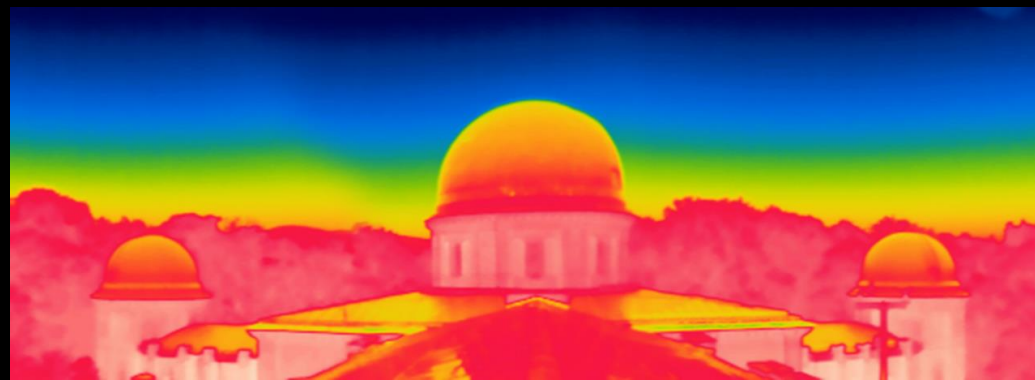
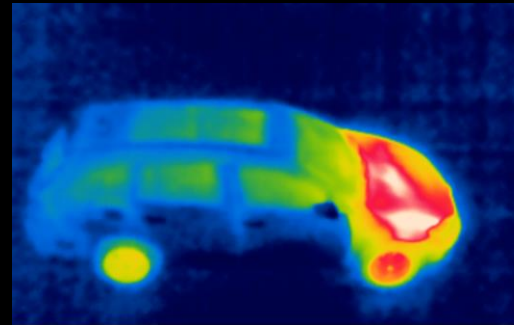
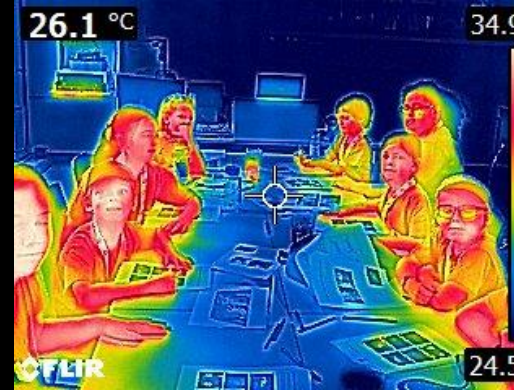
- Today the solar spectrum we used for our thermometer experiments can be simultaneously imaged in the visual and the thermal IR
- A **FLIR E8 thermal camera** was used to measure the different temperatures of black paper illuminated by a wintery solar spectrum
- An overlay of a visual image to the thermal one proves the spatial offset



The thermal world

Such a FLIR E8 thermal camera is also a perfect hands-on tool for the work with the interested public!

- It directly shows how different the world looks with thermal “eyes”
- People can experiment by themselves
- Several applications in e.g. health or for thermal insulation are easy to understand
- And it is really FUN!

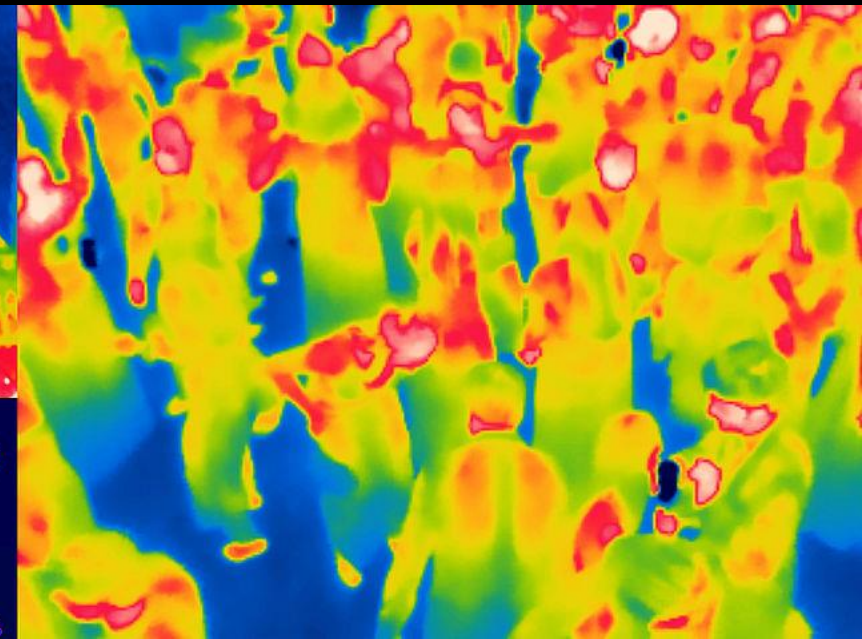
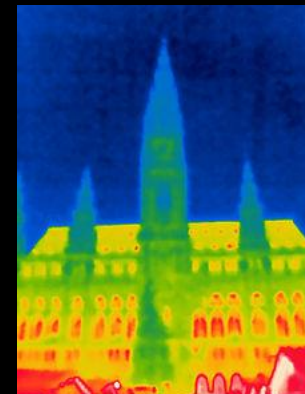
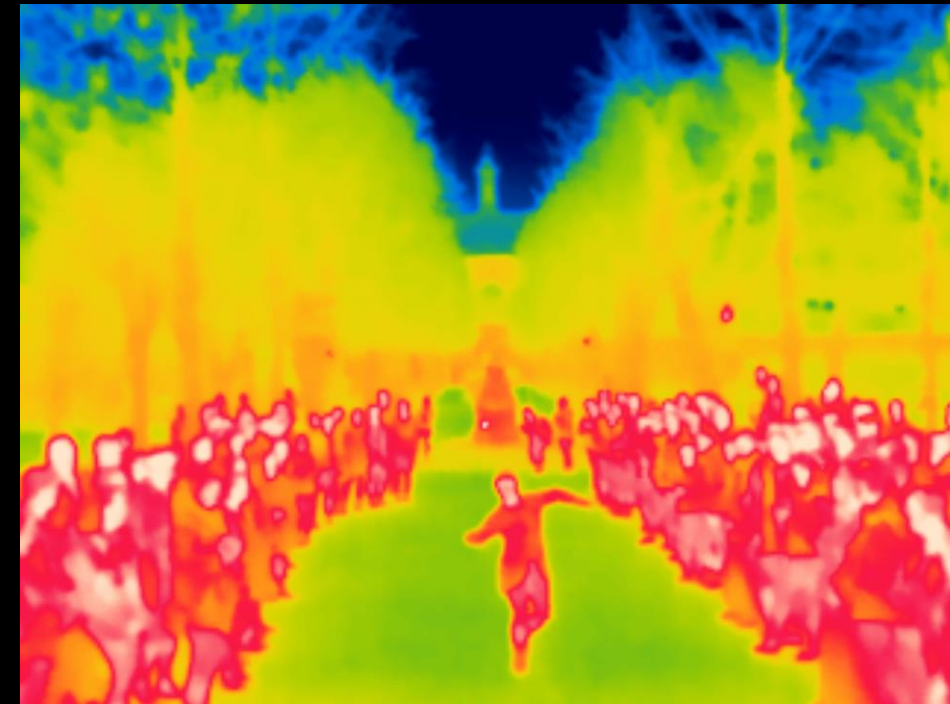


Let's dance

Our thermal camera was the “star” at several science fairs and outreach events and reached very wide audiences and media coverage

Examples:

- The **Dance for Science** event combined art and science in a moving way
- During the **Viennese Ball for Science** we streamed one of the ballrooms in infrared light and had a “hottest dancer” contest. The entertaining part was accompanied with poster displays on related science projects



Aha!Boxes

Especially for kids hands-on experiments are crucial for impactful educational contributions!

- With our own **Aha!Boxes**, small experiment packages we try to initiate experiments with light
- One can do spectroscopy, spin the colour wheel, colour cartoons, and even play “Herschel theatre”
- The free give away experiment boxes were produced together with the **Indian Manthan Educational Programme Society** in a social enterprise



Podcast and clips

Several podcasts, interviews and videoclips round up the educational program on Infrared radiation:

- Scientists speak about their research projects
- Historians highlight the societal context
- In COVID-19 home-office and home-education times we produced short feature video clips on Infrared radiation and the science and technology behind


Podcast

Der Astrophysik-Podcast „Herschel und das unsichtbare Ende des Regenbogens“ ist Teil eines Projekts zur Wissenschaftskommunikation des FWF-Projekts P 23586 „Garantiert staubig – Herschel beobachtet AGB Sterne“ unter der Leitung von Prof. Franz Kerschbaum.

Ausgangspunkt des Projekts ist die Entdeckung der Infrarotstrahlung Anfang des 19. Jahrhunderts durch William Herschel. Heute zählt die Infrarotastronomie zu den wichtigsten Forschungsansätzen der Astrophysik. In dieser 3-teiligen Interviewreihe geht es um die wissenschaftshistorischen Grundlagen der Infrarotastronomie, um aktuelle Forschungsmethoden, die Untersuchung von Exoplaneten und die Suche nach Leben im Universum.

Durchgeführt wird der Podcast von Dr. Daniel Meßner (@meszner). Er ist Historiker und arbeitet für die Universität Ham als Online-Redakteur, für die er auch den Podcast Wissenswelle produziert. Außerdem ist er an Wisspod beteiligt, ein P zur Vernetzung und Verbreitung von Wissenschaftspodcasts und er hat mit Zeitsprung einen wöchentlichen Geschichtspodcast.

Die einzelnen Episoden des Podcasts „Herschel und das unsichtbare Ende des Regenbogens“ werden im Zeitraum 2018 bis Jänner 2019 veröffentlicht.



Episoden

21.01.2018
HER05: Florian Freistetter über das Erzählen von Geschichten und Wissenschaftsvermittlung
„Die Vermittlung des Erforschten ist genauso wichtig, wie das Erforschen selbst“, meint Florian Freistetter. Der Astronom ist seit vielen Jahren als...
Mehr

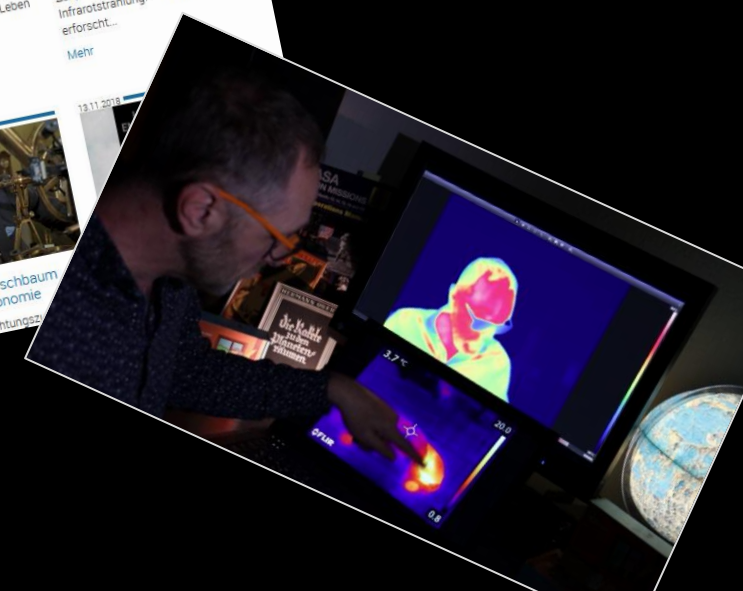
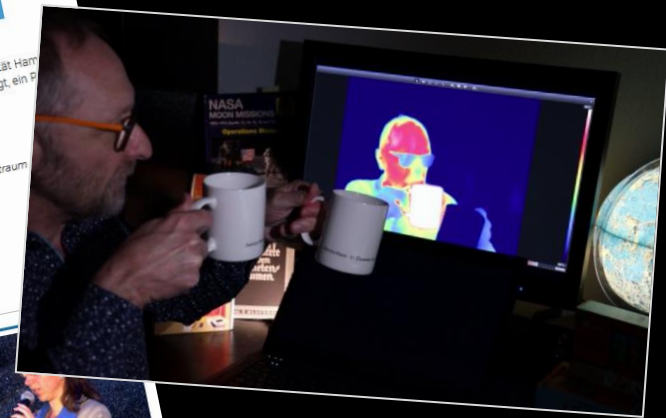
17.01.2019
HER04: Manuel Güdel über bewohnbare Planeten und Leben im Universum
In den letzten Jahren ist die Astrophysik auf der Suche nach Leben im Universum große Schritte weitergekommen. Es wurden zahlreiche Exoplaneten...
Mehr

08.01.2019
HER03: Susanne Hoffmann über Astronomiegeschichte
In dieser Folge beschäftigen wir uns mit Astronomiegeschichte und einer Zeit, lange vor Entdeckung der Infrarotstrahlung: Susanne Hoffmann erforscht...
Mehr

20.12.2018
HER02: Florian Rodler über Exoplaneten
Gibt es Leben im Universum außerhalb...
Mehr

06.12.2018
HER01: Franz Kerschbaum über Infrarotastronomie
Jeder neue Beobachtungsz...
Mehr

13.11.2018



On stage

One very special key element is our newly written theatre play where one can join the Herschel siblings during their experiments and learn about their work in an entertaining way

- Played by scientists themselves at big science fairs and exhibitions
- Accompanied by topical talks on modern IR science projects
- Hands-on with IR-Cameras
- Materials and scripts available to everybody



Visit us!

All elements of our project are documented and accessible via our web pages, both in German and English:

- Learn about the historical discovery
- Redo the critical experiments
- Watch and listen to related podcasts and interviews
- Watch, listen, and download our theatre play and its scripts
- Get our Aha!Boxes and experiment yourself

<https://space.univie.ac.at/en/projects/rainbow/>

Herschel and the invisible end of the rainbow

This Website is dedicated to the FWF science-communication project "*Herschel and the invisible end of the rainbow*". The aim of this project is to communicate knowledge about infrared radiation.

” How was infrared radiation discovered and how can we use it today in everyday life and science?

This central question is treated in a popular-scientific way with interdisciplinary approaches and alternative mediation formats.

Since the discovery of infrared radiation in 1800, human access to the invisible part of the radiation spectrum has changed dramatically. Today, the application of electromagnetic radiation outside of the field visible to our eye is relevant not only in science such as astronomy, physics, biology or chemistry, but also in many fields of medicine, history, art, and our everyday lives.

From infrared astronomy to the versatile use of thermal imaging cameras to the classic remote control that lets us operate electronic devices with the help of infrared signals - all these things are possible only through **the discovery of the invisible end of the rainbow**.

Project overview

History



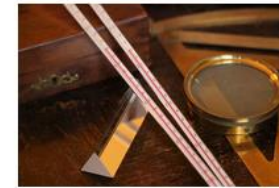
Podcast&Interviews



Theater & Audioplay



The Experiment



Aha!Boxes



Events



Downloads



Links



Videos



Projects

Ariel
Athena
BASKET
Cheops
CORDET+
Herschel
Vienna Flight OS
Plato
Rainbow
History
Podcast & Interviews
Theater & Audio play
The Experiment
Aha!Boxes
Events
Downloads
Links
Videos
Spica
Smile
Brite CoRoT Gaia Most

Contact

Institut für Astrophysik,
Türkenschanzstraße 17, 1180 Wien
T: +43-1-4277-51856
space@univie.ac.at

