

Final Scientific Program

August 10 (Wednesday)

FM6-1: Radio observations and theory I (Aug. 10, 10:30-12:00)

Session Chair: Dongsu Ryu

(blue - 20 minutes, brown - 15 minutes)

1. [Melanie Johnston-Hollitt \(Curtin University, Australia\)](#) - The Importance of Wideband Spectral Observations of Radio Emission in Galaxy Clusters
2. [Ruta Prabhakar Kale \(NCRF-TIFR, India\)](#) - Revealing properties of non-thermal emission from galaxy clusters using the Upgraded GMRT
3. [Reinout Van Weeren \(Leiden University, Netherlands\)](#) - LOFAR observations of the Perseus Cluster
4. [Christian Groeneveld \(Leiden University, Netherlands\)](#) - Galaxy clusters in the Decameter Sky
5. [Gianfranco Brunetti \(INAF, Italy\)](#) - Tackling the complexity of non-thermal phenomena in galaxy cluster sand LSS (on-line presentation)

FM6-2: SZ Observations (Aug. 10, 13:30-15:00)

Session Chair: M. James Jee

(blue - 20 minutes, brown - 15 minutes)

1. [Florian Ruppin \(University of Lyon, France\)](#) - High angular resolution SZ cartography of galaxy clusters with NIKA2 at the IRAM 30-m telescope
2. [Charles Romero \(Smithsonian Astrophysical Observatory, USA\)](#) - The utility of subarcminute SZ observations with MUSTANG-2
3. [Stefania Amodeo \(Observatoire Astronomique de Strasbourg, France\)](#) - Gas thermodynamics from the SZ effects: an ACT view
4. [Luca Di Mascolo \(University of Trieste, Italy\)](#) - Multi-wavelength view of a massive galaxy cluster merger at $z=1.13$
5. [Joshiwa Van Marrewijk \(ESO, Netherlands\)](#) - RXC-J2014.8-2430, the strongest cool core galaxy cluster in REXCESS: How the hot intracluster medium affects the cold molecular gas in and around the brightest cluster galaxy

FM6-3: X-ray observations and theory I (Aug. 10, 15:15-16:45)

Session Chair: Melanie Johnston-Hollitt

(blue - 20 minutes, brown - 15 minutes)

1. [Irina Zhuravleva \(University of Chicago, USA\)](#) - Updates on Turbulence in Hot ICM
2. [Yuto Ichinohe \(Rikkyo University, Japan\)](#) - XRISM observation of galaxy clusters
3. [Eugene Churazov \(MPA, Germany\)](#) - ICM dynamics in the Coma cluster (X-ray view)
4. [Congyao Zhang \(University of Chicago, USA\)](#) - Giant shock waves in galaxy clusters (on-line presentation)
5. [Eunyu Lee \(UNIST, Korea\)](#) - Shocks in merging galaxy clusters in cosmological simulations

August 11 (Wednesday)

FM6-4: X-ray observations and theory II (Aug. 11, 10:30-12:00)

Session Chair: Ruta Prabhakar Kale

(blue - 20 minutes, - 13 minutes)

1. Hiroki Akamatsu (SRON, Netherlands) - X-ray and radio multi-wavelength view of clusters of galaxies (on-line presentation)
2. Junhan Kim (Caltech, USA) - A Multi-Probe Analysis of the 3-D Shapes and Non-Thermal Pressure in the CHEX-MATE Galaxy Clusters
3. John ZuHone (CfA, USA) - The interaction between merger-driven gas motions and AGN feedback in clusters of galaxies (on-line presentation)
4. Roland Timmerman (Leiden University, Netherlands) - Measuring cavity powers of active galactic nuclei in clusters using a hybrid X-ray/radio method
5. Takuya Akahori (NAOJ/SKAO, Japan) - Phoenix rising from the ashes - co-existence of violent cooling and AGN feedback (on-line presentation)
6. Annalisa Pillepich (MPIA, Germany) - X-ray manifestations of AGN feedback, mergers and satellite accretion with the IllustrisTNG simulations

FM6-5: High-energy phenomena and weak lensing (Aug. 11, 13:30-15:00)

Session Chair: Irina Zhuravleva

(blue - 20 minutes, brown - 13 minutes)

1. Rafael Alves-Batista (UA Madrid, Spain) - Neutrinos and gamma rays from clusters of galaxies
2. Saqib Hussain (University of Sao Paulo, Brazil) - High-energy gamma-ray production in clusters of galaxies (on-line presentation)
3. Ji-Hoon Ha (UNIST, Korea) - Particle acceleration at accretion shocks around galaxy clusters
4. M. James Jee (Yonsei University, Korea) - Weak-lensing Study of Merging Galaxy Clusters and Probes of Dark Matter
5. Kyle Finner (Caltech, USA) - Weak-lensing analysis of 30 merging clusters that exhibit radio relics
6. Wonki Lee (Yonsei University, Korea) - Discovery of peculiar double radio relics in the merging cluster ZwCl J1447.2+2619 (on-line presentation)

FM6-6: Radio observations and theory II (Aug. 11, 15:15-16:45)

Session Chair: Reinout Van Weeren

(blue - 20 minutes, brown - 13 minutes)

1. Annalisa Bonafede (University of Bologna & INAF, Italy) - Magnetic field in galaxy clusters and beyond: new perspectives from low frequency observations (on-line presentation)
2. James Okwe Chibueze (North-West University, South Africa) - MeerKAT's view of an interaction between intra-cluster magnetic field and blackhole jets
3. Erik Osinga (Leiden University, Netherlands) - The detection of cluster magnetic fields via radio source depolarization
4. Paola Dominguez Fernandez (University of Bologna, Italy) - Substructure and patchiness in radio relics
5. Jurjen De Jong (Leiden University, Netherlands) - Particle reacceleration in the pre-merging radio bridge A399-401
6. Rajsekhar Mohapatra (Australian National University, Australia) - Multiphase turbulence in the ICM: the role of turbulence heating and the effect of the driving

FM6 e-talks:

1. Hyunjin Cho (UNIST, Korea) - Investigation of the magnetic field in filaments of galaxies using Faraday rotation measure
2. Hyesung Kang (Pusan National University, Korea) - Reacceleration of preexisting suprathermal electrons in weak ICM shocks
3. Dharam Lal (National Centre for Radio Astrophysics, TIFR, India) - Slee et al.'s four extreme relic radio sources revisited
4. Kazuo Makishima (University of Tokyo, Japan) - The missing last piece in the study of ICM dynamics and thermodynamics
5. John Orłowski-Scherer (University of Pennsylvania, USA) - Constraints on the thermodynamic state of X-ray bubbles in MS0735 with MUSTANG-2
6. Lawrence Rudnick (University of Minnesota, USA) - Magnetized ICM filaments and radio jet interactions
7. Sharanya Sur (Indian Institute of Astrophysics, India) - Probing the magnetized intracluster medium (ICM) with synchrotron keys
8. Yong Tian (National Central University, Taiwan) - Mass-velocity dispersion relation on BCG-cluster scales
9. Anatolii Tugay (Taras Shevchenko National University of Kyiv, Ukraine) - Soft X-ray spectral analysis and black hole mass determination of Mrk 273

FM6 e-posters:

1. Ludwig Böss (Ludwig-Maximilian Universität, Germany) - Galaxy Cluster simulations with a spectral cosmic ray model
2. Hyejeon Cho (Yonsei University, Korea) - A multi-wavelength study of a double radio-relic system merging along a large-scale filament
3. Yutaka Fujita (Tokyo Metropolitan University, Japan) - Massive molecular gas as a fuel tank for active galactic nuclei feedback in central cluster galaxies
4. Jaehyun Lee (Korea Institute of Advanced Study, Korea) - Simulating jellyfish features with a gas-rich dwarf galaxy
5. Kosuke Nishiwaki (University of Tokyo, Japan) - Turbulent re-acceleration scenario for radio halos and high-energy emission from galaxy clusters
6. Takumi Ohmura (University of Tokyo, Japan) - Non-thermal emission from head-tail galaxy in three-dimensional magnetohydrodynamic simulations
7. Yuki Omiya (Nagoya university, Japan) - XMM-Newton view of the shock heating in an early merging cluster, CIZA J1358.9-4750
8. Yoan Rappaz (EPFL, Switzerland) - Constraints on the collisionless dynamo during galaxy cluster evolution
9. Dongsu Ryu (UNIST, Korea) - Heating particles by kinetic turbulence in the intracluster medium

Statistics of speakers

Invited speakers - 15

Female - 6

Male - 9

Contributed speakers - 18

Femail - 4

Male - 14

E-talks - 9

Femail - 2

Male - 7

E-posters - 9

Femail - 1

Male - 8

Summary of the scientific highlight of the meeting

Despite a difficult situation due to COVID 19, the meeting had a good number of very nice talks and contributions; 23 in-person talks, 10 on-line talks, 9 e-talks, 9 e-posters.

The estimated number of in-floor participants was around 40, and the participants from the virtual platform are estimated to be around 20 - 30.

The cross-community talks and discussions among radio, X-ray, and SZ observations along with theory provided an insight into the physical processes in the ICM and will eventually help us to describe the dynamics in the ICM and associated physics. These kinds of efforts will continue in future conferences.

An Excecutive Summary of the Meeting

Most of the baryonic matter of galaxy clusters is in the form of hot gas in the intracluster medium (ICM). The ICM has been recognized as a vital element in the formation and evolution of the large-scale structure of the universe and individual galaxies, as well as an essential diagnostic tool when studying galaxy clusters. It is highly dynamic and also contains nonthermal components such as magnetic fields and cosmic-ray protons and electrons. In the Focus Meeting 6 (FM6) of the 31st IAUGA, among cross-communities of radio, X-ray, and SZ observations and theory, we will initiate discussions that define the roles of turbulence, shocks, and cold/sloshing fronts in the ICM, as well as establish reliable, discriminating observational signatures of their properties and inter-relationships. In particular, we will address critical observational and theoretical challenges in the coming decades, specifically how emerging and planned observational efforts, such as LOFAR, uGMRT, MeerKAT, ASKAP, SKA, ngVLA (radio), eROSITA, XRISM, ATHENA (X-ray), and ACT, SPT, Planck, MUSTANG2 on the 100-meter GBT, NIKA2 on the IRAM 30-meter, ALMA + ACA, CCAT-prime, TolTEC on the 50-m LMT/GTM, Simons Observatory, APEX/CONCERTO, CMB-S4, AtLAST, LST, and potential new space-based CMB probes (SZ), can be combined with theoretical understandings to enable a comprehensive picture of the ICM. The need for such a gathering is motivated by revelations of the importance of the dynamics of the ICM through recent observations, especially in radio, X-ray, and SZ, but also in other bands, as well as developments in simulation and theory hinting at possible interpretations. The current understanding is still very incomplete. However, observations with coming facilities, together with signals from multi-messenger astronomy, and rapid progress in simulation and theory, have the potential to resolve fundamental blocks to the understanding of the nature of the ICM.