



**International Astronomical Union**

Union Astronomique Internationale

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# POST MEETING REPORT

IAU symposium #378: “Black hole winds at all scales”

**(i) Final scientific programme, list of invited review speakers and session chairs, to be published in the IAU website:**

A copy of the final program is attached at the end of this document.

Gender balance

- female/male/non-specified speakers invited talks: 6 females, 12 males
- female/male/non-specified invited speakers accepted: 3 females, 7 males
- female/male/non-specified speakers contributed talks: 16 females, 33 males

**(ii) Summary of the scientific highlights of the meeting (1 page, to be published on the IAU website);**

The symposium covered a range of topics related to outflows from black holes. We had a good balance between the physics of the winds, and their impact on their surroundings. We also had interesting discussions about the connection, or lack thereof, between outflows from supermassive black holes at the centers of galaxies, and those from stellar black holes. The multiwavelength aspects were highlighted in both. It was interesting to see that even for specific well-studied sources it is hard to connect the molecular outflow with that of the UV, and the ultrafast sub-relativistic X-ray signatures. A dedicated session on radio emission from these sources made things even more complicated.

In terms of new observations, IR astronomers presented JWST data indicating significant galactic feedback at redshifts above  $z=6$ . A discussion commenced on how actually to measure feedback - the impact of outflows on the host galaxy? New insights into the central

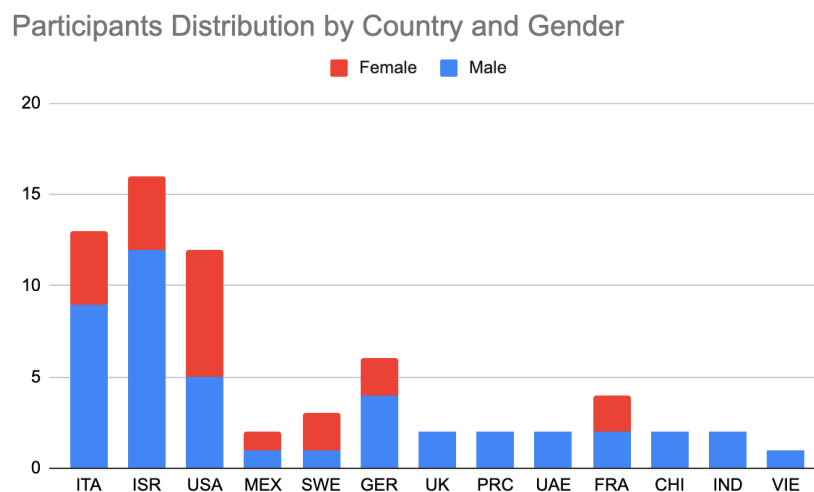
sub-pc regions of active galaxies from GRAVITY were presented. In the mm-band, rich ALMA spectra covering a broad band provided new evidence that even the most obscured sources may host an accretion disk and produce outflows. These are extremely hard to see above the background synchrotron and bright dust emission of these sources. Several new VLBA observations showed that even the radio quiet quasars host a compact (mas) optically thick radio source at their core, while some of them also feature extended optically thin emission that can be associated with an outflow. In the UV with Hubble, broad absorption line systems allowed for quantitative estimates of mass outflow rates indicating that massive outflows in the most luminous quasars carry appreciable mass and energy out to kpc scales in the galaxy. The jury is still out with regard to black hole galactic feedback on the majority of lower luminosity quasars.

On the theoretical ground, a variety of simulations for magnetic and thermally driven winds were presented, some of which attempted to put galactic and stellar black hole winds on an equal footing. Cases from extreme mass accretion rates to advection dominated flows were covered. Topics of radiative driving and radiative transfer in outflows were discussed, a few of which even proposed comparisons with observations. An often overlooked, yet interesting topic was the influence of intermediate black hole systems on their dwarf galaxy hosts.

All in all, it was most gratifying to see researchers from different observational backgrounds and theoretical approaches all participate in the lengthy discussion periods we provided after each session.

**(iii) List of participants, including their distribution by country and gender (double bar chart);**

A list of participants is in attachment. In the following, a double-bar chart representing the distribution of participants by Country and gender.



**(v) An Executive Summary of the Meeting (1-2 pages) to be published on the IAU website.**

IAU Symposium 378 convened 70 astrophysicists, both experts and students, to discuss the latest findings on winds from black hole sources. We spent five full days at the Technion campus in Haifa. The exciting and popular topic brought together observers of many different wavebands, which made for a multitude of new data being presented and discussed. There was a good mix of low-energy and high-energy observations, including ground facilities and space observatories. Theoretical aspects of black hole outflows were also a big part of the discussions, and perhaps as expected, many puzzles about these winds remain.

We took a half-day break to take a guided tour of the old city of Akko, a place with an immensely rich history. We learned about the different religions and regimes that ruled the city and the region over the past 2000 years. The trip was insightful and provided a nice getaway from the intense science discussions. We then took advantage of the nice weather during one of the lunch breaks to take the conference photo below in the Technion's amphitheater. A photo of one of our groups from the tour of Akko can be found below it.





# Black hole winds at all scales

## Sunday 12.3

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08:00 Registration

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09:20 Welcome

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Chair: [Anna Lia Longinotti](#)

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09:40 [Marcella Brusa](#) – The multiphase nature of outflows: from the launching region to the host galaxy

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10:10 [G. Cresci](#) – Bubbles and outflows: the JWST view of the prototypical  $z=1.6$  Quasar XID2028

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10:30 **COFFEE**

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11:00 [S. Aalto](#) – The cold winds of change – ALMA reveals peculiar, collimated molecular outflows from the most obscured galaxy nuclei.

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11:20 [Y. Luo](#) – A Multiwavelength View of Black Holes and Outflows in Post-starburst Galaxies

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11:40 [M. Bianchin](#) – Multiphase gas kinematics as a tracer of AGN-driven outflows across different wavelengths

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12:00 Discussion

# Black hole winds at all scales

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12:20 **LUNCH**

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Chair: [Susanne Aalto](#)

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13:30 **K. Butler** – Atomic and Molecular Gas Outflows in FIR Bright QSOs at High-z

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13:50 **M. Temple** – Testing AGN outflow and accretion models with SDSS quasar demographics

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14:10 **A. Lattimer** – Updated Calculations of the Spectral-Line Radiation Force & Mass-Loss Rates for AGN Outflows

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14:30 **Steve Kraemer** – AGN Feedback at High Spatial Resolution: New Constraints on Dynamics and Efficiency

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15:00 **COFFEE**

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15:40 **J. Stern** – Constraining how quasars drive galaxy-scale winds using emission line spectra

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16:00 **A. Ogorzalek** – A deep, multi-epoch Chandra HETG study of the ionized outflow from NGC 4051

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16:20 Discussion

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16:40 Poster presentations

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17:30 RECEPTION

# Black hole winds at all scales

## Monday 13.3

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08:00 Registration

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Chair: **Gabriele Bruni**

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09:00 **Nahum Arav** - Extremely energetic quasar outflows:  
HST/COS observations in the rest-frame EUV

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09:30 **H. Choi** - Investigating the Physical Properties of Low-  
redshift FeLoBAL Outflows using SimBAL

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09:50 **B. Trefoloni** - Searching for outflows in X-ray weak quasars

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10:10 **M. Vivek** - AGN outflows and its variability

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10:30 **COFFEE**

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11:00 **Chiara Feruglio** Super massive black hole / host galaxy  
growth and the onset of strong feedback at  $z=6 - 7.5$

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11:30 Discussion

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11:50 Group Photo

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12:20 **LUNCH**

# Black hole winds at all scales

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Chair: **Francesca Panessa**

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- 13:20 **P. Olivier Petrucci** - Outflows from Stellar Black Holes vs. those of AGN: similar or not? The Stellar Black Hole point of view
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- 13:50 **A. Ratheesh** - Polarized X-rays from the accretion disk of 4U 1630-47
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- 14:10 **N. Kylafis** - The role of outflows in black-hole X-ray binaries
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- 14:30 **A. Grichener** - Jets in mergers of stellar black holes with cores of giant stars
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- 14:50 **N. Keshet** - Element abundance measurement and absorption measure distribution for the stellar black hole GRO J1655-40
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- 15:10 **COFFEE**
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- 15:40 **D. Kazanas** - MHD Accretion Disk Winds and their Relation to AGN Absorbers
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- 16:10 **S. Chakraborty** - Unraveling fast non-equatorial disk-wind and high-density disk reflection in MAXI J1348-630
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- 16:30 Discussion



# Black hole winds at all scales

## Tuesday 14.3

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Chair: [Dieter Lutz](#)

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09:00 C. Harrison - Establishing how luminous AGN impact upon galaxy evolution using simulations and multi-wavelength observations

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09:30 F. Fiore - Dynamical complexity in micro-scale disk-wind systems

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09:50 G. C. Rivera - Quasar Feedback and Winds in the Era of Deep Radio Surveys

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10:10 P. Kukreti - Kapteyn Astronomical Institute (University of Groningen), and ASTRON, the Netherlands

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10:30 **COFFEE**

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11:00 C. Wethers – The peculiar line emission in Compact Obscured Nuclei (CONs)

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11:20 F. Yuan - Wind from black hole hot accretion flows and its feedback effects

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11:40 Discussion

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12:00 **LUNCH**

# Black hole winds at all scales

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12:30 **TRIP to AKKO**

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## Wednesday 15.3

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Chair: **Chiara Feruglio**

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09:00 H. Netzer - What is the mass outflow rate of ionized neutral and molecular gas in low-z AGN?

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09:30 D. Lutz - The sub-parsec structure of AGN with VLTI/GRAVITY

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09:50 G. Bruni - BAL winds in quasars at hyper-luminosity regime: results from the WISSH project

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10:10 M. Sniegowska - Chemical enrichment of AGN outflows

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10:30 COFFEE

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11:00 D. Chelouche - On The Fine Tuning and Physical Origin of Line Locked Absorption Systems in Quasars

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11:20 C. Yang - 5-12 pc resolution ALMA imaging of gas and dust in the obscured compact nucleus of IRAS 17578-0400

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11:40 Discussion

# Black hole winds at all scales

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12:20 LUNCH

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Chair: [Ari Laor](#)

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13:20 Francesca Panessa - Jets and Outflows in the radio regime

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13:50 S. Chen - The radio evidence for winds in radio-quiet AGN on the VLBA scales

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14:10 L. Ulivi - Outflows and feedback in jetted AGN

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14:30 F. Massaro - The most powerful radio sources in the Southern Sky

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14:50 A. Horesh - Delayed Radio Flares - A New Phenomenon in Tidal Disruption Events

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15:10 COFFEE

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15:50 J. Gelfand - Origin of the Radio Emission of Radio Quiet Quasars

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16:10 M. Lyutikov - Jump-starting relativistic winds and jets

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16:30 Discussion

# Black hole winds at all scales

Thursday 16.3

Chair: [Joseph Gelfand](#)

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| 09:00 | Claude-Andre Faucher-Giguere - Physics and Observational Diagnostics of Wind Bubbles Driven by Active Galactic Nuclei                     |
| 09:30 | A. Pe'er - Study accretion and ejection using a new GPU-accelerated GRMHD code  |
| 09:50 | C. Marconcini - Innovative approach to 3D AGN outflow kinematic modelling: accurate determination of outflow physical properties          |
| 10:10 | N. Akerman - Ram-pressure induced radial inflows of gas to the galaxy centre  |
| 10:30 | COFFEE  |
| 11:00 | C. Partmann - Intermediate mass black hole feedback in dwarf galaxy simulations with a resolved ISM and accurate nuclear stellar dynamics |
| 11:20 | M. K. Vyas - Photons' scattering in a relativistic outflows with velocity shear: generation of high energy power-law spectra              |
| 11:40 | Discussion  |
| 12:00 | Concluding Remarks  |
| 12:20 | LUNCH   |



# Black hole winds at all scales

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13:20

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13:50

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14:10

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14:30    Evening Tour of Haifa, TBC