

Section A: Overview of the Research Project

1. Title of the research project:

The gas depletion timescale of star-forming galaxies at intermediate redshift.

2. Broad area of research:

Science

3. Academic level of research project:

Master's

4. Abstract of research:

Over the past ~10 billion years of cosmic time, the star formation rate density of the universe has dropped by almost two orders of magnitude. An approach to investigating this decrease is to probe the evolution of the neutral hydrogen, HI, gas content of galaxies over cosmic time since HI provides the gas reservoir from which stars eventually form in galaxies. Recently, Chowdhury et al. (2022) used HI stacking to measure the average HI masses and the HI depletion timescales of star-forming galaxies at $0.74 < z < 1.45$ using deep observations on the GMRT. Their results imply that gas accretion at $z \sim 1$ is not efficient enough to maintain the HI reservoirs of massive galaxies and is likely the cause of the drop in star formation rate density. The goal of this project will be to use the first internal release of LADUMA L-band data which covers a redshift range of $0 < z < 0.56$ to measure the average HI masses of star-forming galaxies as a function of stellar mass and redshift to determine the gas depletion timescales of galaxies at intermediate redshift to connect with the measurements by Chowdhury et al (2022) at higher redshifts.

5. Primary supervisor's details:

- a. Full name of primary supervisor: Assoc. Prof. Sarah Blyth
- b. Email address: sarblyth@ast.uct.ac.za
- c. University: University of Cape Town

6. Co-supervisor's details:

- a. Full name of co-supervisor: Dr Rosalind Skelton
- b. Institution: South African Astronomical Observatory

Please note that *both* supervisors will be responsible for supervising the student's research.

Section B: Details of Research Project

1. Scientific merit:

Over the past ~10 billion years of cosmic time, the star formation rate density of the universe has dropped by almost two orders of magnitude (Madau & Dickinson, 2014); galaxies today are forming stars at only a fraction of the rate they were ~10 billion years ago. In order to better understand why we observe this phenomenon, we need to understand how the hydrogen gas, the fuel for star formation in galaxies, is evolving over cosmic time. Neutral atomic hydrogen, HI, which provides the reservoir from which molecular hydrogen, and eventually stars, can form, dominates the mass fraction of the interstellar medium (ISM) of galaxies and is detectable through its 21cm spin-flip transition by radio telescopes.

Recently, Chowdhury et al. (2022) used HI stacking to measure the average HI masses and the HI depletion timescales of star-forming galaxies at $0.74 < z < 1.45$ using deep observations on the GMRT. They found that the most massive galaxies ($\log(M^*) \sim 10 M_{\text{sun}}$) which dominate the star formation rate density at those redshifts have very short HI depletion timescales of less than 1 billion years. This would imply that they would need very high gas accretion rates to enable them to continue forming stars at their current rate. However Chowdhury et al. (2022) found that the average HI masses of galaxies with stellar masses of $\log(M^*/M_{\text{sun}}) \sim 10$, decrease by a factor of ~3.2 from $z \sim 1.3$ to $z \sim 1$ which implies that accretion at that epoch is not efficient enough to maintain the HI reservoirs of massive galaxies and is likely the cause of the drop in star formation rate density.

The LADUMA large survey project on MeerKAT is a deep HI survey encompassing the Extended Chandra Deep Field South. The survey is using a combination of L-band and UHF-band observations on MeerKAT to probe the HI emission from galaxies over the last ~9 billion years of cosmic time ($0 < z < 1.4$). The goal of this project will be to use the first internal release of LADUMA L-band data which covers a redshift range of $0 < z < 0.56$ to measure the average HI masses of star forming galaxies as a function of stellar mass and redshift to determine the gas depletion timescales of galaxies over that range of cosmic time to connect with the measurements by Chowdhury et al (2022) at higher redshifts. The project will utilise HI stacking supported by LADUMA's existing large spectroscopic redshift catalogue and sample selection will be achieved based on the multi-wavelength photometric catalogues in hand for the LADUMA field.

2. Feasibility:

Data availability and analysis techniques:

The project will rely on the HI stacking technique whereby galaxies are identified in optical catalogues, their spectra are extracted from the HI data cubes (detections and non-detections) and are stacked based on their redshifts (measured optically). This is a very useful technique in cases where the signal-to-noise ratio is too poor to directly detect individual galaxies and the HI properties of galaxy samples can then be measured on average. The student will use the HI stacking software developed by LADUMA team members (Healy et al. 2019).

The data required for this project are already in hand: the project will use the existing LADUMA internally-released L-band radio dataset consisting of 127 hours of MeerKAT observing time on source. LADUMA's large spectroscopic redshift catalogue consists of thousands of redshifts compiled from both publicly available spectroscopy as well as proprietary LADUMA redshifts from the team's own campaigns. These will be used for the stacking measurements. In addition, substantial multi-wavelength photometry already exists and is available for galaxies in the LADUMA field and these data will be used to determine the sample selection for stacking as well as the star formation rates of the stacked galaxies.

Resources and equipment:

As a LADUMA team member, the student will have access to the IDIA/ilifu cloud computing facilities where the LADUMA data will be processed and analysed. Being at UCT will enable the student to interact with IDIA researchers and technical experts who will be able to help support the computing aspects. As a student in the Department of Astronomy, the student will also have access to the usual desk and office space, internet access and library access afforded to all postgraduate students.

High level breakdown of activities:

- Identify ideal redshift ranges within which to perform stacking analysis based on availability of spectroscopic redshifts and other observational constraints (e.g. RFI bands, etc.) (2024)
- Identify galaxies on the star-forming main sequence in identified redshift ranges using photometric catalogues (2024)
- Perform HI stacking analysis (2024)
- Analyse results (2024 - 2025)
- Write up thesis (2025)

3. Relevance to SRAO research priority areas:

This project falls under the **highest priority area: MeerKAT** for science as listed in the application guide. The project will utilise L-band radio data which is already in hand from the LADUMA Large Survey Project on MeerKAT to measure the gas depletion timescales of a sample of galaxies at intermediate redshift.

4. Skills/experience useful to the student on this project:

Good python programming skills will be needed and experience in analyzing and working with HI data cubes will be an advantage. However, the student will learn these skills on the project if they have not yet had this experience.

Curriculum Vitae : SARAH-LOUISE BLYTH

Contact Information

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University of Cape Town
Rondebosch, Cape Town, 7701, South Africa

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Research Interests

Galaxy evolution, radio astronomy (HI), large scale structure, Physics/Astronomy education

Education

Ph.D. in High Energy Nuclear Physics, University of Cape Town, South Africa (2007)

(Hosted at Lawrence Berkeley National Laboratory, California, USA)

Thesis title: "Using the ϕ -meson to probe the medium created in Au+Au collisions at RHIC"

M.Sc. (with distinction) in High Energy Nuclear Physics, University of Cape Town, South Africa (2004)

(Hosted at Lawrence Berkeley National Laboratory, California, USA)

Thesis title: "Jet Study in Ultra-Relativistic Heavy-Ion Collisions with the ALICE Detector at the LHC"

BSc. (Hons) in Theoretical Physics, University of Cape Town, South Africa (1999)

BSc. in Physics and Astrophysics (*with distinction in Physics & the degree*), University of Cape Town, South Africa (1998)

Awards & Leadership Positions

- Co-Director National Astrophysics and Space Science Programme (NASSP), UCT-node (2018 - 2021)
 - Co-Chair of SKA HI Science Working Group (2018 - 2021, international invited position)
 - Co-PI of LADUMA survey on MeerKAT (2009 - present)
 - Chair of SARA0 Users' Committee (2021 - present, member since 2018, national invited position)
 - Member of the Pathfinder HI Coordination Committee (PHISCC) (2010 - present)
 - Member of the Inter-University Institute for Data Intensive Astronomy (IDIA) Management Committee (2018 - 2021, invited University position)
 - NRF C2 rating (awarded 2016)
 - RHIC & AGS Thesis award for an outstanding thesis related to research conducted at the RHIC or AGS complex (2008)
 - NRF Innovation Postdoctoral Fellowship (2008)
 - Junior Representative on STAR Experiment Council (2006-2007)
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Academic Experience

University of Cape Town, Cape Town, South Africa

(2020 -) Associate Professor, Department of Astronomy, University of Cape Town

(2017 -) Deputy Head of Department

(2018 - 2021) Co-Director National Astrophysics and Space Science Programme - UCT node

(2016 - 2020) Senior Lecturer

(2009 - 2015) Lecturer

(2008) NRF Innovation Postdoctoral Fellow in Astronomy

(mid-end 2007) Postdoctoral Fellow in Astronomy (departmentally funded)

Lawrence Berkeley National Laboratory, Berkeley, California, USA
(2005 - 2006) Visiting Scholar (during PhD work)

**Other Work
Experience**

(Aug 2001 - Dec 2002) *Management Consultant*, Pyxis Capital Management
(Mar 2000 - Jun 2001) *Business Analyst*, MarchFIRST

Absences

Maternity leave (October 2009 - January 2010)
Maternity leave (June 2012 - October 2012)

Supervision

Doctoral

Munira Hoosain, *primary supervisor* (2021 -) (SARAO-funded)
Nadine Hank, *co-supervised* (2021 -) (University of Groningen)
Nazir Makda, *co-supervised* (2019 -)
Gerald Balekaki, *co-supervised*, (2016 -) (Computer science)
Tshiamiso Makwela, *co-supervised*, graduated 2022
Narges Hatamkhani, *co-supervised*, graduating December 2022
Julia Healy, *co-supervised*, graduated 2021 (SARAO-funded, Joint degree UCT / University of Groningen)
Jamie Bok, *co-supervised*, (Upgraded from MSc.) graduated 2021
Tom Mutabazi, *supervised*, (upgraded from MSc.), graduated June 2015, (SKA-funded)

Masters

Tilman Oelgeschläger, *co-supervised*, (August 2022 -)
Munira Hoosain, *co-supervised*, (graduated 2022)
Nadine Hank (SARAO-funded), *supervised*, (graduated 2021)
Nazir Makda, *co-supervised*, (graduated 2020)
Julia Healy (SKA-funded), *supervised*, (graduated June 2017)
Scott Badenhorst, *co-supervised*, (graduated June 2015)
Christopher Schollar, *supervised*, (graduated June 2015)
Riona Ramraj, *co-supervised*, (graduated 2014)
Zara-Nomena Randriamanakoto, *co-supervised*, (graduated 2010)

Honours

1 Astronomy Hons student (Nadine Hank, 2017)
7 (previous) jointly supervised Computer Science Hons students over past ~6 years

Postdoctoral

Jacinta Delhaize, SKA Postdoctoral Fellow (Aug 2018 - Jan 2022)
Natasha Maddox, SKA Postdoctoral Fellow (Aug 2011 - Jul 2014)

**Successful
Funding Proposals**

Research funding

- NRF Competitive Support for Rated Researchers, R 792 800 (2021)
- UCT URC Travel Grant, R 14k (2018)
- NWO / NRF Cooperation Programme for HI Surveys (*SA PI*), R450k (+ €15k *p.a. NL*) (2017-2019)

- NRF Incentive funding, R40k p.a. (2016 - 2018)
- NWO / NRF Cooperation Programme for HI Surveys (SA PI), R450k (+ €15k p.a. NL) (2013-2016)
- NRF Multi-Wavelength Astronomy Research Programme, R127k (2015)
- URC Visiting Scholars Fund, R23k (2015)
- NRF Competitive Support for Unrated Researchers, R341k (2015-2017)
- UCT URC Travel Grant, R26k (2014)
- SKA-SA Mobility Grant, R10k (2014)

Teaching funding

- SARAO Block Grant, R774k (2020), (*undergraduate student bursaries*)
- SARAO Block Grant, R725k (2019), (*undergraduate student bursaries*)

Meeting Organisation

SOC, "A Precursor View of the SKA Sky", SKA Observatory Virtual Conference, March 2021
 SOC, "2020 PHISCC Workshop", to be held in Cagliari, Italy May 2020, postponed due to Covid-19
 SOC, "SKA General Science Meeting and Key Science Workshop 2019", Manchester, UK, April 2019
 SOC, "SKA/SARAO Bursary Conference", Cape Town, South Africa, 2016, '17, '18, '19, '20, '21
 LOC + SOC, "2016 PHISCC Workshop: Upgrading our HI Toolkit", Cape Town, South Africa, February 2016
 LOC (Lead), Fourth LADUMA Team Meeting, Cape Town, South Africa, February 2016
 SOC, "2015 PHISCC Workshop: HI Surveys Get Real, Rutgers", NJ, USA, March 2015
 SOC, "Life-cycle of gas in galaxies: A local perspective" meeting, ASTRON, NL, August 2015
 LOC + SOC, "5th Pathfinder HI Science Coordination Committee (PHISCC) Workshop", Cape Town, South Africa, January 2012
 LOC (Lead), First LADUMA Team Meeting, Cape Town, South Africa, January 2012

Recent Conference Talks

Probing Galaxy Merger Activity Via HI Asymmetries, short talk at MIAPP 2-week residential invited meeting on *Galaxy Evolution in a New Era of HI Surveys*, Garching, Germany, August 2019

Future high redshift observations of HI kinematics, invited talk at the Focus Meeting on Galactic Angular Momentum, IAU General Assembly, Vienna, August 2018

LADUMA: Looking at the Distant Universe with the MeerKAT Array, contributed talk at 11th Pathfinder HI Science Coordination Committee Workshop, Pingtang, China, June 2018

Probing galaxy merger activity through HI global profile asymmetries, contributed talk at 10th Pathfinder HI Science Coordination Committee Workshop, Pune, India, February 2017

Galaxy Evolution Probed by Extragalactic HI, invited talk at AAMID Workshop, Cape Town, March 2016

Looking At the Distant Universe with MeerKAT and SALT, keynote talk at the Science with SALT conference, Stellenbosch, June 2015

Effective visualisation to enhance identification of RFI in radio astronomy data, contributed talk at eResearch Africa conference, Cape Town, December 2014

LADUMA: Looking At the Distant Universe with the MeerKAT Array, invited talk at Transformational Science with the SKA conference, Stellenbosch, South Africa, February 2014

Legacy Science Surveys with the MeerKAT, invited talk at the Special Session on African Astronomy at

the American Astronomical Society Meeting, Washington D.C. USA, January 2014

Recent Public Talks

- From the Dark Side of the Moon to Black Holes*, UCT Summer School lecture (2020)
- Looking at Galaxies with Radio Eyes*, lecture to Astronomical Society of Southern Africa (2019)
- The Solar System*, talk to Grades 4-7 learners at Forres Preparatory School, Cape Town (2019)
- LADUMA: Looking at the Distant Universe with the MeerKAT Array*, lecture at ASSA Symposium (2018)
- From MeerKAT to the SKA*, lecture to Friends of the Hout Bay Museum (2018)
- A Brief Tour of the Universe*, 5 lecture course presented at UCT Summer School (2017)
- Galaxies and Dark Matter*, lecture to U3A, Bergvliet Chapter (2017)
- Radio Astronomy: SKA and the Future*, lecture to Parklands College School (2017)
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Publications

Astronomy & Astronomy Education:

First author means highest contribution and primary author. For student papers, the student is typically listed first and the supervisors directly afterwards.

ASymba: H I global profile asymmetries in the SIMBA simulation, M. Glowacki, N. Deg, S.-L. Blyth, N. Hank, R. Davé, E. Elson, K. Spekkens, MNRAS, Volume 517, Issue 1, pp.1282-1298 (2022)

Looking at the Distant Universe with the MeerKAT Array: Discovery of a Luminous OH Megamaser at $z \lesssim 0.5$, M. Glowacki, J. Collier, A. Kazemi-Moridani, et al., ApJ, Volume 931, Issue 1, id.L7 (2022)

MeerKAT 21-cm HI imaging of Abell 2626 and beyond, J. Healy, T. Deb, M.A.W. Verheijen, S.-L. Blyth, P. Serra, M. Ramatsoku, B. Vulcani, A&A, Volume 654, id.A173 (2021)

Abell 2626 and friends: large and small scale structure, J. Healy, S.P. Willner, M.A.W. Verheijen, S.-L. Blyth, AJ, Volume 162, Issue 5, id.193 (2021)

HI content in Coma cluster substructure, J. Healy, S.-L. Blyth, M.A.W. Verheijen, K.M. Hess, P. Serra, J.M. van der Hulst, T.H. Jarrett, K. Yim, G.I.G. Jozsa, A&A, Volume 650, id.A76 (2021)

MIGHTEE: are giant radio galaxies more common than we thought?, J. Delhaize, I. Heywood, M. Prescott, M.J. Jarvis, I. Delvecchio, I.H. Whittam, S.V. White, M.J. Hardcastle, C.L. Hale, J. Alfonso, Y. Ao, M. Brienza, M. Bruggen, J.D. Collier, E. Daddi, M. Glowacki, N. Maddox, L.K. Morabito, I. Prandoni, Z. Randriamanakoto, S. Sekhar, F. An, N.J. Adams, S. Blyth, R.A.A. Bowler, L. Leeuw, L. Marchetti, S.M. Randriamampandry, K. Thorat, N. Seymour, O. Smirnov, A.R. Taylor, C. Tasse, M. Vaccari, MNRAS, Volume 501, Issue 3, p3833-3845 (2021)

MIGHTEE-HI: The H I emission project of the MeerKAT MIGHTEE survey, N. Maddox, N., B.S. Frank, A.A. Ponomareva, M.J. Jarvis, E.A.K. Adams, R. Davé, T.A. Oosterloo, M.G. Santos, S.L. Blyth, M. Glowacki, R.C. Kraan-Korteweg, W. Mulaudzi, B. Namumba, I. Prandoni, S.H.A. Rajohnson, K. Spekkens, N.J. Adams, R.A.A. Bowler, J.D. Collier, I. Heywood, S. Sekhar, A.R. Taylor, A&A, Volume 646, id.A35 (2021)

- Systematically Asymmetric: A comparison of HI profile asymmetries in real and simulated galaxies*, N. Deg, S.-L. Blyth, N. Hank, S. Kruger, C. Carignan, MNRAS, Volume 495, Issue 2, p.1984-2001 (2020)
- HISS, a new tool for HI stacking: application to NIBLES spectra*, J. Healy, S.-L. Blyth, E. Elson, W. van Driel, Z. Butcher, S. Schneider, M.D. Lehnert, R. Minchin, MNRAS, Volume 487, Issue 4, p.4901-4938 (2019)
- On the uncertainties of results derived from HI spectral line stacking experiments*, E.C. Elson, A.J. Baker, S.-L. Blyth, MNRAS, Volume 486, Issue 4, p4894-4903 (2019)
- Enhanced HI profile asymmetries in close galaxy pairs*, J. Bok, S.-L. Blyth, D.G. Gilbank, E.C. Elson, MNRAS, Volume 484, Issue 1, p582-594 (2019)
- HST H_{α} grism spectroscopy of ROLES: a flatter low-mass slope for the $z \sim 1$ SSFR-mass relation*, Riona Ramraj, David G. Gilbank, Sarah-Louise Blyth, Rosalind E. Skelton, Karl Glazebrook, Richard G. Bower, Michael L. Balogh, MNRAS, Volume 466, Issue 3, p.3143-3160 (2017)
- Synthetic data products for future HI galaxy surveys: a tool for characterising source confusion in spectral line stacking experiments*, E.C. Elson, S.L. Blyth, A.J. Baker, MNRAS, Volume 460, Issue 4, p.4366-4381 (2016)
- NIBLES – an HI census of stellar mass selected SDSS galaxies: I. The Nançay HI survey*, W. van Driel, Z. Butcher, S. Schneider, M.D. Lehnert, R. Minchin, S.-L. Blyth, L. Chemin, N. Hallet, T. Joseph, P. Kotze, R.C. Kraan-Korteweg, A.O.H. Olofsson, M. Ramatsoku, Astronomy & Astrophysics, Volume 595, id.A118, 43 (2016)
- Exploring Neutral Hydrogen and Galaxy Evolution with the SKA*, S.-L. Blyth, J.M. van der Hulst, M.A.W. Verheijen, HI SWG Members, B. Catinella, F. Fraternali, M.P. Haynes, K.M. Hess, B.S. Koribalski, C. Lagos, M. Meyer, D. Obreschkow, A. Popping, C. Power, L. Verdes-Montenegro, M. Zwaan (2015) PoS(AASKA14)128 (Chapter in revised SKA Science Book)
- Variation of galactic cold gas reservoirs with stellar mass*, N. Maddox, K.M. Hess, D. Obreschkow, M.J. Jarvis, S.-L. Blyth, MNRAS, Volume 447, Issue 2, p1610-1617 (2015)
- The introductory astronomy course at the University of Cape Town: probing student perspectives*, V. Rajpaul, S. Allie, S.-L. Blyth, Physical Review Special Topics - Physics Education Research (2014), Volume 10, Issue 2, id.020126
- A Simple Model for Global HI Profiles of Galaxies*, I.M. Stewart, S.-L. Blyth, W.J.G. de Blok, Astronomy & Astrophysics, Volume 567, A61, p27 (2014)
- The Norma cluster (ACO 3627) - III. The distance and peculiar velocity via the near-infrared Ks-band Fundamental Plane*, T. Mutabazi, S.-L. Blyth, P.A. Woudt, J.R. Lucey, T. H. Jarrett, M. Bilicki, A. Schroeder, S.A.W. Moore, MNRAS, Volume 439, Issue 4, p3666-3682 (2014)
- Scalable desktop visualization of very large radio astronomy data cubes*, S. Perkins, J. Questiaux, S. Finnis, R. Tyler, S. Blyth, M.M. Kuttel, New Astronomy, 30, 17 (2014)
- Comparison of HI and optical redshifts of galaxies - the impact of redshift uncertainties on spectral line stacking*, Natasha Maddox, Kelley M. Hess, S.-L. Blyth, M.J. Jarvis, MNRAS, Volume 433, Issue 3, p.2613-2625 (2013)
- Quantified HI morphology - VII. Star formation and tidal influence on local dwarf HI morphology*, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, S.-L. Blyth, MNRAS, Volume 435, Issue 2, pp 1020-1036 (2013)

Quantified HI Morphology – I: Multi-wavelength analysis of the THINGS galaxies, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, E.C. Elson, MNRAS, Volume 416, Issue 4, pp 2401-2414 (2011)

Quantified HI Morphology - II: Lopsidedness and interaction in WHISP column density maps, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, E.C. Elson, MNRAS, Volume 416, Issue 4, pp 2415-2425 (2011)

Quantified HI Morphology – III: Merger visibility times from HI in galaxy simulations, B. W. Holwerda, N. Pirzkal, T.J. Cox, W.J.G. de Blok, J. Weniger, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, MNRAS, Volume 416, Issue 4, pp 2426-2436 (2011)

Quantified HI Morphology – IV: The merger fraction and rate in WHISP, B. W. Holwerda, N. Pirzkal, W.J.G. de Blok, A. Bouchard, S.-L. Blyth, K.J. Van der Heyden, MNRAS, Volume 416, Issue 4, pp 2437-2446 (2011)

Luminous Red Galaxies in Simulations: Cosmic Chronometers?, S. Crawford, A. Ratsimbazafy, C. Cress, E. Olivier, S.-L. Blyth, K.J. van der Heyden, MNRAS, Volume 406, Issue 4, pp.2569-2577 (2010)

Physics:

STAR Collaboration papers authorship strictly alphabetical in all cases, no matter primary author. Other papers, primary author is listed first.

Partonic flow and ϕ -meson production in Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV, B.I. Abelev et al., Physical Review Letters 99, 112301, (2007)

(This is my thesis paper for which I was primary author, but listed strictly alphabetically.)

A Cone Jet-Finding Algorithm for Heavy-Ion Collisions at LHC Energies, S-L Blyth, M.J. Horner, T. Awes, T. Cormier, J.L. Klay, S.R. Klein, M. van Leeuwen, A. Morsch, G. Odyniec, A. Pavlinov, Journal of Physics G: Nucl. Part. Phys. 34 (2007)

Longitudinal Double-Spin Asymmetry for Inclusive Jet Production in p+p Collisions at s=200GeV, B.I. Abelev et al., Physical Review Letters, vol. 100, Issue 23, id. 232003 (2008)

Enhanced strange baryon production in Au+Au collisions compared to p+p at $\sqrt{s_{NN}}=200$ GeV, B.I. Abelev et al., Physical Review C, vol. 77, Issue 4, id. 044908 (2008)

ρ_0 photoproduction in ultraperipheral relativistic heavy ion collisions at $\sqrt{s_{NN}}=200$ GeV, B.I. Abelev et al., Physical Review C, vol. 77, Issue 3, id. 034910 (2008)

Forward Neutral-Pion Transverse Single-Spin Asymmetries in p+p Collisions at s=200 GeV, STAR, B.I. Abelev et al., Physical Review Letters, vol. 101, Issue 22, id. 222001 (2008)

Forward Lambda production and nuclear stopping power in d + Au collisions at $\sqrt{s_{NN}} = 200$ GeV (STAR Collaboration) B.I. Abelev et al., Physical Review C 76 (2007) 064904

Energy dependence of π^+ , p and anti-p transverse momentum spectra for Au+Au collisions at $\sqrt{s_{NN}} = 62.4$ and 200-GeV (STAR Collaboration) B.I. Abelev et al., Physics Letters B 655 (2007) 104

Mass, quark-number, and $\sqrt{s_{NN}}$ dependence of the second and fourth flow harmonics in ultra-relativistic nucleus-nucleus collisions (STAR Collaboration), B.I. Abelev et al., Physical Review C 75 (2007) 054906

Rapidity and species dependence of particle production at large transverse momentum for d+Au collisions at $\sqrt{s_{NN}} = 200$ GeV (STAR Collaboration), B.I. Abelev et al., Physical Review C 76 (2007) 054903

Strange particle production in p+p collisions at $\sqrt{s_{NN}} = 200$ GeV (STAR Collaboration), B.I. Abelev et al., Physical Review C 75 (2007) 064901

Transverse momentum and centrality dependence of high-p(T) non-photon electron suppression in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. (STAR Collaboration), B.I. Abelev et al., Physical Review Letters 98 (2007) 192301

Delta phi Delta eta Correlations in Central Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV (STAR Collaboration) J. Adams et al., Physical Review C 75 (2007) 034901

Scaling Properties of Hyperon Production in Au+Au Collisions at $\sqrt{s_{NN}} = 200$ GeV., (STAR Collaboration), J. Adams et al., Physical Review Letters 98 (2007) 062301

Longitudinal Double-Spin Asymmetry and Cross Section for Inclusive Jet Production in Polarized Proton Collisions at $\sqrt{s_{NN}} = 200$ GeV, B.I. Abelev et al., Physical Review Letters 97 (2006) 252001

Neutral Kaon interferometry in Au+Au collisions at $\sqrt{s_{NN}}=200$ GeV, B.I. Abelev et al., Physical Review C 74 (2006) 054902

Identified baryon and meson distributions at large transverse momenta from Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV, (STAR Collaboration) B.I. Abelev et al., Physical Review Letters 97 (2006) 152301

The Multiplicity dependence of inclusive p(t) spectra from p-p collisions at $\sqrt{s_{NN}} = 200$ GeV, (STAR Collaboration) J. Adams et al., Physical Review D 74 (2006) 032006

Proton - lambda correlations in central Au+Au collisions at $\sqrt{s_{NN}} = 200$ -GeV, (STAR Collaboration), J. Adams et al., Physical Review C 74 (2006) 064906

Strange baryon resonance production in $\sqrt{s_{NN}} = 200$ GeV p+p and Au+Au collisions,(STAR Collaboration) J. Adams et al., Physical Review Letters 97 (2006) 132301

Direct observation of dijets in central Au+Au collisions at $\sqrt{s_{NN}}=200$ GeV, (STAR Collaboration) J. Adams et al., Physical Review Letters 97 (2006) 162301

Forward neutral pion production in p+p and d+Au collisions at $\sqrt{s_{NN}} = 200$ GeV, (STAR Collaboration) J. Adams et al., Physical Review Letters 97 (2006) 152302

Identified hadron spectra at large transverse momentum in p+p and d+Au collisions at $\sqrt{s_{NN}} = 200$ GeV, (STAR Collaboration), J. Adams et al, Physics Letters B 637 (2006) 161

Multiplicity and pseudorapidity distributions of charged particles and photons at forward pseudorapidity in Au + Au collisions at $\sqrt{s_{NN}} = 62.4$ GeV, (STAR Collaboration), J. Adams et al., Physical Review C 73 (2006) 034906

Directed flow in Au+Au collisions at $\sqrt{s_{NN}} = 62$ GeV, (STAR Collaboration), J. Adams et al., Physical Review C 73 (2006) 034903 4

Conference Proceedings

A scalable database model of RFI data for MeerKAT radio telescope, Gerald Nathan Balekaki, Michelle Kuttel, Sarah Blyth, Anja Schroeder, Proceedings of South African Institute for Computer Scientists and Information Technologists Conference (SAICSIT 2019), 16-18 September 2019, Skukuza, South Africa, DOI: 10.1145/3351108.3351127

Improving the usability of scientific software with participatory design: a new interface design for ra-

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