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IR2022 meeting summary

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IR 2022



IR2022 – Meeting Summary Talk

Ryan Lau (ISAS/JAXA), Abi Frost (KU Leuven), Leo Burtscher (Leiden), and the IR2022 SOC

18 February 2022



Initial Impressions

The “High 5” Categories



The IR2022 “High 5” (not to be confused with VLT/Hi-5!)
High Spatial Resolution, ***High*** Spectral Resolution, ***High*** Contrast Imaging,
High Background, ***High*** Cadence/Time resolution



Initial Impressions

The “High 5” Categories

*JWST will be revolutionary....
...but ground-based mid-IR will continue to push the science and technical limits of the high 5 themes, especially **high spatial resolution***

*The IR2022 “High 5” (not to be confused with VLT/Hi-5!)
High Spatial Resolution, **High** Spectral Resolution, **High** Contrast Imaging,
High Background, **High** Cadence/Time resolution*

Resolving Star and Planet Formation



Speakers: M. Richter, I. Kamp, S. Grant, D. Coria, B. Lopez, A. Corporaal, E. Koumpia, A. Frost

- **High spatial AND spectral resolution** critical for pushing understanding of star and (2nd gen?) planet formation physics, chemistry and dynamics
- A clear need for large coordinated observing programs (*let's go for it!*)
- A resounding consensus that the MIR community should continue to **push for a high spectral resolution IR space mission**
 - $R > \sim 50,000$

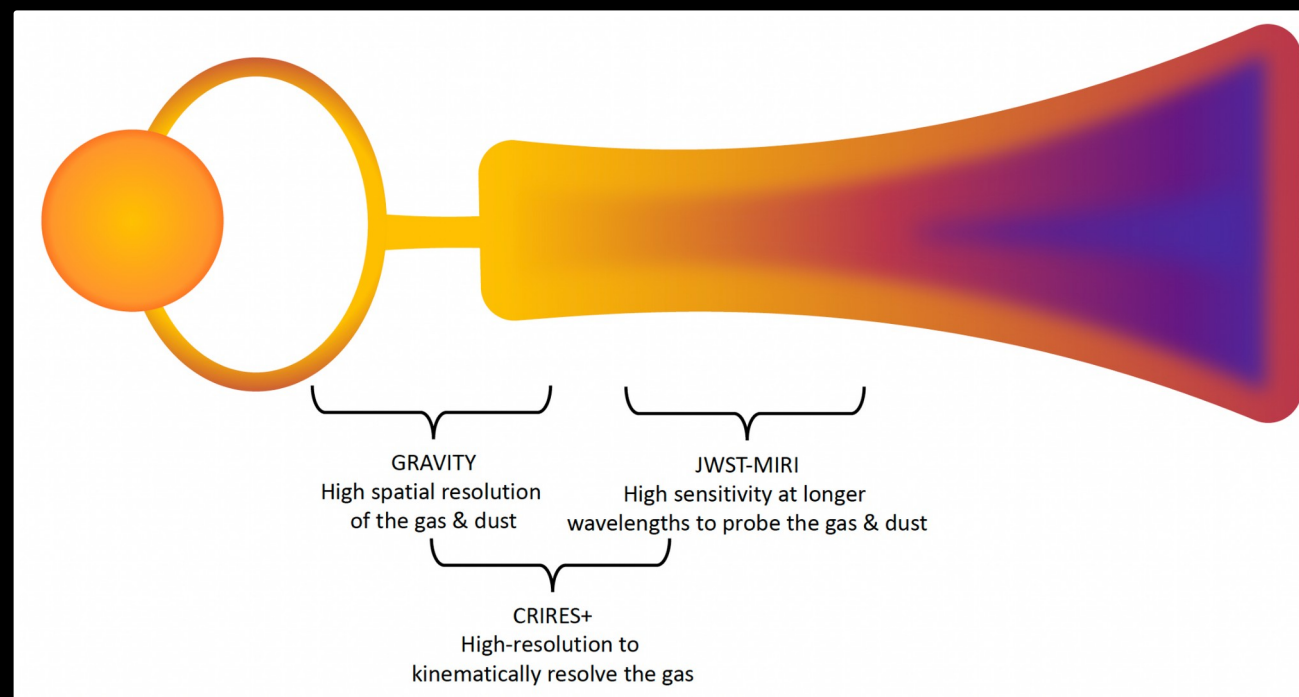


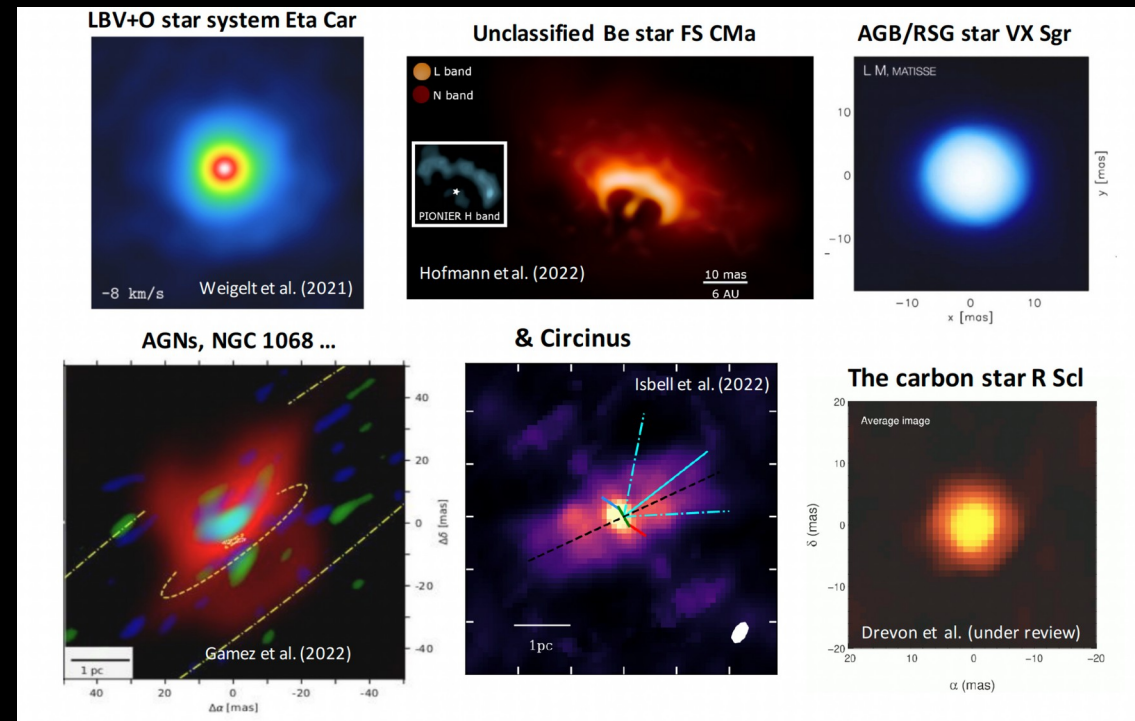
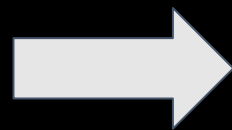
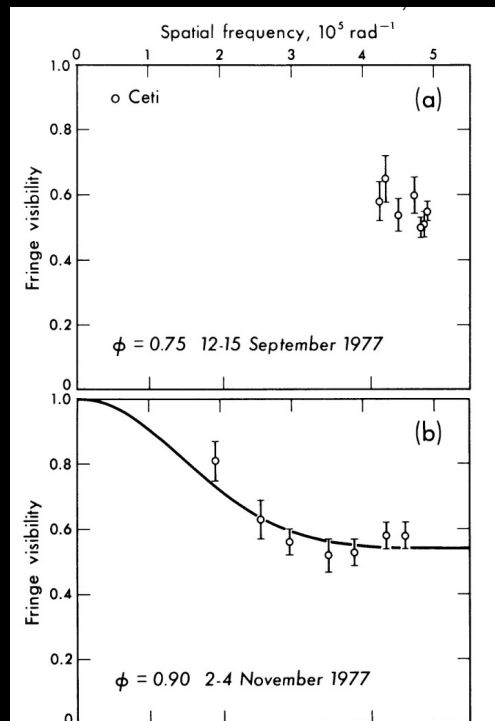
Image from S. Grant's Talk

Resolving Star and Planet Formation



Speakers: M. Richter, I. Kamp, S. Grant, D. Coria, B. Lopez, A. Corporaal, E. Koumpia, A. Frost

- *Mid-IR interferometry has come a long way from 1974... Synergy between VLTI and JWST present new opportunities to engage broader mid-IR community*

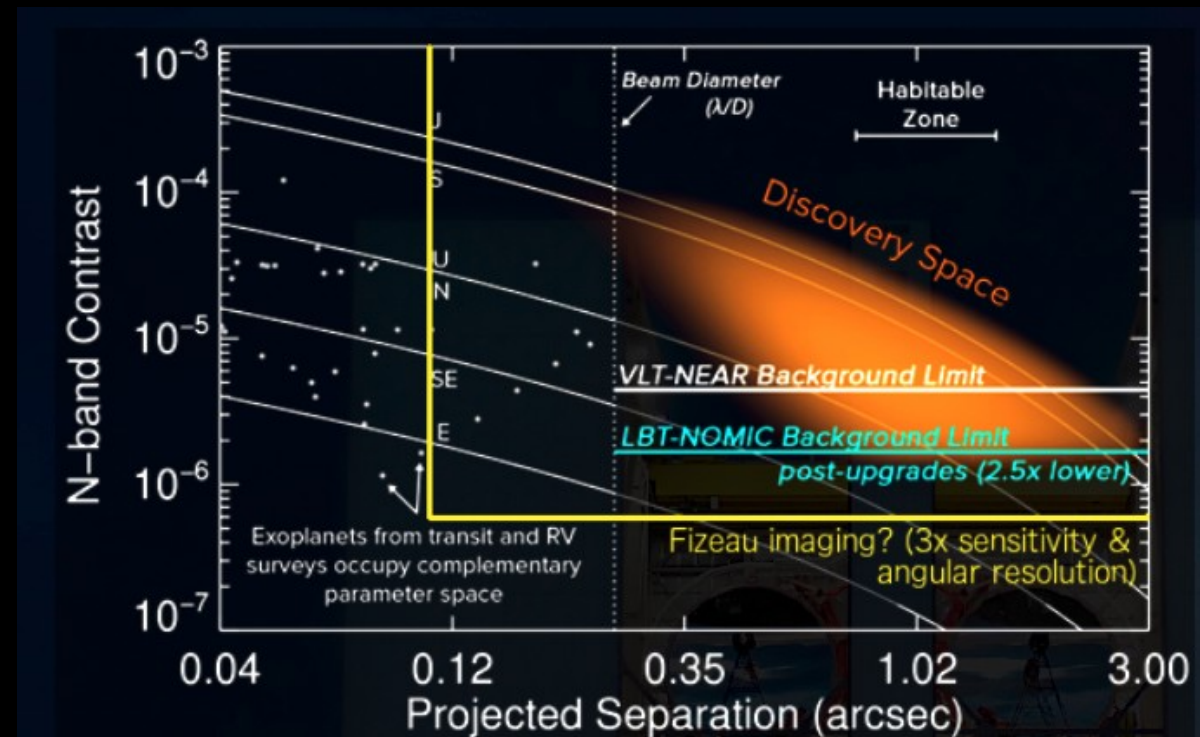


Exoplanets and the Promise of the Mid-IR

Speakers: B. Biller, S. Ertel, K. Wagner, J. Kammerer, E. Rickman, L. Pueyo, V. Faramaz, O. Absil, R. Bowens
Pre-recorded talk: V. Ivanov



- Large discovery space for exoplanet characterization at mid-IR wavelengths (*from ground and space!*)
- **High Contrast limits** being pushed by LBTI, VLT(I), and MMT/MIRAC-5
 - Exciting new observations and surveys (e.g. HOSTS and LESSONS)
- Immense sensitivity gains for direct detection to be realized with ELTs*



*but it is crucial to consider the impact of water vapor (O. Absil's talk)



From S. Ertel's talk (adapted from figure from K. Wagner)

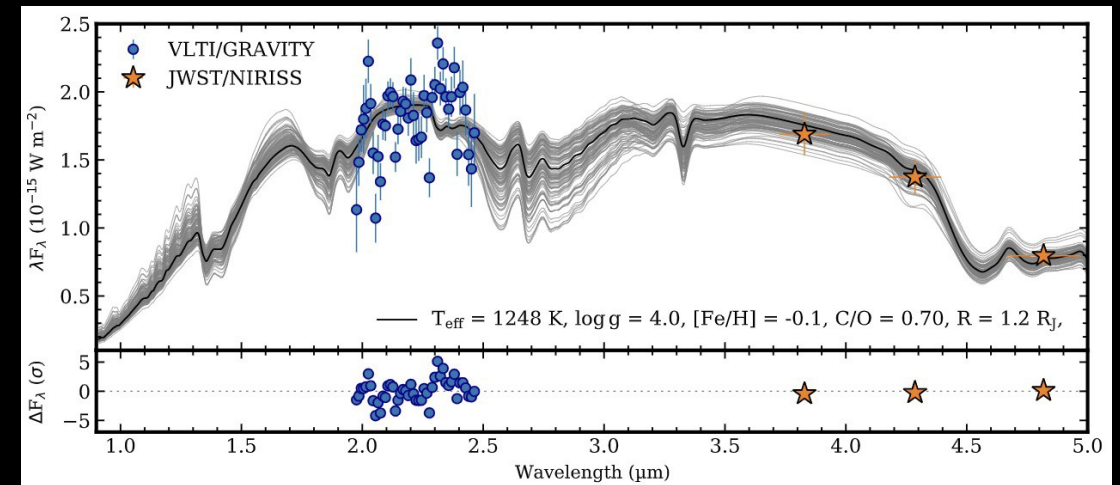
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- Promising ground- and space-based synergies (e.g. GRAVITY + JWST)
- Community coordination important to pursue and utilize new mid-IR detector technologies
- Facilities such as LBTI and Palomar continue to be valuable testbeds for new instrumentation

Point from discussion: Important for community to consider the role *mid-IR polarimetry* for *ELTs* and *future space missions*



From J. Kammerer's talk

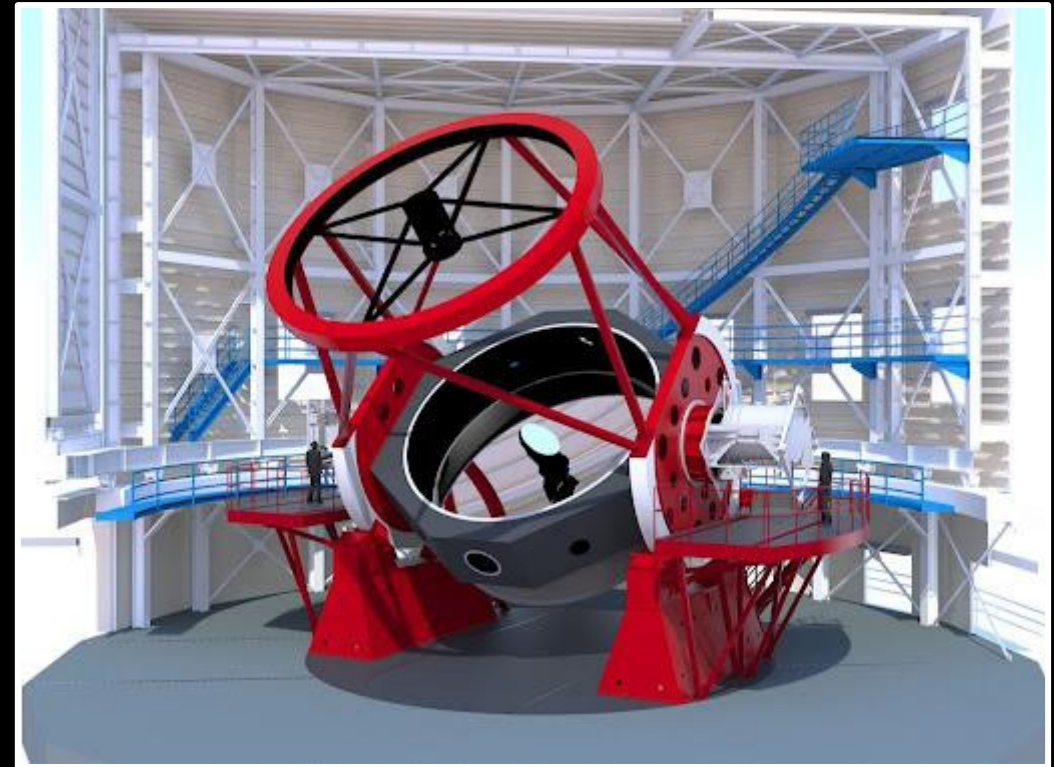


“Looking Up” and Facing Challenges in the Mid-IR

Speakers: T. Kamizuka, A. Torres-Quijano, T. Müller, T. Ootsubo, T. Kaminski, D. Taniguchi, S. Mattila, R. Stein, M. Kasliwal
Posters: R. Szakáts



- Technical developments advanced by **TAO/MIMIZUKU** to face ground-based mid-IR challenges
 - **High background** → Cold chopper
 - **Atmospheric correction** → Field stacker
 - **Flat correction** → On-board calibration unit
 - **SNR and Strehl improvements** → Drift scanning?
- **Solar system science and NEO monitoring**
 - Flexibility and sky coverage of ground-based mid-IR remains critical in era of JWST



Tokyo Atacama Observatory (TAO) from T. Kamizuka's Talk

An explosion of new transient science in the Mid-IR



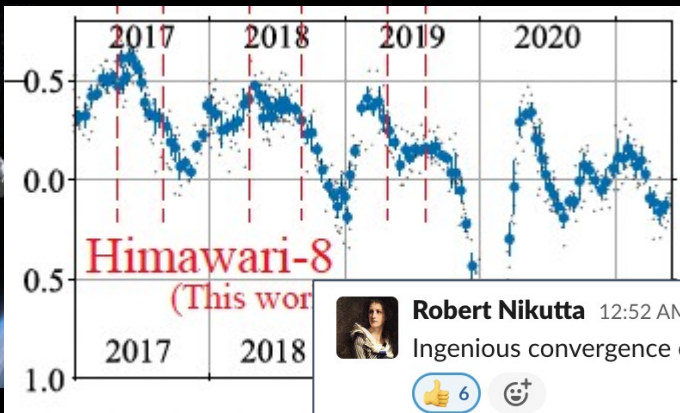
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Probing the hidden physics of obscured stellar mergers (T. Kaminski's talk)

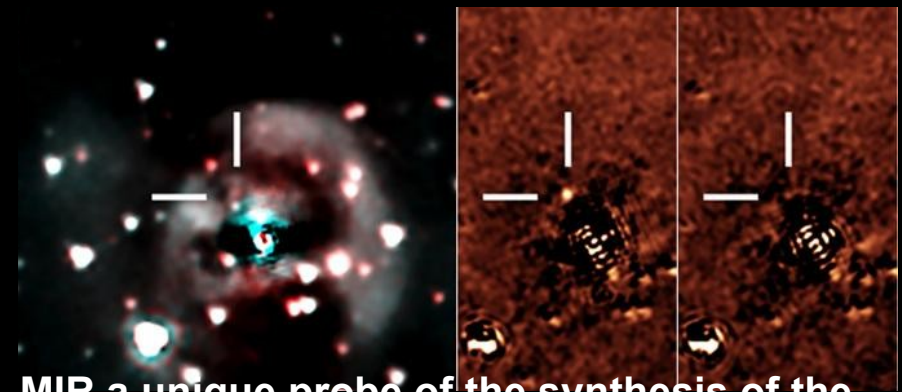


Tracing dusty origins of nuclear transients and neutrino sources (R. Stein's and S. Mattila's talks)



Uninterrupted 5 yr light curve of Betelgeuse w/ a weather satellite

 **Robert Nikutta** 12:52 AM
Ingenious convergence of technologies, [@Daisuke Taniguchi!](#)
 6 



MIR a unique probe of the synthesis of the heaviest known elements (M. Kasliwal's talk)

An explosion of new transient science in the Mid-IR

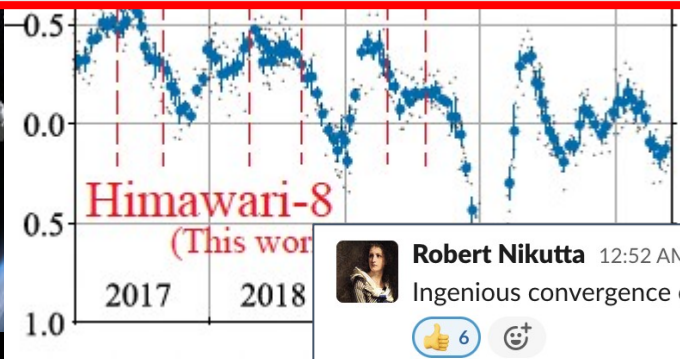
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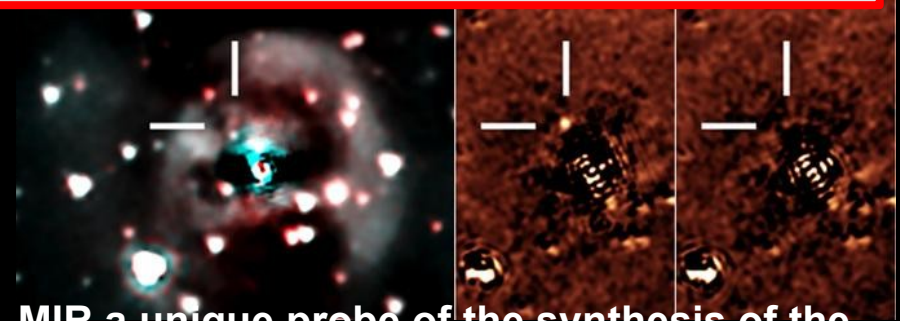
Tracing dusty origins of nuclear transients and sources (M. Kasliwal's and S. Mattila's talks)

Mid-IR will continue to play a key role in the era of new transient discovery engines and multi-messenger astronomy

light curve of Betelgeuse w/ a weather satellite



Robert Nikutta 12:52 AM
Ingenious convergence of technologies, @Daisuke Taniguchi!

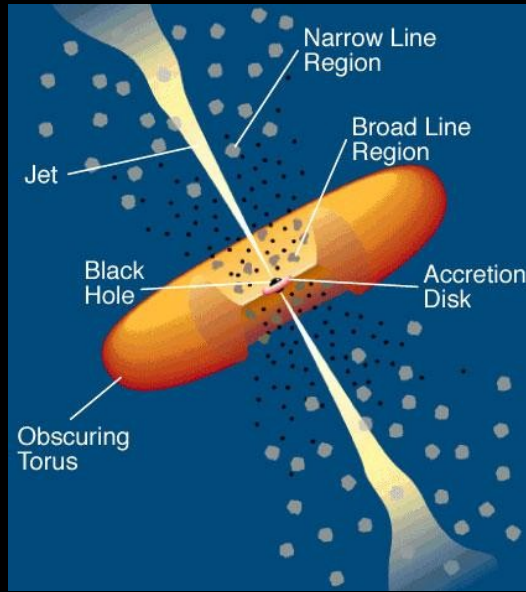
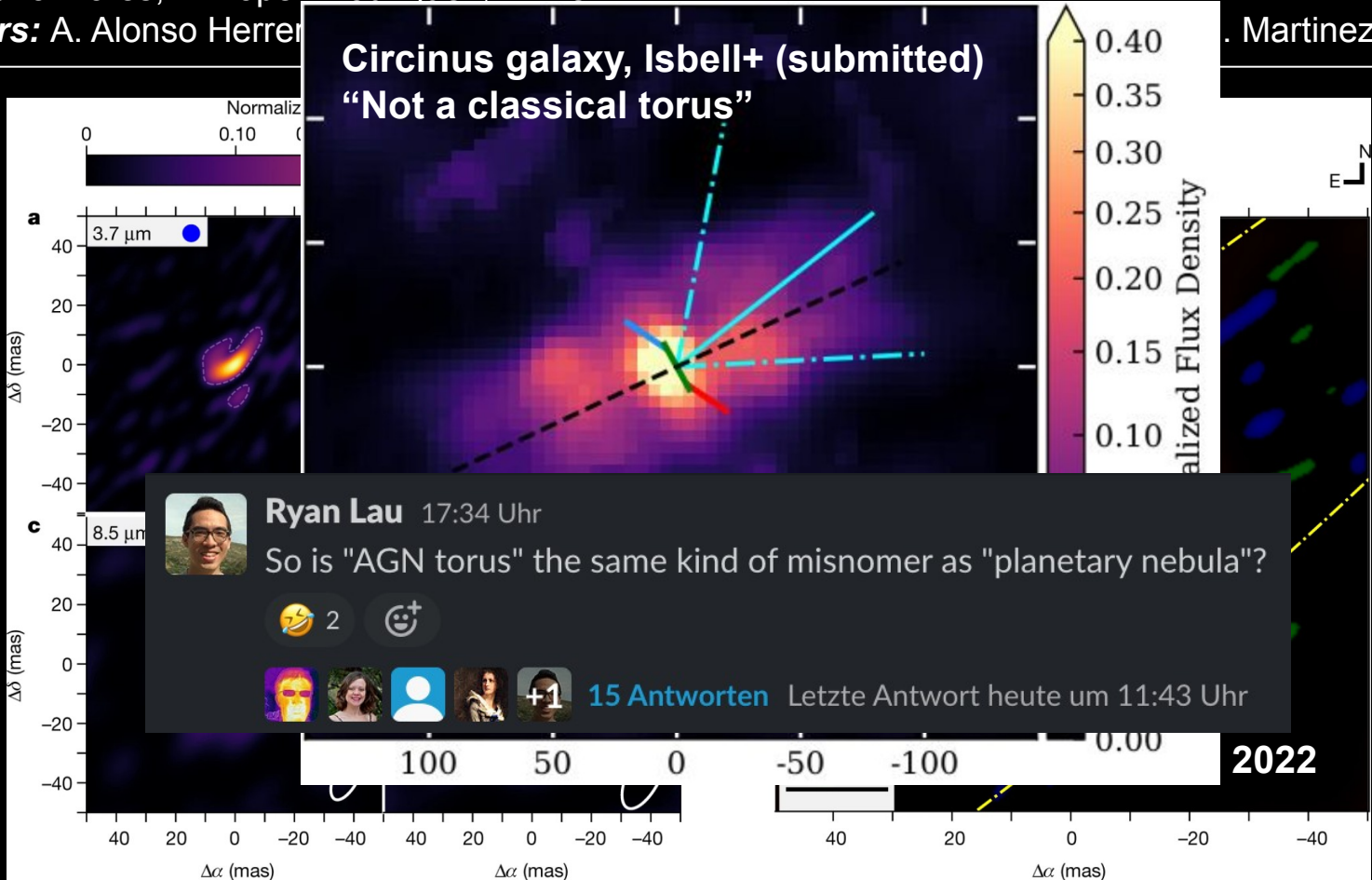
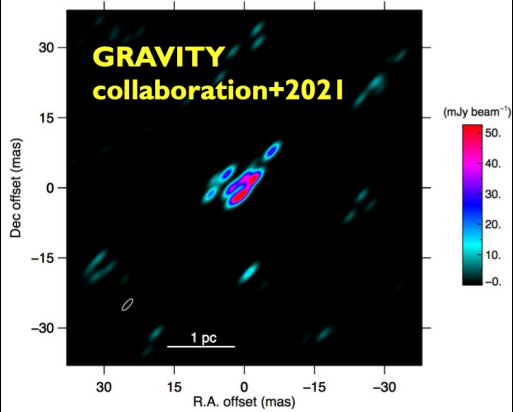
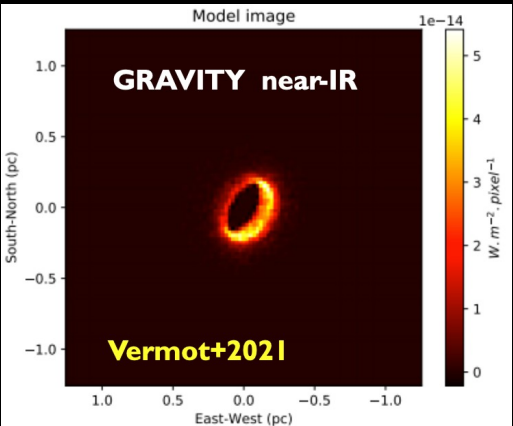


MIR a unique probe of the synthesis of the heaviest known elements (M. Kasliwal's talk)

Are GRAVITY and MATISSE confirming or burying the unified torus model?



Speakers: C. Ramos Almeida, V. Gamez Rosas, J. Isbell, P. Vermot, L. Burtscher, R. Nikutta, M. Bianchin, C. Richardson, S. Motino Flores, E. Lopez Rodriguez, Y. Xie
Posters: A. Alonso Herrero, ... Martinez



Tension between GRAVITY and MATISSE interpretation: Are we seeing an obscuring torus or the inner ring of hot dust?

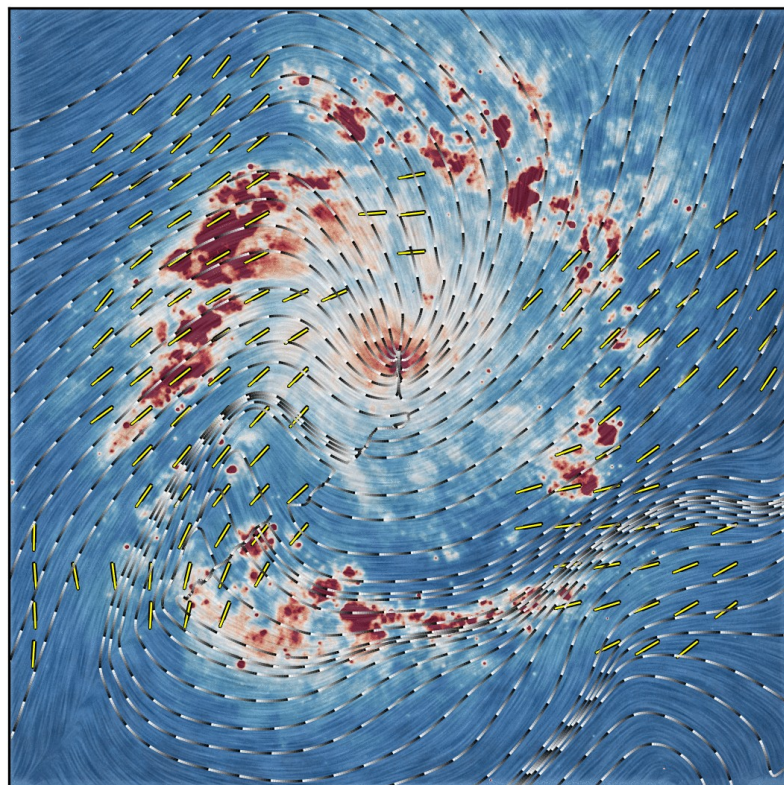
A bright future for mid-IR AGN research



Speakers: C. Ramos Almeida, V. Gamez Rosas, J. Isbell, P. Vermot, L. Burtscher, R. Nikutta, M. Bianchin, C. Richardson, S. Motino Flores, E. Lopez Rodriguez, Y. Xie

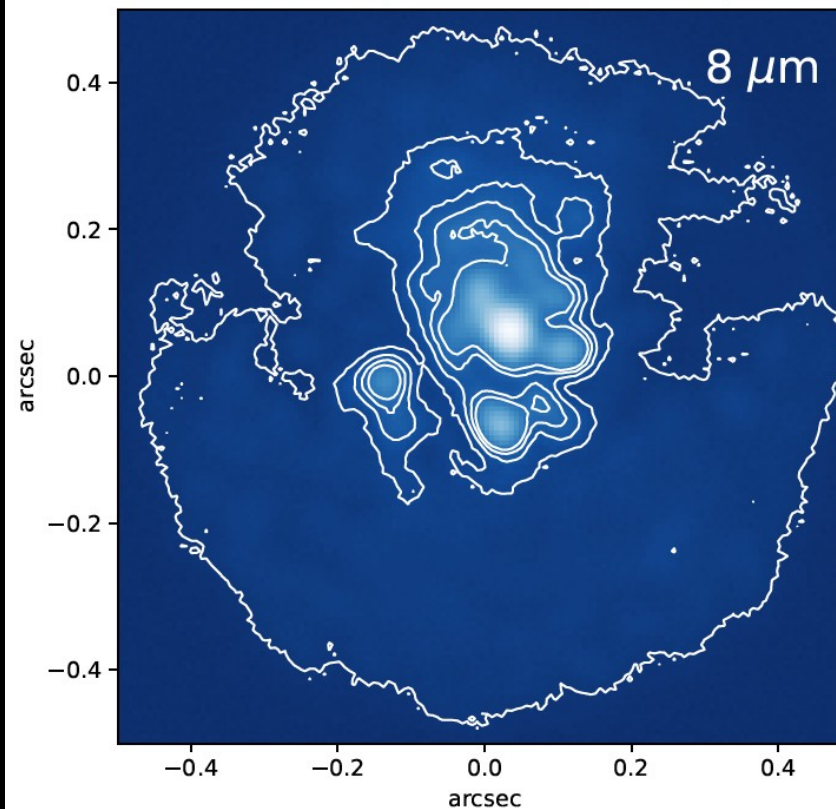
Posters: A. Alonso Herrero, J. de Souza Mendes, A. Dumont, M. Leist, I. E. Lopez, M. Martinez

Starburst ring of NGC 1097: B-field orientation and direction within 1 Kpc



Lopez-Rodriguez et al. 2021

CAT3D-WIND model, extended disk and wind, $i=45\text{deg}$



Mock METIS observation (poster, Alonso Herrero et al.)

Mid-IR spectropolarimetry as a powerful tool to trace dust chemistry and accretion in AGNs

ELTs will be great for AGNs and allow us to study the polar outflow of AGNs in unprecedented detail.

But what can we expect before IR2024?

- LBTI imaging of NGC 1068
- more AGNs from MATISSE and GRAVITY
- possibly higher sensitivity with 8m telescopes thanks to better detectors (GeoSnap)
- first JWST results!

PAHs - synergy between wavelengths, ground & space

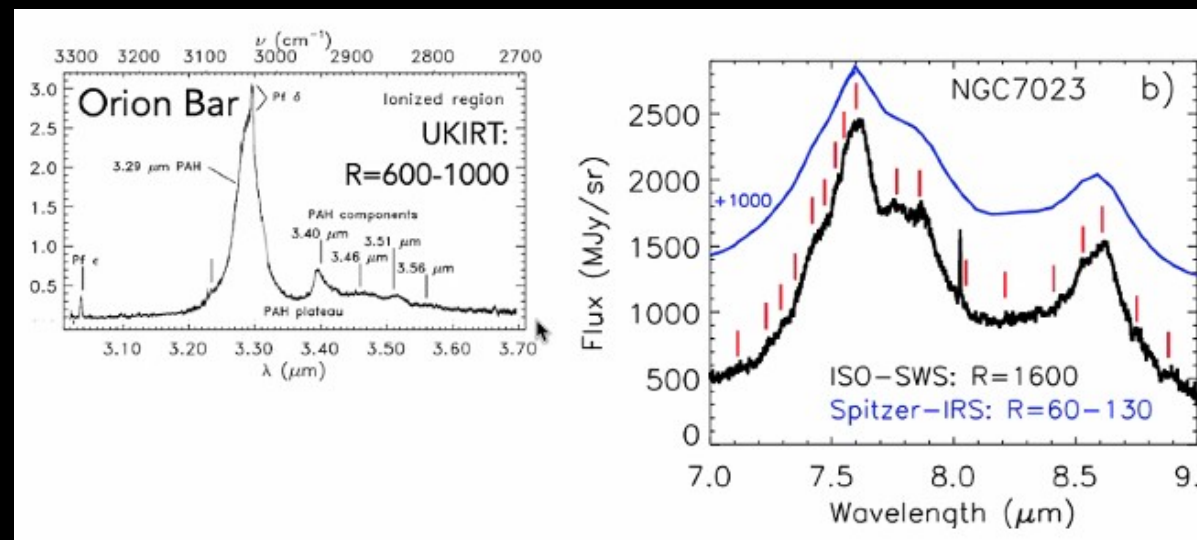


Speakers: Els Peeters, Izumi Endo, Cuc Dinh, Mikako Matsuura, René Oudmaijer, Ryan Lau Randa Asa, Michal Michalowski

Posters: Erin Smith, Matthew Hankins

Pre-recorded talks: Jim de Buizer, Yanxia Xie, Lisa Shepard

- PAHs important considerations for physical and chemical effects (e.g. surface chemistry, heating) and generated by both optical and UV irradiation
 - JWST can provide wide wavelength coverage, medium res can probe substructure
 - However ground-based IR required for larger FOV studies and to avoid saturation when looking at brightest sources
- PAHs also allow us to trace the Galactic centre e.g. with VISIR/VLT (Cuc Dinh's talk)
 - Various dusty structures with different temperature gradients
 - Stars creating mid-IR dust structures?



From Els Peeters talk

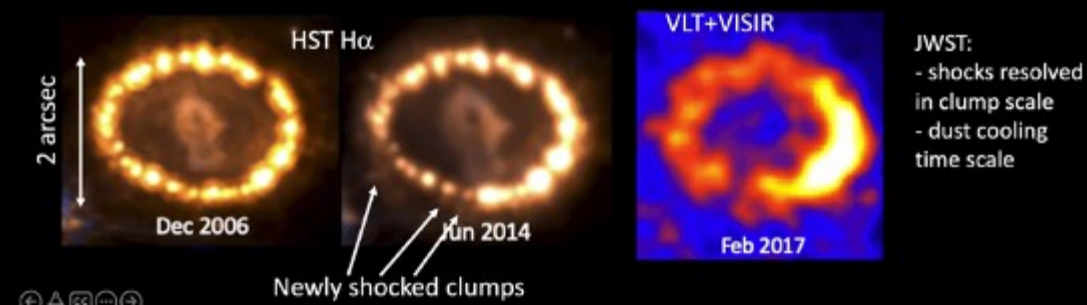


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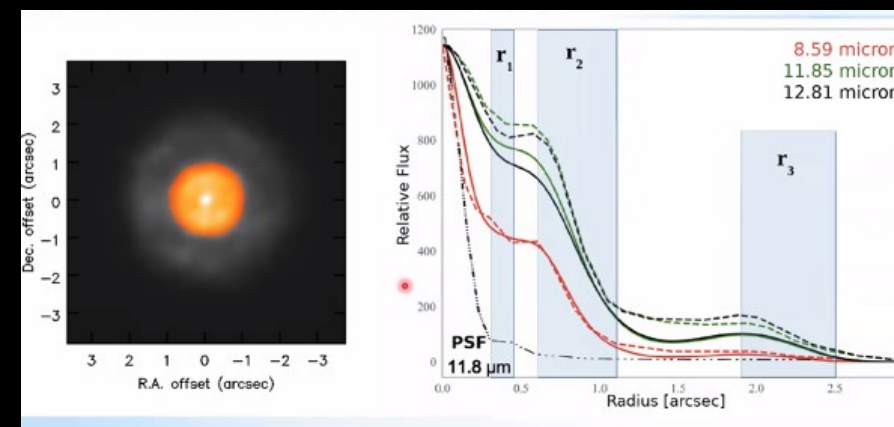
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- SNe both create and destroy dust
 - dust created cools over yr timescales, but also can move/expand surrounding dust
 - how much dust is destroyed depends heavily on dust composition
- JWST will be key for looking at dust composition
- Supergiants:
 - YHGs e.g. Fried Egg
 - Multiple epochs of dust formation leading to high levels of structure
 - collisional excitation changing chemistry
 - RSGs:
 - spectral studies like Randa Asa's can allow us to determine whether these massive stars are coming from the same or multiple stellar populations
 - Could this assist stellar lensing (Michal Michalowski)?
 - Post-AGBs



From Mikako Matsuura's talk



From Rene Oudmaijers' talk

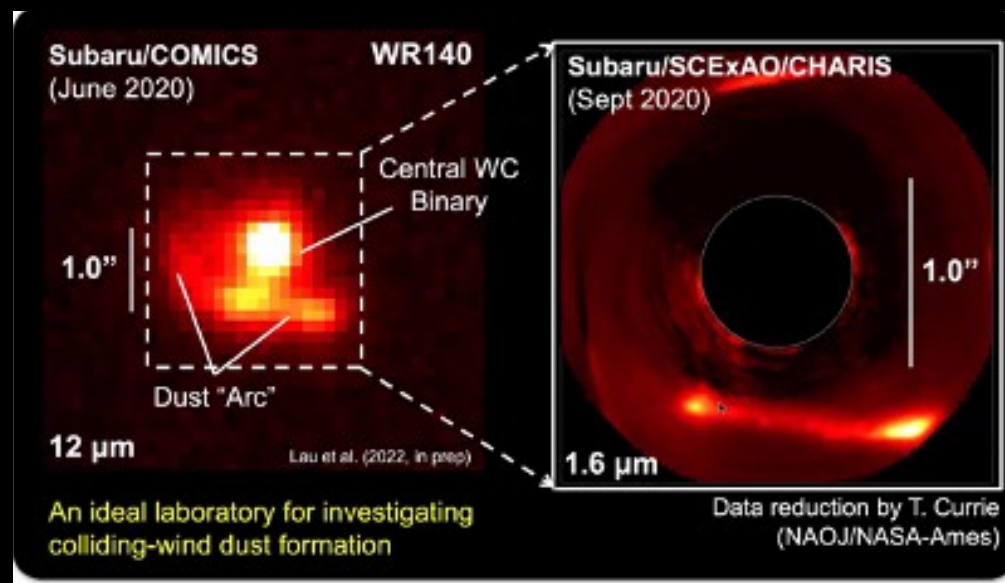


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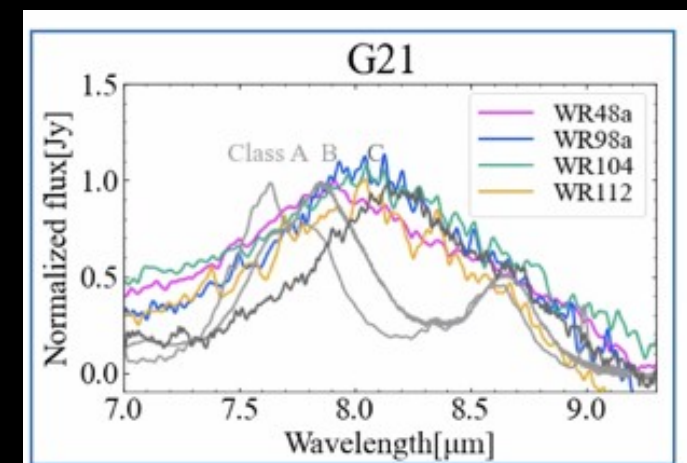
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- WR stars key dust creators
 - Binary interaction triggers dust creation in WCs
 - Common spectral features seen between different WC stars - broad $8\mu\text{m}$ feature
 - PSF subtraction and SAM can help isolate dust created and monitoring can follow it's evolution

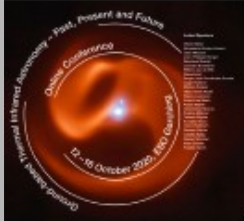


From Ryan Lau's talk



From Izumi Endo's talk

Takeaways

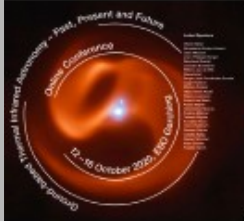


Action items for us all

IR2020 Summary Talk Slide by B. Brandl and N. Levenson

- Continue conversations
 - e.g., new plans for observing proposals; connect theory and observations across fields
- Tools: handbook for thermal infrared astronomy; next workshop or school
- Build the community
 - develop people who are already here
 - broaden the community; thermal-IR should not be an isolated niche
- Use current instruments effectively
 - get great science results; make these known
- Make the science case for future capabilities
 - show unique opportunities; connect to important astrophysics overall

Takeaways



Action items for us all

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IR2022 - Action Items

- ***Continue to build up the mid-IR community***
 - ***From a science perspective***
 - Coordinate (Large) observing proposals
 - Exploit synergies with JWST
 - Connect on instrumentation development
 - ***From a social perspective***
 - Organize future IR202X meetings or meet more frequently
 - “IR” Seminars? Instrument-focused workshops?
 - Keep the IR2022 Slack Workspace open
- ***Explore new scientific windows of opportunity for ground-based mid-IR***
 - e.g. multi-messenger astronomy, opportunities with new facilities

IR2022 - Action Items

“Diversity is being invited to the party, inclusion is being asked to dance” - Linn Boldt-Christmas et al



- **Continue to build up the mid-IR community**
 - **From a diversity perspective**
 - As astro inspires all, all should be represented
 - Diversity improves scientific discussions (e.g Nielsen et al. 2018, Nature Hum Behav 2, 726-734)
 - **Current state of diversity**
 - *The state of diversity is still group or even subject dependent*
 - **Proactive improvement needed across the board and within research groups**
 - *Lack of intersectional support (people from multiple marginalised groups)*
 - **Importance of online/hybrid meetings**
 - *Online meetings remove a lot of financial and therefore locational bias*
 - **The future**
 - *Checking your own implicit biases and acting to stop them affecting who you hire and collaborate with is very important - tests here <https://implicit.harvard.edu/implicit/takeatest.html>*
 - *Need to retain diversity up to the professor level - improve working environments*
 - *regular DEI training/discussions*
 - *department priority -> allocate funding!*
 - *everyone needs to stand up for and support their marginalised colleagues - they can't do all the work!*



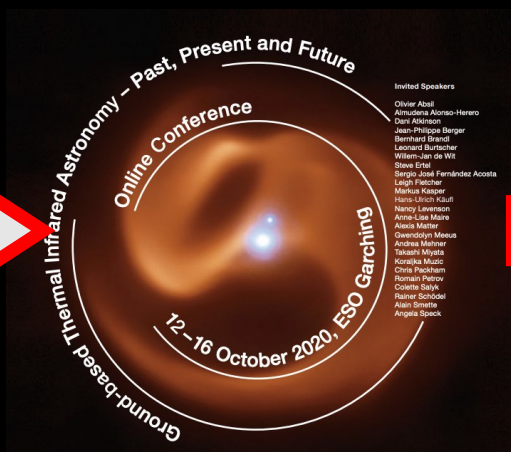
The Future of “IR” Meetings

Any Questions? Comments? Feedback? Thoughts on IR202X?

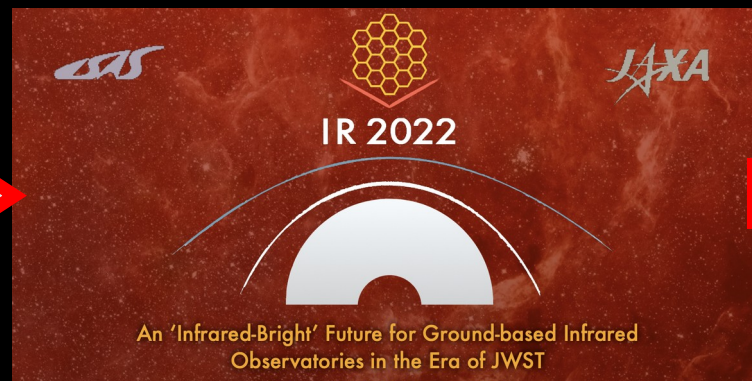
Will leave Slack workspace open → Let's discuss on #feedback_for_ir202x



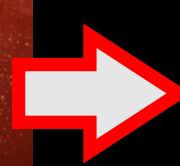
2018 Lorentz Center Meeting
12 – 16 Nov 2018



IR2020
12 – 16 October 2020
(Hosted by ESO)



IR2022
14 – 18 February 2022
(Hosted by ISAS/JAXA)



IR202X