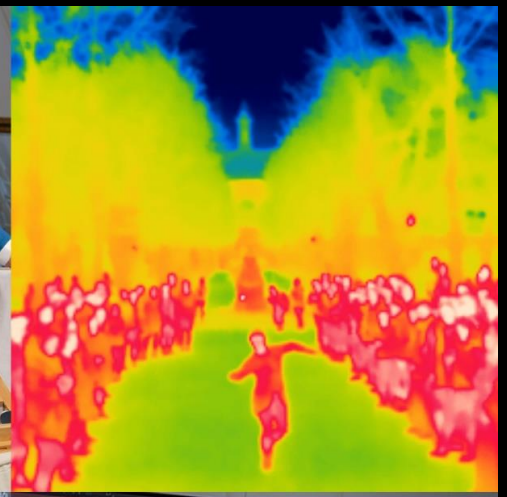
Herschel and the invisible end of the rainbow



Franz Kerschbaum

&

Magdalena Brunner

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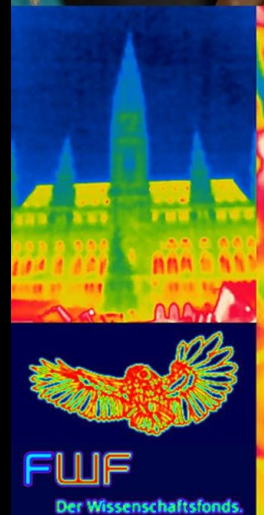
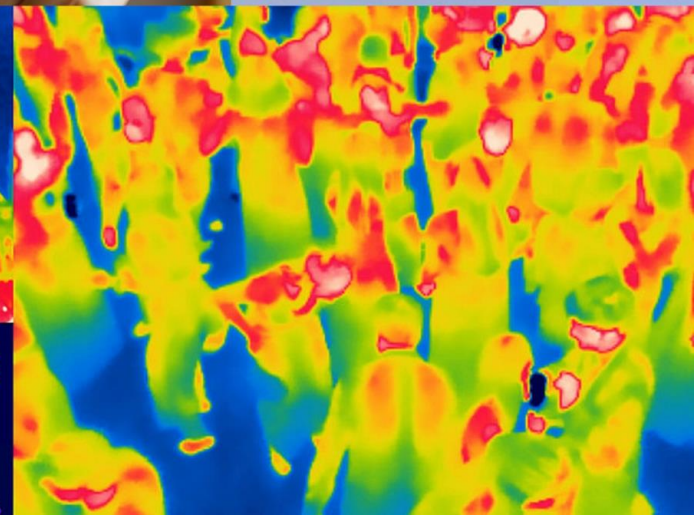
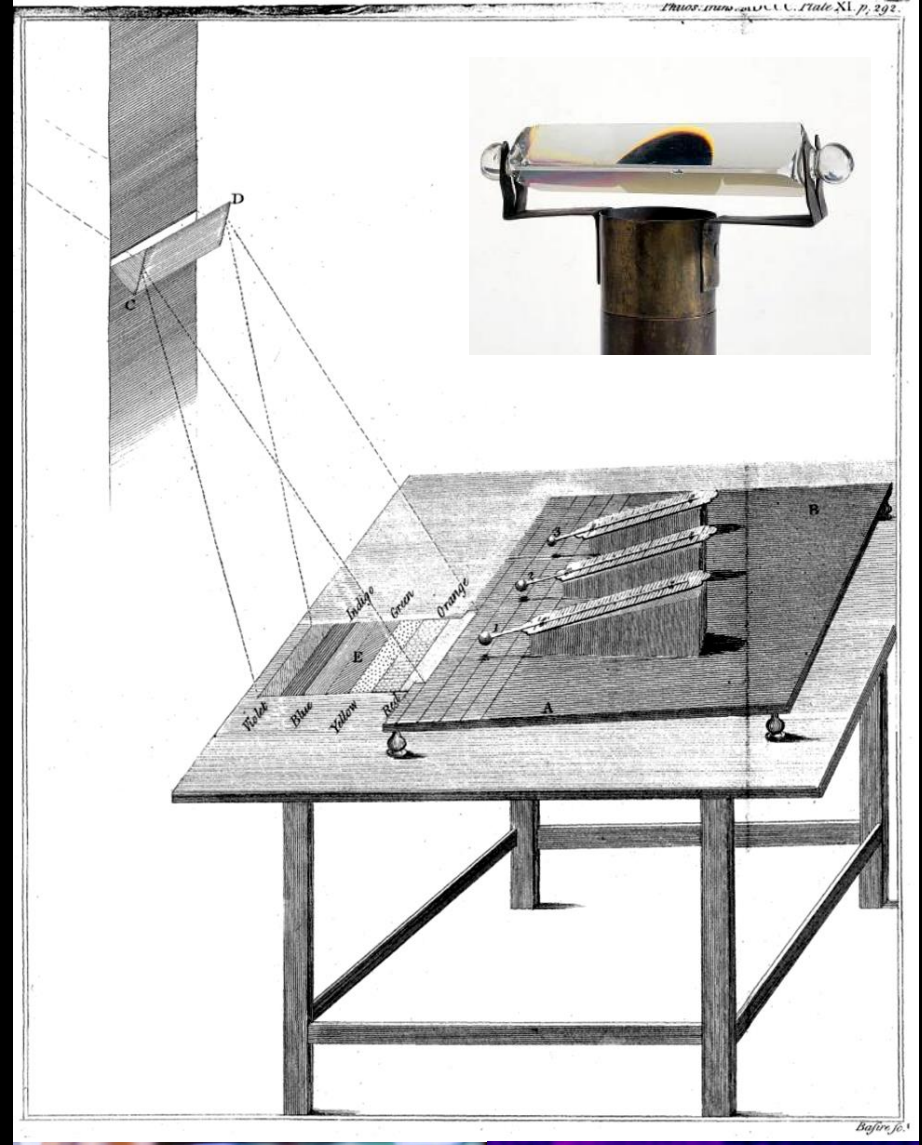
FWF
Der Wissenschaftsfonds.

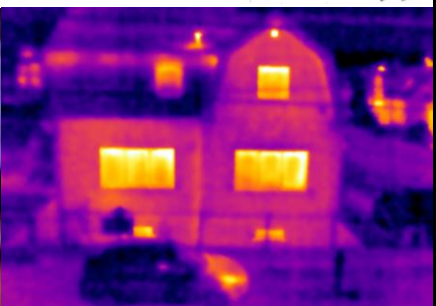




The 1800 discovery

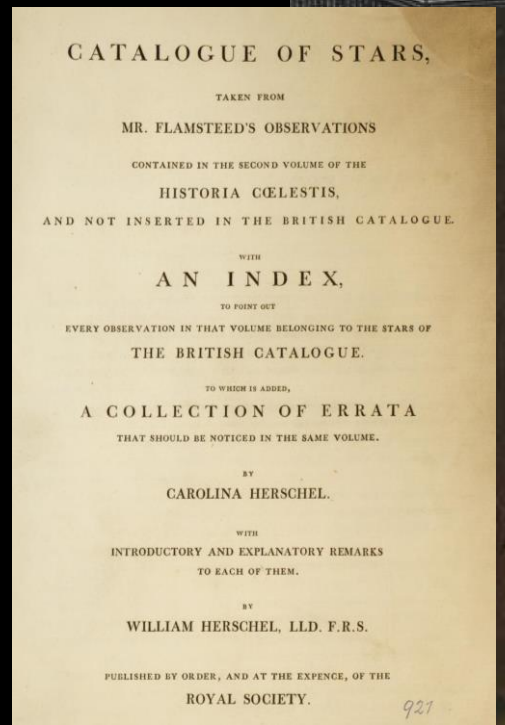
- While studying heat and colours **William Herschel** discovered infrared radiation by chance in already 1800
- It was the first „invisible“ radiation that was not pure „magic“ but was probed in a systematic way
- Other forms of invisible light followed only much later - e.g. radio waves (1886) or X-rays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



CATALOGUE OF STARS,

TAKEN FROM

MR. FLAMSTEED'S OBSERVATIONS

CONTAINED IN THE SECOND VOLUME OF THE

HISTORIA CŒLESTIS,

AND NOT INSERTED IN THE BRITISH CATALOGUE.

WITH

AN INDEX,

TO POINT OUT

EVERY OBSERVATION IN THAT VOLUME BELONGING TO THE STARS OF

THE BRITISH CATALOGUE.

TO WHICH IS ADDED,

A COLLECTION OF ERRATA

THAT SHOULD BE NOTICED IN THE SAME VOLUME.

BY

CAROLINA HERSCHEL.

WITH

INTRODUCTORY AND EXPLANATORY REMARKS

TO EACH OF THEM.

BY

WILLIAM HERSCHEL, LLD. F.R.S.

PUBLISHED BY ORDER, AND AT THE EXPENCE, OF THE

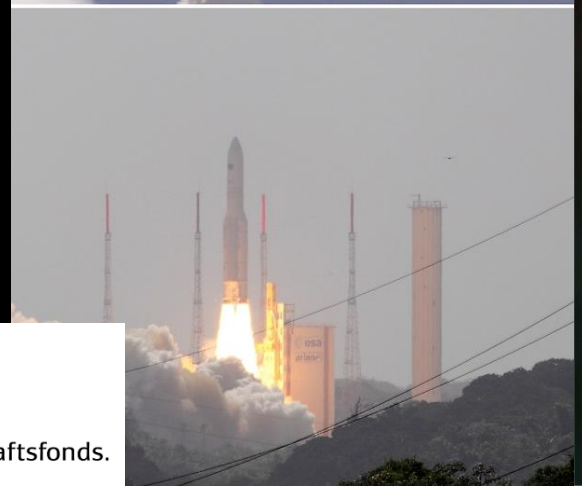
ROYAL SOCIETY.

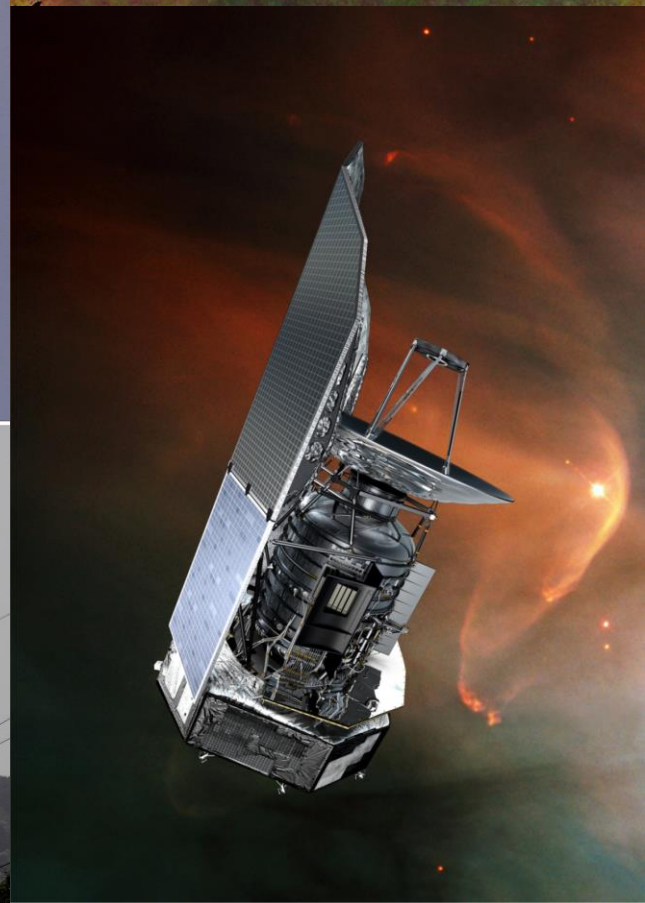
921

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**





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Der Wissenschaftsfonds.

The experiment

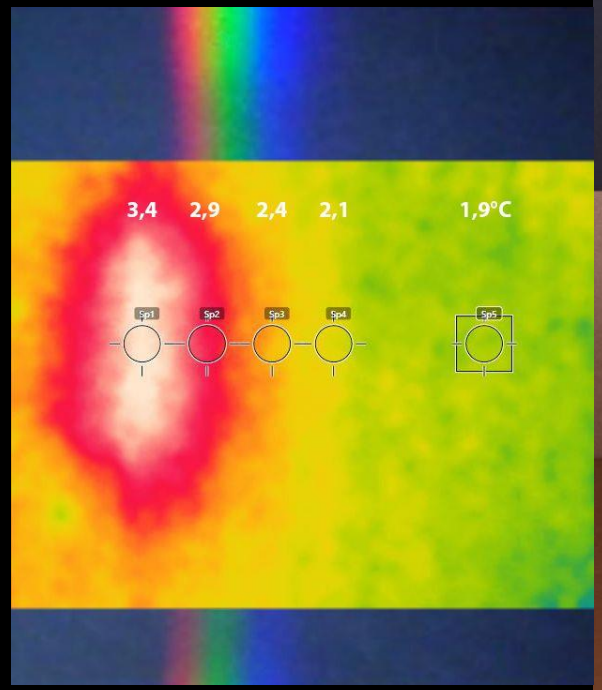
Redoing the **original Herschel experiments** was the starting point of our activities:

- 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!

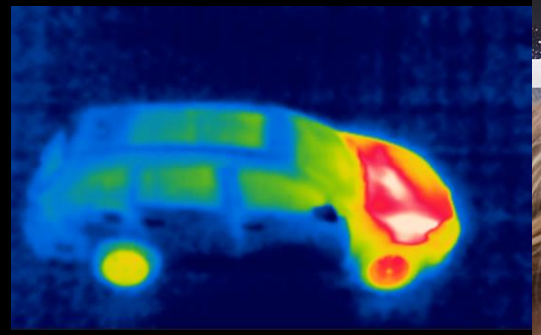
- Today the solar spectrum we used for our thermometer experiments can be simultaneously imaged in the visual and the thermal IR
- A **FLIR E8 thermal camera** was used to measure the different temperatures of black paper illuminated by a winterly solar spectrum
- An overlay of a visual image to the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

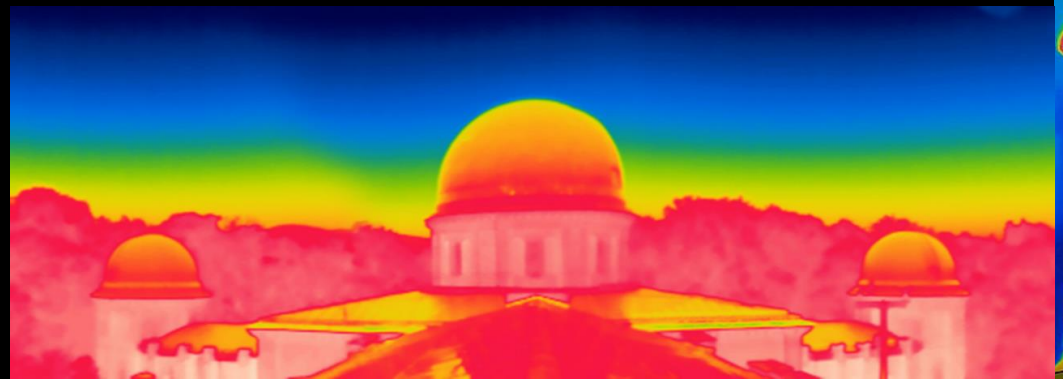


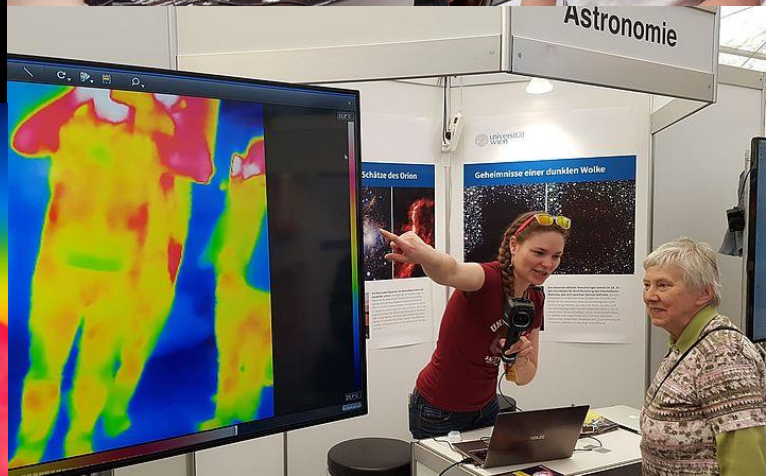
The thermal world

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!





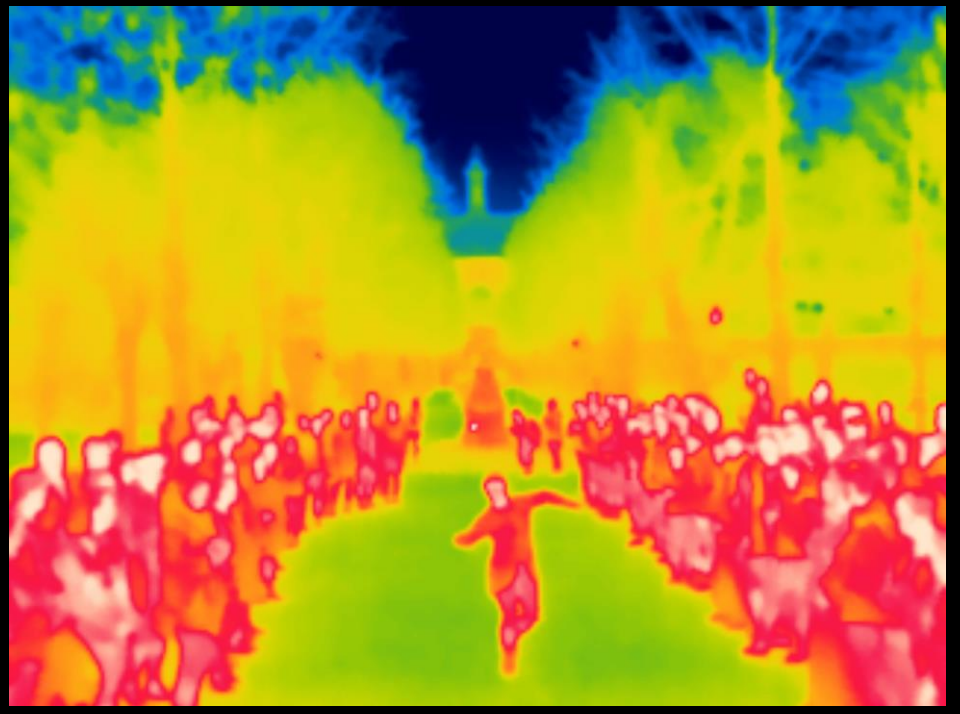


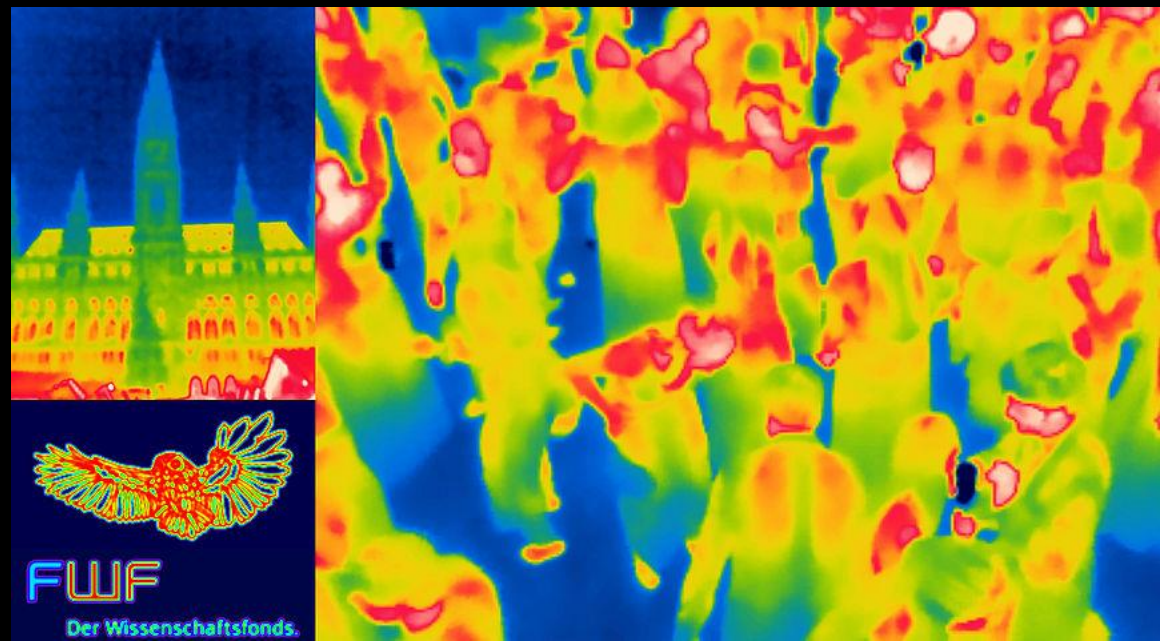
Let’s dance

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

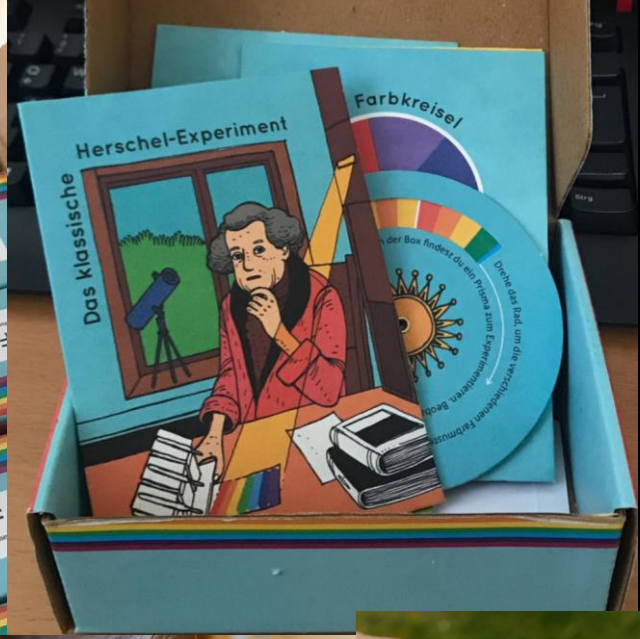




Aha!Boxes

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

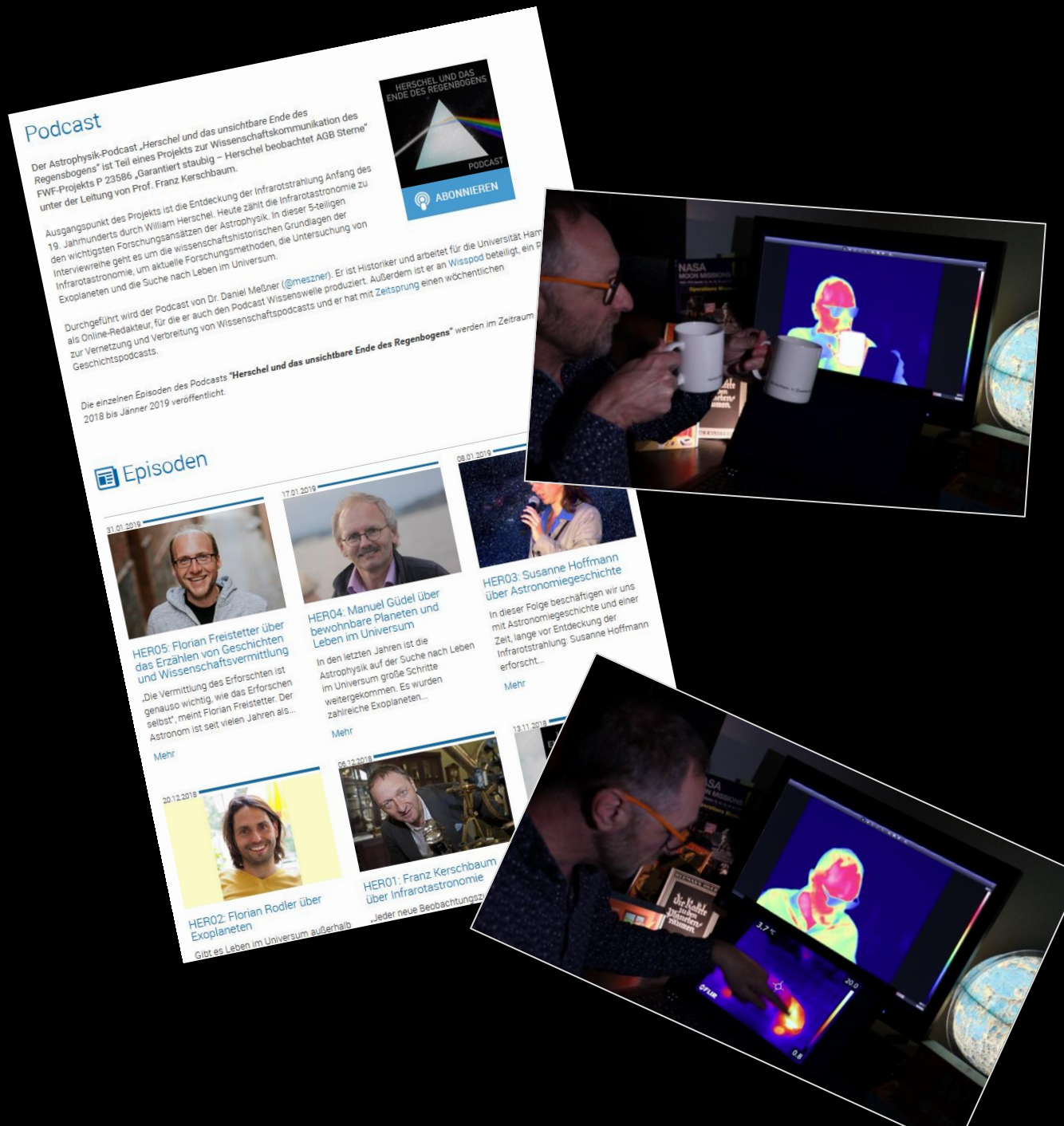
- With our own **Aha!Boxes**, small experiment packages we try to initiate experiments with light
- One can do spectroscopy, spin the colour wheel, colour cartoons, and even play “Herschel theatre”
- The free give away experiment boxes were produced together with the **Indian Manthan Educational Programme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



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/