

## ***REPORT ON THE RADIONET3 NETWORKING ACTIVITY***

**TITLE: LIFE-CYCLE OF GAS IN GALAXIES: A LOCAL PERSPECTIVE**

**DATE:** 31 AUG – 4 SEP, 2015 **TIME:** (WHOLE DAY)

**LOCATION:** *DWINGELOO, THE NETHERLANDS*

**MEETING WEBPAGE** *[www.astron.nl/localgas2015](http://www.astron.nl/localgas2015)*

**HOST INSTITUTE:** *ASTRON, THE NETHERLANDS INSTITUTE FOR  
RADIO ASTRONOMY*

**PARTICIPANTS NO:** *93*

**MAIN LEADER:** *ASTRON*

## REPORT:

### 1. Agenda of the meeting

Attached.

The detailed program of the meeting, including links to pdfs for most presentations (available by clicking on the speaker's name), is available on the conference website at:

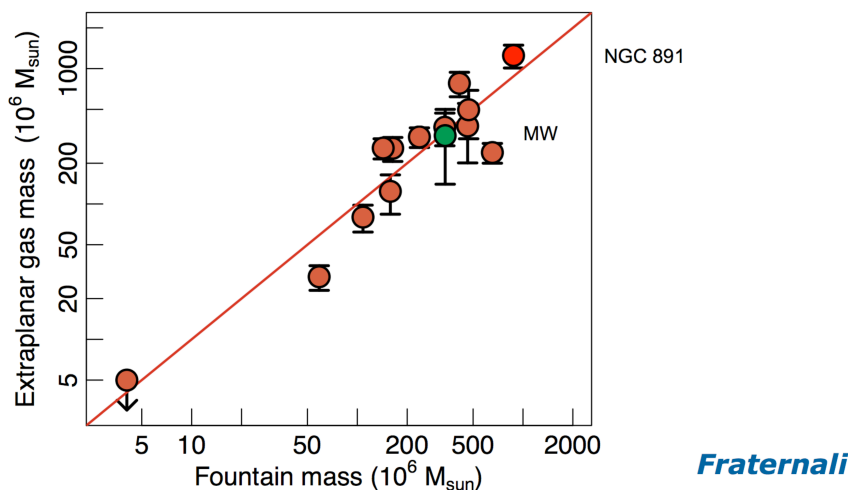
<http://www.astron.nl/localgas2015/programme.php>

### 2. Scientific Summary

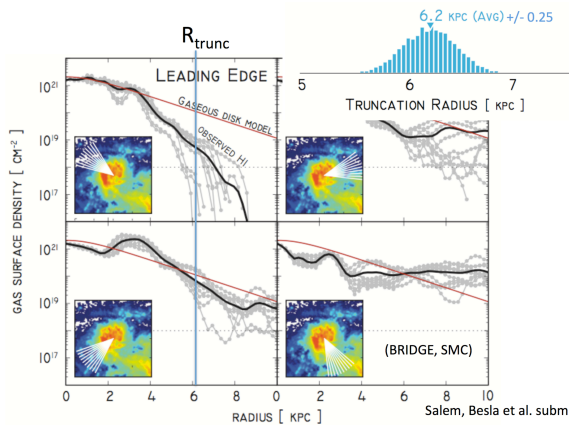
The goal of the meeting was to bring together researchers working in different areas to understand how galaxies acquire their gas supply and then subsequently convert atomic gas to molecular gas and then to stars. One of the primary goals was to understand the role of HI in these processes in preparation for what we will learn with the SKA. The meeting brought together researchers working on highly resolved, multiple line studies of individual molecular clouds in the Milky Way, global molecular cloud properties in nearby galaxies, and global galaxy studies. There was fruitful discussion between these different groups with organized discussion sessions on understanding the ISM from Planck, gas accretion in galaxies, the role of star formation in gas cycling, and star formation in HI dominated environments.

Particularly relevant results are highlighted below.

#### HALOGAS HI mass vs Fountain mass



Global results for the HALOGAS survey, presented by Erwin de Blok, indicate the presence and mass of a thick HI disk correlate with the star formation rate (SFR) of the host galaxy. A simple model for estimating the mass of gas in a galactic fountain from the SFR gives good agreement with the observed extra planar gas mass.



## Constraints on CGM density at ~ 48 kpc

$$n_{\text{MWHalo}}(R = 48.2 \pm 2.5 \text{ kpc}) = 1.1_{-0.45}^{+0.44} \times 10^{-4} \text{ cm}^{-3}$$

Salem, Besla et al. subm.



Estimates at ~ 50kpc from stripping simulations of other MW Satellites:

Gatto, Fraternali et al. (2013)  $(1.3 - 3.6) \times 10^{-4} / \text{cm}^3$

Grcevich & Putman (2009)  $(0.1-10) \times 10^{-4} / \text{cm}^3$

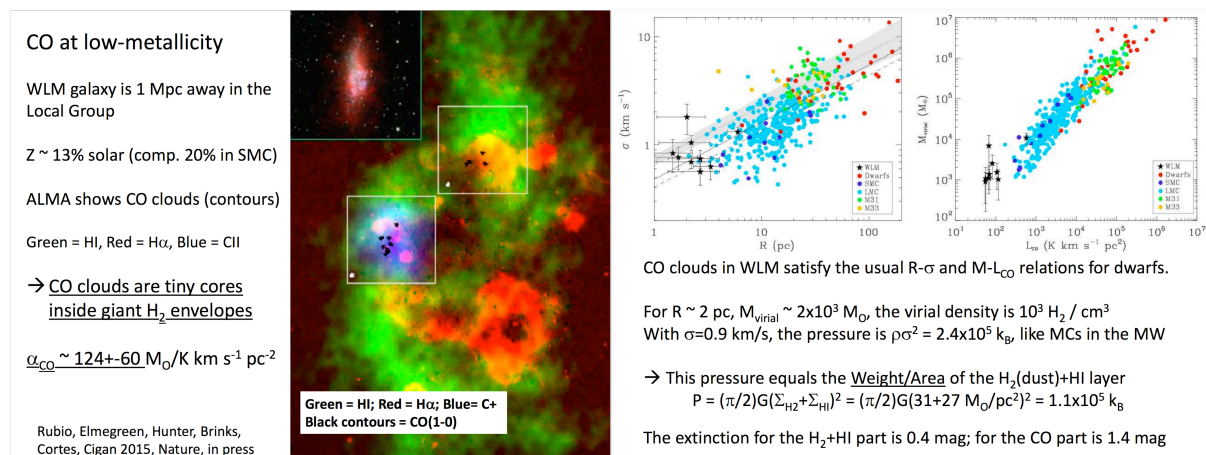
IF BETA PROFILE: (BUT SEE FAERMAN TALK)

$$M_{\text{gas smooth}}(R < 300 \text{ kpc}) = 2.6 (+/- 1.4) \times 10^{10} M_{\odot}$$

(7-24% of Expected Baryons in 1e12 halo)

Similar to that inferred for M31 (Lehner et al. 2015)

Gurtina Besla presented results using the truncation radius of the Large Magellanic Cloud to constrain the density of the circumgalactic medium at its location ( $r \sim 48$  kpc). This then gives a number for the total gas mass of the halo, for an assumed density profile.



To conclude the meeting, Bruce Elmegreen presented ALMA results for individual CO clouds in the WLM dwarf galaxy. The CO clouds are tiny cores in giant H $_2$  envelopes, and are consistent with scaling relations for clouds in other galaxies (see Annie Hughes's talk for caveats and a fuller picture), and consistent with the theoretical expectations for low metallicity conditions.

The meeting had 86 participants from all around the world. About half the participants have European affiliations. Slightly more than half the participants were junior researchers and the program included a majority of talks by junior researchers (~37/63). 32 of the participants were women. Of the 18 invited speakers, 5 were postdocs and nine were women.

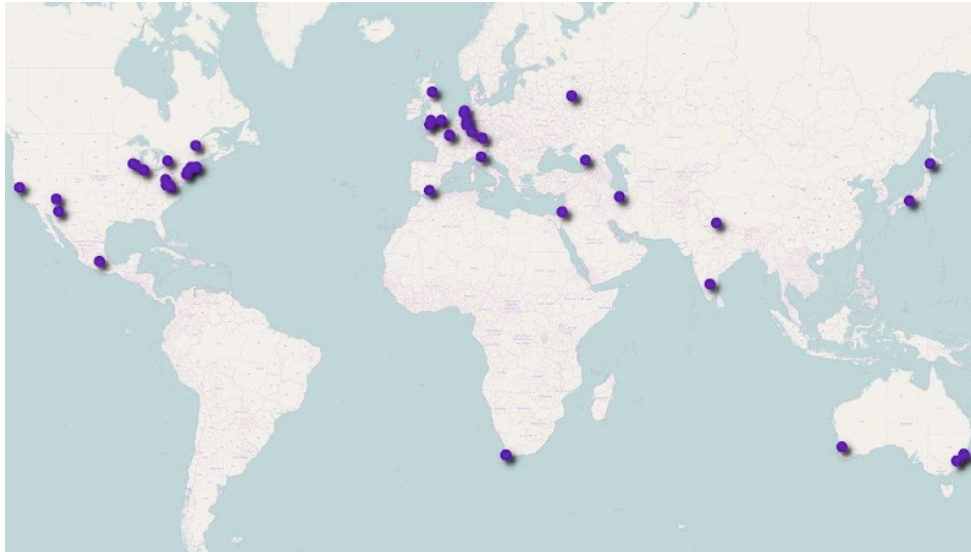


An unofficial conference picture of everyone demonstrating 50 degrees during Bob Benjamin's talk.



The conference photo.





A visual summary of the geographic distribution of participants.

### **3. Attendance list (incl. participant names, affiliation and country) signed by the participants and confirmed by the organizer**

Attached.

### **4. Financial Report / RadioNet3 contribution**

The RadioNet3 contribution was used to provide travel support for the invited speakers, SOC, LOC and select students by waiving the registration fee (150€). Twenty-five people had waived registration fees, for a total of 3750€. Three of the invited speakers (Rahul Shetty, Nia Imara, and Blakesley Burkhardt) also received limited travel grants of 200€. The list of people who received waived registration fees are:

1. Betsey Adams, ASTRON (The Netherlands)
2. George Heald, ASTRON (The Netherlands)
3. Naomi McClure-Griffiths, RSAA-ANU (Australia)
4. Tom Oosterloo, ASTRON (The Netherlands)
5. Brad Frank, ASTRON (The Netherlands)
6. Eva Juette, Astronomisches Institut der Ruhr-Universitaet Boch (Germany)
7. Bob Benjamin, University of Wisconsin-Whitewater (USA)
8. Gurtina Besla, University of Arizona (USA)
9. Robert Braun, SKA (UK)
10. Blakesley Burkhardt, Harvard-Smithsonian Center for Astrophysics (USA)
11. Erwin de Blok, ASTRON (The Netherlands)
12. Bruce Elmegreen, IBM (USA)
13. Edith Falgarone, ENS & Observatoire de Paris (France)
14. Filippo Fraternali, University of Bologna (Italy)
15. Mark Heyer, University of Massachusetts (USA)
16. Deidre Hunter, Lowell Observatory (USA)
17. Nia Imara, Harvard-Smithsonian Center for Astrophysics (USA)
18. Jill Rathborne, CSIRO (Australia)
19. Rahul Shetty, Heidelberg University (Germany)
20. Amiel Sternberg, Tel Aviv University (Israel)
21. Marc Verheijen, Kapteyn Astronomical Institute (The Netherlands)
22. Bahar Bidaran, Alzahra University (Iran)

- 23. Maryam Arabsalmani, ESO (Germany)
- 24. Anastasia Ponomareva, Kapteyn Astronomical Institute (The Netherlands)
- 25. Renzo Sancisi, Kapteyn Astronomical Institute (The Netherlands)

## **5. Conference Proceedings and Web page**

There are no conference proceedings; instead presentations are available on the conference website at <http://www.astron.nl/localgas2015/programme.php>

# Program Local Gas Conference

Van de Hulst Auditorium - ASTRON

31 August - 4 September

## Monday 31 August

08:45 Shuttle bus at van der Valk with stops at Wesseling, de Borken

Collecting bikes

09:00-09:50 Registration at the registration desk and coffee/tea

09:50-10:00 Welcoming remarks

Betsey Adams

### Session 1: Transitions in the ISM (forming molecules)

Chair: Rahul Shetty

10:00-10:30 HI-to-H<sub>2</sub> Transitions in Galaxy Star-Forming Regions

Amiel Sternberg

10:30-10:50 Deciphering local, multi-phase HI with 21-SPONGE and artificial intelligence

Claire Murray

10:50-11:10 The impact of the optically thick HI on the HI-to-H<sub>2</sub> transition in the ISM

Min-Young Lee

11:10-11:20 Poster talks

11:20-11:50 *coffee break in the hallway*

11:50-12:20 Atomic Hydrogen and the Origin of Molecular Clouds

Nia Imara

12:20-12:40 I\_CO-A\_V in the Local Group:

Towards a Prescription for the CO Emission as a function of Metallicity

Cheoljong Lee

12:40-13:00 Forming molecules in a violent environment: outflows in starburst nuclei

Arpita Roy

13:00-14:00 *Lunch in the hallway*

### Session 2: Turbulence and multi-phase medium

Chair: Jill Rathborne

14:00-14:30 The Origins and Implications of Turbulence in Galaxies

Blakesley Burkhart

14:30-14:50 Density structures caused by supersonic turbulent motions

Lukas Konstandin

14:50-15:10 A global view on the correlation of dust and gas

Daniel Lenz

15:10-15:30 SILCC: Chemical and dynamical evolution

of the SN-driven ISM and the launching of outflows

Philipp Girichdis

15:30-15:40 poster talks

15:40-16:10 *coffee break in the hallway*

16:10-16:40 Think Global, Act Local: Atomic Hydrogen in the Milky Way

Naomi McClure-Griffiths

16:40-17:00 High-Resolution Images of Diffuse Neutral Clouds in the Milky Way

Yurii Pidopryhora

17:00-17:20 The ISM

Edith Falgarone

17:20-17:40 ISM discussion

### 18:00-20:00 Reception at Bospub

20:00 Shuttle bus from Bospub to Wesseling, van der Valk

## Tuesday 1 September

08:45 Shuttle bus at van der Valk with stops at Wesseling, de Borken

### Session 3: Halo gas

Chair: George Heald

09:30-10:00	The HALOGAS Survey	Erwin de Blok
10:00-10:20	A GBT Survey of the HALOGAS Galaxies: Revealing the Complete HI Environment Around Spirals	Nickolas Pingel
10:20-10:40	UGCA 105: A dwarf with a beard	Gyula I. G. Józsa
10:40-10:50	poster talks	
10:50-11:20	Coffee break	
11:20-11:50	Models of the Kinematics of Gas in the Disk-Halo Interface: A Galactic Perspective	Bob Benjamin
11:50-12:10	Disk-corona gas cycle in simulated Milky Way-like galaxies.	Antonino Marasco
12:10-12:30	Kinematical misalignments in the EAGLE simulations	Paolo Serra
12:30-12:50	Hot Galactic Halos	Yakov Faerman
12:50-13:50	Lunch	

### Session 4: Local gas accretion

Chair: Naomi McClure-Griffiths

13:50-14:20	Local Group Clues to the Galaxy Gas Life Cycle	Robert Braun
14:20-14:40	Neutral Gas Clouds in the Local Group	Felix Lockman
14:40-15:00	Evidence of gas accretion at the disk-halo interface of M33	Yong Zheng
15:00-15:10	Poster talks	
15:10-15:40	Coffee break	
15:40-16:10	The Evolution of the Gaseous Magellanic System	Gurtina Besla
16:10-16:30	Dark gas in the Milky Way	Helga Denes
16:30-17:00	The search for isolated HI clouds in the environment of HALOGAS galaxies	Eva Juetten
17:00-17:20	Will we ever see gas accretion?	Filippo Fraternali
17:20-17:40	Gas accretion discussion	

18:00-19:00 Poster session and borrel

19:00-20:30 Chinese buffet at ASTRON

20:30 Shuttle bus from ASTRON to Borken, Wesseling, van der Valk

## Wednesday 2 September

08:45 Shuttle bus at van der Valk with stops at Wesseling, de Borken

### Session 5: Expanding the life-cycle of gas

Chair: Amelie Saintonge

09:30-09:50	Magnetic fields and cosmic rays in the disk-halo interface of spiral galaxies	Ralf-Juergen Dettmar
09:50-10:10	The Life Cycle of Gas in Galaxy Clusters	Ian Parrish
10:10-10:30	Extended gaseous discs in early-type galaxies: 3D spectroscopy of the ionized gas	Moiseev, Alexey
10:30-10:50	AGN Feedback in Action: The Molecular Outflow in Circinus Galaxy	Laura Zschaechner
10:50-11:30	coffee break	
11:30-11:50	3D Spectroscopy of Galactic Outflows	Dominik Bomans
11:50-12:10	Molecular gas in the starburst galaxy NGC 1808 revealed with ALMA	Dragan Salak
12:10-12:40	GMC Populations and Star Formation in Nearby Galaxies	Annie Hughes
12:40-13:30	Lunch	

### Free Afternoon

13:30 Bus from ASTRON to Giethoorn

18:30 Bus from Giethoorn to de Borken

19:30-22:00 Conference dinner: Barbecue at Hotel de Borken

22:00 Shuttle bus from de Borken to Wesseling, van der Valk

## Thursday 3 September

08:45 Shuttle bus at van der Valk with stops at Wesseling, de Borken



## Session 6: Understanding SF laws

Chair: Liese van Zee

09:30-09:50	Spiral Shocks and the triggering of star formation	Ian Bonnell
09:50-10:10	Birthing star forming clouds in the grand design	Yusuke Fujimoto
10:10-10:30	Role of Cloud Cloud Collisions in High Mass Star Formation	Asao Habe
10:30-10:50	Properties of the Molecular Gas and Star Formation Process in Andromeda	Andreas Schrubba
10:50-11:20	coffee break	
11:20-11:40	Dark gas in the disc of the giant low surface brightness galaxy Malin 2	Anna Saburova
11:40-12:00	A novel model for the stellar IMF	Gustavo Dopcke
12:00-12:20	The link between HI, H2 and star formation in the local Universe: the COLD GASS perspective	Amelie Saintonge
12:20-12:40	The multi-scale nature of galactic star formation in discs and nuclei across cosmic time	Diedrik Kruijssen
12:40-13:00	The Connection between Star Formation and Metallicity Evolution in Barred Spiral Galaxies	Hugo Martel
13:00-14:00	lunch	

## Session 7: Star formation in extreme environments

Chair: Diederik Kruijssen

14:00-14:30	Star formation in high pressure environments	Jill Rathborne
14:30-14:50	Star formation and tidal interactions in Wolf Rayet galaxies	Amitesh Omar
14:50-15:10	How to suppress star formation in dwarf galaxies	John Forbes
15:10-15:30	Multiwavelength view on stellar feedback and gas kinematics in nearby dwarf galaxies	Oleg Egorov
15:30-16:00	coffee break	
16:00-16:30	Diffuse molecular gas and variations in star formation scaling relationships in local galaxies	Rahul Shetty
16:30-16:50	The star formation law in Tidal Dwarf Galaxies	Ute Lisenfeld
16:50-17:10	Discussion on the Role of Star Formation in Gas Cycling	Mark Heyer
17:10-17:30	discussion	
17:45	Shuttle bus from ASTRON to de Borken, Wesseling, van der Valk	

## Friday 4 September

08:45 Shuttle bus at van der Valk with stops at Wesseling, de Borken

## Session 8: The role of HI in SF

Chair: Tom Oosterloo

09:30-10:00	HI and Star Formation in Dwarf Irregular Galaxies	Deidre Hunter
10:00-10:20	The spatially resolved Kennicutt-Schmidt relation in the HI dominated regime	Sambit Roychowdhury
10:20-10:40	Tracing HI Gas Cycles and Global Star Formation with the ALFALFA H-alpha Survey	Anne Jaskot
10:40-11:00	Gas and Stars in Nearby Dwarf Galaxies with Extended Neutral Hydrogen Disks	Liese van Zee
11:00-11:30	Coffee break	
11:30-11:50	Atomic and Molecular Gastronomy in a remarkable HI-massive Galaxy	Michelle Cluver
11:50-12:10	Star Formation in HI Dominated Environments	Jennifer Donovan Meyer
12:10-12:30	Gaseous Dwarf-Dwarf Interactions in the Local Universe	Sarah Pearson
12:30-12:50	HI observations of galaxies in the southern filament of the Virgo Cluster with the KAT-7 and the WSRT	Amidou Sorgho
12:50-13:10	On the non-evolution of neutral gas mass density	Tayyaba Zafar
13:10-14:10	Lunch	
Session 9: Current and future HI surveys		
Chair: Kelley Hess		
14:10-14:40	HI imaging surveys with Apertif	Marc Verheijen
14:40-15:00	An overview of MHONGOOSE	Ioannis Bagetakos
15:00-15:20	How gas feeds galaxies with a phased array feed.	Atilla Popping
15:20-15:50	Coffee break	
15:50-16:10	The role of HI in star formation	Bruce Elmegreen
16:10-16:30	discussion	
16:45	shuttles to train station	

## List of participants

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There are 91 participants registered out of a total of 96 available slots.

Name	Affiliation
Adams, Betsey	ASTRON
Arabsalmani, Maryam	European Southern Observatory
Bagetakos, Ioannis	ASTRON/Kapteyn
Benjamin, Robert	U of Wisconsin-Whitewater
Besla, Gurtina	U. Arizona
bidaran, bahar	Alzahra university
Bomans, Dominik	Astr. Inst. Ruhr-Univ. Bochum
Bonnell, Ian	University of St Andrews
Braun, Robert	SKA Organisation
Burkhart, Blakesley	Harvard-Smithsonian Center for Astrophysics
Busekool, Eva	Kapteyn Astronomical Institute, University of Gron
Cluver, Michelle	University of the Western Cape
de Blok, Erwin	ASTRON
Denes, Helga	CSIRO/ANU
Dettmar, Ralf-Juergen	Ruhr-Universitaet Bochum
Donovan Meyer, Jennifer	NRAO
Dopcke, Gustavo	Cardiff University
Egorov, Oleg	Sternberg Astronomical Institute of Moscow State U
Elmegreen, Bruce	IBM Research
Faerman, Yakov	Tel Aviv University
Falgarone, Edith	ENS & Observatoire de Paris
Forbes, John	University of California, Santa Cruz
Forgan, Duncan	School of Physics and Astronomy, University of St
Frank, Bradley	ASTRON
Fraternali, Filippo	University of Bologna
Fujimoto, Yusuke	Hokkaido University
Gazol, Adriana	CRyA
Giese, Nadine	Kapteyn Astronomical Institute
Girichidis, Philipp	MPA Garching
Habe, Asao	Hokkaido University
Heald, George	ASTRON
Heiderman, Amanda	University of Virginia/ NRAO
Hess, Kelley	Kapteyn Astronomical Institute/ASTRON
Heyer, Mark	University of Massachusetts
Hughes, Annie	IRAP

Hunter, Deidre	Lowell Observatory
Imara, Nia	Harvard-Smithsonian Center for Astrophysics
Jarrett, Thomas	Univ of Cape Town
Jaskot, Anne	Smith College
Józsa, Gyula I. G.	SKA South Africa
Juette, Eva	Astronomisches Institut der Ruhr-Universitaet Boch
Kasparova, Anastasia	Sternberg Astronomical Institute, Moscow State Uni
Konstandin, Lukas	University of Exeter
Kruijssen, Diederik	Heidelberg University
Lee, Cheoljong	University of Virginia
Lee, Min-Young	CEA-Saclay
Lenz, Daniel	Argelander-Institut für Astronomie
Lisenfeld, Ute	Universidad de Granada
Lockman, Felix	National Radio Astronomy Observatory
Marasco, Antonino	Kapteyn Astronomical Institute
Martel, Hugo	Université Laval
McClure-Griffiths, Naomi	RSAA-ANU
Mills, Elisabeth	NRAO
Moiseev, Alexey	Special Astrophysical Observatory of RAS
Moss, Vanessa	CAASTRO/University of Sydney
Murray, Claire	University of Wisconsin-Madison
Omar, Amitesh	Aryabhata Research Institute
Oosterloo, Tom	ASTRON/Kapteyn
Papastergis, Manolis	Kapteyn Institute/Univ. of Groningen
Parrish, Ian	Canadian Institute for Theoretical Astrophysics (C
Pearson, Sarah	Columbia University
Pidopryhora, Yurii	Argelander-Institut für Astronomie Bonn
Pingel, Nickolas	West Virginia University
Ponomareva, Anastasia	Kapteyn Astronomical Institute
Popping, Attila	ICRAR / UWA
Punzo, Davide	Kapteyn Astronomical Institute
Ramatsoku, Mpati	Kapteyn Astronomical Institute
Ramon-Fox, Gerardo	University of St. Andrews
Rathborne, Jill	CSIRO Astronomy and Space Science
Ronaghi, Nima	Sharif University of Technology
Roy, Arpita	Indian Institute of Science/Raman Research Institu
Roychowdhury, Sambit	Max Planck Institute for Astrophysics
Saburova, Anna	Sternberg Astronomical Institute of M.V. Lomonosov
Saintonge, Amelie	UCL
Salak, Dragan	Kwansei Gakuin University



Schruba, Andreas	MPE
Serra, Paolo	CSIRO ATNF
Shetty, Rahul	Heidelberg University
Sorgho, Amidou	University of Cape Town
Sternberg, Amiel	Tel Aviv University
van der Hulst, Thijs	Kapteyn Astronomical Institute
van Woerden, Hugo	Kapteyn Institute RUG
van Zee, Liese	Indiana University
Verheijen, Marc	Kapteyn Astronomical Institute
Wang, Jing	CSIRO/ATNF
Williamson, David	Université Laval
Yildiz, Mustafa	Kapteyn Astronomical Institute
Zafar, Tayyaba	European Southern Observatory (ESO)
Zasov, Anatoly	Sternberg Satronomical Inst. of Moscow State Unive
Zheng, Yong	Columbia University
Zschaechner, Laura	MPIA

Sancisi, Renzo Kapteyn Astronomical Institute  
 Srihar, Sarvesh Kapteyn Astronomical Institute



6 Oct 2015