Curriculum-Vitae

Name	:	*Dr. Dipak Debnath*
Date of Birth	:	Jan. 24, 1980
Place of Birth	:	Bhaluka, Nadia, West Bengal, India
Nationality	:	Indian
Religion	:	Hindu
Mother Language	:	Bengali
Sex	:	Male
Marital Status	:	Married (spouse: *Mrs. Moumita Debnath*)
Blood Group	:	B^+
Distinguishable Mark	:	One cut mark on forehead, between two eyebrows
Current Institution	:	Institute of Astronomy Space and Earth Science, Kolkata, India
Present Designation	:	Associate Professor
Area of Research	:	Astronomy & Astrophysics
Specialization	:	X-ray observational and theoretical studies for black holes, gamma-ray bursts, solar flares etc., and instrumentation.
Thesis Title	:	*X-Ray properties of the Sun and some compact objects of our Galaxy*
Office Address	:	Institute of Astronomy Space and Earth Science AJ 316, Sector II, Salt Lake, Kolkata, 700091, India Tel.: +91-7439761297; Email: iases.2022@gmail.com
Resident Address (For Communication)	:	Flat D3, Binayak Enclave, Fartabad Beltala, Garia, Kolkata, 700084, West Bengal, India Tel: 8961995355 / 9432680632 (WhatsApp)
Permanent Address	:	S/O Late Nanda Dulal Debnath Vill. : Bhaluka, P.O. : Joania Bhaluka, P.S. : Kotwali, District : Nadia, PIN : 741317, West Bengal, India
Publications & Citations		
In Refereed Journals	:	50 (published/accepted) & 5 (submitted/in-preparation)
In Conference Proceedings	:	63
Google Scholar Citations	:	Total 1717 (h-index : 23 & i10-index : 36)
Email Ids	:	dipdeb80@gmail.com / dipak.iases@gmail.com

Educational Qualifications :

Name of Exam./Degree	School/College/Institution	Board/University	Year
Madhyamik	Bhaluka High School (H.S.)	W. B. B. S. E.	1996
Higher Secondary	Kabi Bijoylal H.S. Institute	W. B. C. H. S. E.	1998
B.Sc. (Physics Hons.)	Chakdaha College	University of Kalyani	2002
M.Sc. (Physics)	Department of Physics, K.U.	University of Kalyani	2004
Ph.D. (Physics Theoretical)†	Indian Centre for Space Physics	University of Calcutta	2011

† Thesis submitted on 21st June 2010, and degree received on 3rd January 2011.

Work experience :

Sr.	Positions held	Name of the Institute	From	To	Pay-Band/Amount
1	Junior Research Fellow (JRF)	Indian Centre for Space Physics (ICSP) Chalantika 43, Kolkata 700084, India	03.01.2005	02.01.2007	Rs. 8000 +30% HRA
2	Senior Research Fellow (SRF)	ICSP, Kolkata Chalantika 43, Kolkata 700084, India	03.01.2007	04.05.2008	Rs. 14000 +30% HRA
3	Visiting Scientist	The Abdus Salam International Centre for Theoretical Physics (ICTP), Italy	05.05.2008	04.11.2008	Euro 1400
4	SRF	ICSP, Kolkata	05.11.2008	31.08.2009	Rs. 14000 +30% HRA
5	Visiting Scientist	ICTP, Italy	01.09.2009	28.02.2010	Euro 1400
6	SRF	ICSP, Kolkata	01.03.2010	06.07.2010	Rs. 18000 +30% HRA
7	Research Associate	ICSP, Kolkata	07.07.2010	31.10.2010	Rs. 22000 +30% HRA
8	Scientist-B	ICSP, Kolkata	01.11.2010	17.06.2012	Rs. 32000
9	Assistant Professor	Indian Centre for Space Physics (ICSP) Chalantika 43, Kolkata 700084, India	18.06.2012	31.12.2016	Rs. 15600-39100 AGP 5400
10	Visiting Scientist	NASA GSFC, Maryland, 20771, USA	01.09.2014	28.09.2014	
11	Visiting Assistant Professor	National Tsing Hua University Hsinchu, 30013, Taiwan	28.04.2016	22.07.2016	NTD 70,000 (On Sabbatical Lev.)
12	Assistant Professor-II	Indian Centre for Space Physics (ICSP) Chalantika 43, Kolkata 700084, India	01.01.2017	03.07.2022	Rs. 15600-39100 AGP 7600
13	Associate Professor	Institute of Astronomy Space and Earth Science AJ 316, Sector II, Salt Lake, Kolkata, 700091	04.07.2022	till date	

Professional Recognition/ Award/ Prize/ Certificate/ Fellowship, etc. received :

Sr.	Name of Award	Awarding Agency	Year
1	CSIR Junior Research Fellow	UGC-CSIR Joint NET Examination	2004
2	Visiting Scientist	ICTP, Trieste, Italy	2008-2010
3	Guest Lecturer	RKMRC, Narendrapur, Kolkata	2010 -
4	HOD, High Energy Astrophysics	Indian Centre for Space Physics, Kolkata	2012 - 2020
5	Acting Administrative Officer	Indian Centre for Space Physics, Kolkata	2012 - 2020
6	Member, Academic Council	Indian Centre for Space Physics, Kolkata	2012 -
7	Extended Faculty	University of Gour Banga, Malda, West Bengal	2014
8	Principal Investigator	Fast Track Scheme for Young Scientist, DST	2014-2017
9	Principal Investigator	Respond Project, ISRO	2014-2017
10	Visiting Scientist	NASA/GSFC, Greenbelt, Maryland, USA	2014
11	Visiting Assistant Professor	Institute of Astronomy, NTHU, Hsinchu, Taiwan	2016
12	Principal Investigator	Extra Mural Research Funding, SERB, DST	2017-2020
13	Principal Investigator	India-Taiwan Cooperation Project, GITA, DST	2018-2021
14	Principal Investigator	Respond Project, ISRO	2018-2021

Professional Responsibilities (Reviewer, Editor, Conference Organiser, etc.):

1. **Reviewer** of the Journal of Optics (JOPT) paper (2015).
2. **Reviewer** of the ASI Conference Proceeding (ASInC) paper (2015).
3. **Reviewer** of the Astrophysics and Space Science (Ap&SS) paper (2017).
4. **Convener** of the ASI the Workshop4: "X-ray Observations and Data Analysis of Compact Objects" at Jaipur, India on 6th March (2017).

5. **Principal Investigator** of ASTROSAT A03 cycle proposal entitled *"Observation of some persistent stellar mass black holes to constrain accretion flow dynamics across spectral states and its timing properties"* with Co-Is Prof. S. K. Chakrabarti and Prof. A. R. Rao.
6. **Deputy Organizer** of the COSPAR-18-E1.4: "Black Hole Astrophysics: Observational Evidence of Theoretical Models" at Pasadena, CA, United States, 14-22 July (2018).

Research Projects Sanctioned/Submitted/Completed:

1. **Sanctioned** Indian Space Research Organisation (ISRO), Government of India, sponsored **RESPOND** grant (ISRO/RES/2/418/18-19, dated: 25.06.2018) for research proposal entitled *"Study of a few Persistent and Transient Black Holes using ASTROSAT and Other Satellite Data"* as principal investigator (PI), jointly with Prof. Sandip K. Chakrabarti (co-principal investigator). Total project cost is 31.83 Lakh.
2. **Sanctioned** Global Innovation & Technology Alliance (GITA), DST, Government of India and MOST, Taiwan sponsored **India-Taiwan Programme of Cooperation in Science & Technology** project (GITA/DST/TWN/P-76/2017, dated: 26.03.2018) on *"Accretion Characteristics of Galactic Outburst Sources from X-ray Observation"* jointly with Prof. H. K. Chang, NTHU, Hsinchu, Taiwan (PI from Taiwan side) and Prof. Sandip K. Chakrabarti (Co-PI from Indian side) as a PI. Total project cost is Rs. 27.45 Lakh.
3. Successfully **completed** Department of Science and Technology (DST), Government of India, sponsored **Extra Mural Research Funding (Individual Centric)** project (EMR/2016/003918, dated: 24.03.2017) on *"X-ray Properties of Accretion Flows and Estimation of Fundamental Parameters of Black Hole Binaries"* as a PI. Total project cost is Rs. 19.98 Lakh (revised budget: Rs. 20.89 Lakh).
4. Successfully **completed** Indian Space Research Organisation (ISRO), Government of India, sponsored **RESPOND** grant (ISRO/RES/2/388/2014-15, dated: 26.05.2014) for research proposal entitled *"Study of timing properties of few outbursting black hole candidates"* as PI, jointly with Prof. Sandip K. Chakrabarti (Co-PI) for the period of three years starting from July 2014 to July 2017. Total project cost is Rs. 13.89 Lakh (revised budget: Rs. 17.91 Lakh).
5. Successfully **completed** Department of Science and Technology (DST), Government of India, sponsored **Fast Track Scheme for Young Scientist** (SR/FTP/PS-188/2012, dated: 10.01.2014) as PI on *"Study of the spectral properties of few transient black hole candidates with Two Component Advective Flow model"*, for the period of three years starting from January 2014 to January 2017. Total project cost is Rs. 17.16 Lakh (revised budget: Rs. 18.53 Lakh).

Supervising Students:

i) **Ph.D. Scholars:**

1. Md. Aslam Ali Molla submitted Ph.D. Thesis entitled *"Observational Evidence Of Two Component Advective Flows Around Black Holes From The Analysis Of Satellite Data"* at University of Calcutta on 10th Oct., 2017. He worked as a Ph.D. student at ICSP from 15th July, 2013 under joint supervision of Prof. Sandip K. Chakrabarti and me; as a DST-FTY or MoES project fellow.
2. Mr. Arghajit Jana submitted Ph.D. Thesis entitled *"Trend of Accretion Flow Parameters from Spectral and Timing Properties of Outbursting Black Hole Candidates"* at University of Calcutta on 6th May, 2019. He worked as a Ph.D. student at ICSP from 13th July, 2014 under joint supervision of me and Prof. S. K. Chakrabarti; as a ISRO-Respond or DST-GITA or CSIR-SRF project fellow. Presently working as a post-doctoral fellow at NTHU, Hsinchu, Taiwan.
3. Mr. Debjit Chatterjee submitted Ph.D. Thesis entitled *"Study Of Physical Properties Of And Around Accreting Stellar Mass Black Holes"* at University of Calcutta on 12th March, 2020. He worked as a Ph.D. student at ICSP from 7th February, 2015 under joint supervision of me and Prof. S. K. Chakrabarti; as a research fellow of DST/FTY and DST/SERB projects. Presently working as a post-doctoral fellow at IIA, Bengaluru, India.

4. Mr. Kaushik Chatterjee worked as a research fellow under DST Inspire fellowship programme since 23rd April, 2017. He is mainly working on temporal properties of a few transient black hole X-ray binaries under the joint supervision of me and Prof. S. K. Chakrabarti. He has submitted his thesis for the Ph.D. degree in March, 2022.
5. Ms. Riya Bhowmick is working as a CSIR-UGC NET qualified UGC-JRF since 14th Jan., 2019. She is working on flow properties of a few Galactic stellar mass black holes under joint supervision of me and Prof. S. K. Chakrabarti.
6. Mr. Abhrajit Bhattacharjee is working as a ISRO-RESPOND project fellow since 1st Feb., 2019. He is mainly working on theoretical studies of Kerr black holes under joint supervision of Prof. S. K. Chakrabarti and me.
7. Mr. Sujoy Kumar Nath is working as a ISRO-RESPOND project fellow since 16th May, 2019. He is mainly working on observational studies of low mass X-ray binaries under joint supervision of me and Prof. Sandip K. Chakrabarti.

ii) **M.Sc./ Pre-Ph.D. Project Students:**

1. Mr. Soumik Banerjee from Ramakrishna Mission Residential College (RKMRC), Narendrapur, Kolkata, 700103; has completed his M.Sc. project work in 2011-12, on *"X-ray temporal variability study of H 1743-322 during its 2007-08 outburst"* under my supervision.
2. Mr. Koushik Pan from RKMRC, Narendrapur; has completed his M.Sc. project work in 2012-13, on *"Temporal variability study of 4U 1630-47 during its 2007-08 outburst"* under my supervision.
3. Mr. Iman Barik and Mr. Subhasish Saha from RKMRC, Narendrapur; has completed their M.Sc. project works in 2013-14, on *"Timing properties of H 1743-322 during its early phase of 2003 outburst"*, and on *"Spectral study of H 1743-322 during its early phase of 2003 outburst"* respectively under my supervision.
4. Mr. Ashok Kumar Mondal and Mr. Raju Goswami from RKMRC, Narendrapur; has completed their M.Sc. project works in 2014-15, on *"Spectral property study of the black hole candidate H 1743-322 during its entire phase of 2004 outburst"*, and on *"Timing property of H 1743-322 during its entire phase of 2004 outburst"* respectively under my supervision.
5. Mr. Deep Singha Roy and Mr. Kaustav Malakar from RKMRC, Narendrapur; has completed their M.Sc. project works in 2019-20, on *"Spectral Property Study of the Black Hole Candidate XTE J1818-245 during its Outburst in 2005"*, and *"Study of Timing Property of XTE J1818-245 during its entire phase of 2005 Outburst"* under my supervision.
6. Mr. Suman Das and Mr. Indrajit Maity from RKMRC, Narendrapur; has completed their M.Sc. project works in 2020-21, on *"Spectral Property Study of the Black hole Candidate GX 339-4 during its Outburst in 2007"*, and *"Study of Temporal Evolution of the Black hole Candidate GX 339-4 during it's Outburst in 2007-'08"* under my supervision.
7. My Ph.D. studuents completed their projects (PHY004), which were part of their Pre-Ph.D. course work under joint supervision of me and Prof. S. K. Chakrabarti. Arghajit Jana, Debjit Chatterjee, and Md. Aslam Ali Molla (academic semester 2016-17); Kaushik Chatterjee (academic semester 2018-19); Riya Bhowmick and Sujoy K. Nath (academic semester 2021).

Teaching Experiences:

1. Delivered lectures and guided post-M.Sc. students for Pre-Ph.D. course work according to the UGC guide-line and affiliated by University of Calcutta at Indian Centre for Space Physics (ICSP), Kolkata for the academic semester 2016-17. The subjects (each of full 50 marks) taught during the course are: PHY 001: Research Methodology, PHY 002: Review of Topical Research, PHY 003: Astrophysics and Space Science, and PHY 004: Project Work.

2. A series of lectures are delivered on astrophysical topics of *i*) *Basic background & Instrumentation, ii*) *Spectral Classification of Stars, iii*) *Binary Stars, and iv*) *Galaxies* at Ramakrishna Mission Residential College, Narendrapur; which is a part of astrophysics elective course for M.Sc. (Physics) 4^{th} semester students for last ten academic years (starting from 2010-11).
3. A series of classes are taken on astrophysical topics of *i*) *Stellar Objects & Stellar Explosions, ii*) *Gravitational Collapse and Relativistic Astrophysics, iii*) *Accretion Disks around Compact Objects* at Department of Physics, University of Gour Banga; which are a part of astrophysics elective course for M.Sc. (Physics) IV^{th} semester students (2014).

Research Experiences:

1. Done background simulation for ASTROSAT/CZT and RT-2 payloads with the help GEANT4 toolkit; written in C++.
2. Done Monte Carlo simulations of Fresnel Zone Plates (FZPs) and Coded Aperture Masks (CAMs) with the codes written in IDL for the hard X-ray imaging of CZT and CMOS detectors, used in RT-2/CZT payload. We also verified our simulation results with the experimental results. I hope that these coders will be used for X-ray imaging study of astronomical objects in future satellite or balloon borne experiments.
3. Completed Test & Evaluations and channel-energy calibrations of RT-2 payloads (RT-2/S, RT-2/G & RT-2/CZT) using programs written by us in LabVIEW, C and IDL etc. languages. RT-2 was an Indo-Russian collaborative experiment, was a part of Russian CORONAS-PHOTON mission satellite, mainly to study Sun in hard X-ray energy band (from $\sim 15-1000$ keV). The RT-2 payloads were developed and tested by TIFR, VSSC, ICSP under guidance of ISRO, was successfully launched in 550 km low earth polar orbit from Plesetsk, Russia on January 30, 2009.
4. Solar X-ray study using RT-2 data onboard CORONAS-PHOTON Mission was done. We also Compared our results with results obtained from other solar satellite (RHESSI, GOES etc.) data.
5. Detailed analysis of Gamma-ray bursts (GRBs), were observed with RT-2 (onboard CORONAS-PHOTON Mission), SWIFT or FERMI, etc. astronomy satellites.
6. Improving two-component advective flow (TACF) model, introduced by Chakrabarti and his collaborators, after inclusion of Bulk motion Comptonization, spin, etc. into the model code.
7. Studying accretion flow dynamics of black hole candidates with TCAF model, after successful generation and inclusion of the model table *fits* file into NASA's spectral fitting software package XSPEC. Also trying to improve model fit statistics by self-written FORTRAN programs to read fits file and fittinf spectra. Also doing model fit by running model code in XSPEC platform (which generates theoreatical spectrum while fits observed spectrum with the least-square fit technique), for better and user-friendly fitting of the black hole X-ray spectra.
8. Study evolution of quasi-periodic oscillation (QPO) frequencies, observed during rising and declining phases of outbursts of a few transient black hole candidates with our proposed Propagating Oscillatory Shock (POS) model in 2005.
9. Working on the comparative study of the spectral properties of black hole candidates with TCAF and other (for example, combined diskbb plus power-law, CompST, etc.) model fitted results.
10. Estimation intrinsic parameters such as mass of the black hole, distance, spin, etc. from various temporal (e.g, using POS model), spectral (e.g., using TCAF model) analysis methods.
11. Estimation of jet X-ray fluxes after separating it from total observed X-ray. Studying nature of the jet by studying correlation of the radio and the X-ray jet fluxes.
12. Estimation of viscous time scales, equipartition magnetic field, cooling and infall time scales, etc.

13. Involved in detailed timing and spectral properties of few Galactic black hole candidates (for e.g., GRO J1655-40, H 1743-322, GX 339-4, Swift J1753.5-0127, MAXI J1659-152, MAXI J1836-194, MAXI J1543-564, MAXI J1535-571, MAXI J1348-630, MAXI J1813-095, MAXI J1910-057, XTE J1118+480, XTE J1752-223, XTE J1908+094, V404 Cygni, 4U 1630-472, GRS 1716-249, GRS 1915+105, IGR J17091-3624, etc.) using archival data of astronomy satellites, such as RXTE, Swift, NuSTAR, AstroSat, XMM-Newton, etc.
14. Long term outbursting nature of the three Galactic recurring transient black hole candidates (H 1743-322, GX 339-4, 4U 1630-472) are studied to find relation between outburst and quiescent phases. Triggering mechasim of the outbursts are also studiend.

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List of Publications :

In Refereed Journals:

1. **Propagating oscillatory shock model for QPOs in GRO J1655-40 during the March 2005 outburst** by S.K. Chakrabarti, A. Nandi, **D. Debnath**, R. Sarkar and B.G. Datta, in **Indian J. Phys. 79(8), 841-845 (2005)** (arXiv:astro-ph/0508024).
2. **Evolution of the quasi-periodic oscillation frequency in GRO J1655-40 - - Implications for accretion disk dynamics** by Sandip K. Chakrabarti, **Dipak Debnath**, Anuj Nandi, and P.S. Pal, in **A&A LETTERS, 489, L41-L44 (2008)** (DOI: 10.1051/0004-6361:200810136) (arXiv:0809.0876).
3. **Spectral and timing evolution of GRO J1655-40 during its outburst of 2005** by **D. Debnath**, S.K. Chakrabarti, A. Nandi and S. Mandal, in **BASI, 36, 151-189 (2008)** (arXiv:0902.3791).
4. **Fresnel Zone Plate Telescopes for X-ray Imaging I: Experiments with a quasi-parallel beam** by S.K. Chakrabarti, S. Palit, **D. Debnath**, A. Nandi, V. Yadav and R. Sarkar, in **Exp. Astron., 24, 109-126 (2009)** (DOI: 10.1007/s10696-009-9144-y) (arXiv:0910.1987).
5. **Fresnel Zone Plate Telescopes for X-ray Imaging II: Results of numerical simulations** by S. Palit, S.K. Chakrabarti, **D. Debnath**, A. Nandi, V. Yadav, V. Girish and A.R. Rao, in **Exp. Astron., 27, 77-93 (2009)** (DOI: 10.1007/s10686-009-9176-3) (arXiv:0910.2353).
6. **RT-2 Detection of Quasi-Periodic Pulsations in the 2009 July 5 Solar Hard X-ray Flare** by A.R. Rao,J.P. Malkar,M.K. Hingar,V.K. Agrawal,S.K. Chakrabarti, A. Nandi, **D. Debnath**,T.B. Kotoch, T.R. Chidambaram, P. Vinod, S. Sreekumar, Y.D. Kotov, A.S. Buslov, V. N. Yurov, V.G. Tyshkevich , A.I. Arkhangelskij, R.A. Zyatkov, S. S. Begum, P.K. Manoharan, in **ApJ, 714, 1142 (2010)** (arXiv:1003.3992) (DOI: 10.1088/0004-637X/714/2/1142).
7. **Properties of the Propagating Shock wave in the accretion flow around GX 339-4 in 2010 outburst** by **D. Debnath**, S. K. Chakrabarti and A. Nandi, in **A&A, 520, A98 (2010)** (DOI: 10.1051/0004-6361/201014990) (arXiv:1009.3351).
8. **Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation I: RT-2/S and RT-2/G Payloads** by **D. Debnath**, A. Nandi, A. R. Rao, J. P. Malkar, M. K. Hingar, T. B. Kotoch, S. Sreekumar, V. P. Madhav and S. K. Chakrabarti, in **Exp. Astron., 29, 1-25 (2011)** (DOI: 10.1007/s10686-010-9205-2) (arXiv:1011.3326).
9. **Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation II: RT-2/CZT Payload** by . B. Kotoch, Anuj Nandi, **D. Debnath**, J. P. Malkar, A. R. Rao, M. K. Hingar, V. P. Madhav, S. Sreekumar and S. K. Chakrabarti, in **Exp. Astron., 29, 27-54 (2011)** (DOI: 10.1007/s10686-010-9189-y) (arXiv:1011.3331).
10. **Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation III: Coded Aperture Mask and Fresnel Zone Plates in RT-2/CZT Payload** by A. Nandi, S. Palit, **D. Debnath**, S. K. Chakrabarti, T. B. Kotoch, R. Sarkar, V. Yadav, V. Girish,

A. R. Rao and D. Bhattacherya, in **Exp. Astron., 29, 55-84 (2011)** (DOI: 10.1007/s10686-010-9184-3) (arXiv:1011.3338).

11. **Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation IV: Background Simulations using GEANT-4 Toolkit** by R. Sarkar, S. Mandal, **D. Debnath**, T. B. Kotoch, A. Nandi, A. R. Rao, S. K. Chakrabarti, in **Exp. Astron., 29, 85-107 (2011)** (DOI: 10.1007/s10686-010-9208-z) (arXiv:1011.3340).
12. **Instruments of RT-2 Experiment onboard CORONAS-PHOTON and their test and evaluation V: Onboard software, Data Structure, Telemetry and Telecommand** by S. Sreekumar, P. Vinod, E. Samuel, J. P. Malkar, A. R. Rao, M. K. Hingar, V. P. Madhav, **D. Debnath**, T. B. Kotoch, A. Nandi, S. S. Begum and S. K. Chakrabarti, in **Exp. Astron., 29, 109-133 (2011)** (DOI: 10.1007/s10686-010-9185-2) (arXiv:1011.3344).
13. **Onboard performance of the RT-2 detectors** by A. R. Rao, J. P. Malkar, M. K. Hingar, V. K. Agrawal, S. K. Chakrabarti, A. Nandi, **D. Debnath**, T. B. Kotoch, R. Sarkar, T. R. Chidambaram, P. Vinod, S. Sreekumar, Y. D. Kotov, A. S. Buslov, V. N. Yurov, V. G. Tyshkevich, A. I. Arkhangelskij, R. A. Zyatkov, in **SoSyR, 45, 123-134 (2011)** (DOI: 10.1134/S0038094611020158).
14. **Detection of GRB 090618 with RT-2 Experiment Onboard the Coronas - Photon Satellite** by A. R. Rao, J. P. Malkar, M. K. Hingar, V. K. Agrawal, S. K. Chakrabarti, A. Nandi, **D. Debnath**, T. B. Kotoch, R. Sarkar, T. R. Chidambaram, P. Vinod, S. Sreekumar, Y. D. Kotov, A. S. Buslov, V. N. Yurov, V. G. Tyshkevich, A. I. Arkhangelskij, R. A. Zyatkov, S. Naik, in **ApJ, 728, 42 (2011)** (arXiv:1012.0461) (DOI: 10.1088/0004-637X/728/1/42).
15. **Accretion flow dynamics during the evolution of timing and spectral properties of GX 339-4 in 2010-11 outburst** by A. Nandi, **D. Debnath**, S. Mandal, and S.K. Chakrabarti, in **A&A, 542, A56, (2012)** (DOI: 10.1051/0004-6361/201117844) (arXiv:1204.5044).
16. **Evolution of the temporal and the spectral properties in 2010 and 2011 outbursts of H 1743-322** by **D. Debnath**, S.K. Chakrabarti, and A. Nandi, in **AdSpR, 52, 2143-2155 (2013)** (DOI: 10.1016/j.asr.2013.09.002) (arXiv:1309.2564).
17. **Implementation of Two Component Advective Flow Solution in XSPEC** by **D. Debnath**, S. K. Chakrabarti, and S. Mondal in **MNRAS LETTERS, 440, L121-L125 (2014)** (DOI: 10.1093/mnrasl/slu024) (arXiv:1402.0989).
18. **Inference on accretion flow dynamics using TCAF solution from the analysis of spectral evolution of H 1743-322 during 2010 outburst** by S. Mondal, **D. Debnath**, and S. K. Chakrabarti, in **ApJ, 786, 4 (2014)** (arXiv:1401.4239) (DOI: 10.1088/0004-637X/786/1/4).
19. **Spectral signatures of dissipative standing shocks and mass outflow in presence of Comptonization around a black hole** by S. Mondal, S. K. Chakrabarti, and **D. Debnath** in **Ap&SS, 353, 223-231 (2014)** (DOI: 10.1007/s10509-014-2008-6) (arXiv:1406.1878).
20. **Is Compton Cooling Sufficient to Explain Evolution of Observed Quasi-periodic Oscillations in Outburst Sources?** by S. Mondal, S. K. Chakrabarti, and **D. Debnath** in **ApJ, 798, 57 (2015)** (arXiv:1410.8266) (DOI: 10.1088/0004-637X/798/1/57).
21. **Characterization of GX 339-4 outburst of 2010-11: analysis by xspec using two component advective flow model** by **D. Debnath**, S. Mondal, and S. K. Chakrabarti in **MNRAS, 447, 1984-1995 (2015)** (DOI: 10.1093/mnras/stu2588) (arXiv:1306.3745).
22. **Accretion Flow Dynamics of MAXI J1659-152 from the Spectral Evolution Study of its 2010 Outburst using the TCAF Solution** by **D. Debnath**, A. A. Molla, S. K. Chakrabarti, and S. Mondal in **ApJ, 803, 59 (2015)** (DOI: 10.1088/0004-637X/803/2/59) (arXiv:1504.05312).
23. **Resonance Condition and Quasi Periodic Oscillations Frequency of the Outbursting Source H 1743-322** by S. K. Chakrabarti, S. Mondal, and **D. Debnath** in **MNRAS, 452, 3451-3456 (2015)** (DOI: 10.1093/mnras/stv1566) (arXiv:1507.02831).

24. **Accretion Flow Dynamics of MAXI J1836-194 During its 2011 Outburst from TCAF Solution** by A. Jana, **D. Debnath**, S. K. Chakrabarti, S. Mondal, and A. A. Molla in **ApJ, 819, 107 (2016)** (DOI: 10.3847/0004-637X/819/2/107) (arXiv:1601.02080).

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48. **Spectral study of different black hole candidates and measurement of spin parameter** by Mondal, S., **D. Debnath**, Chakrabarti, S. K., et al. in the proceeding of *42nd COSPAR*, 2018 [cosp, 42E, 2326 (2018)].

49. **Role of viscosity and cooling on the origin of spectral and timing properties: observational evidences** by Mondal, S., **D. Debnath**, Patricia, A., et al. in the proceeding of *42nd COSPAR*, 2018 [cosp, 42E, 2327 (2018)].

50. **Is matter in H1743-322 supplied at a constant rate?** by Nagarkoti, S., **D. Debnath**, Chakrabarti, S. K. in the proceeding of *42nd COSPAR*, 2018 [cosp, 42E, 2393 (2018)].

51. **Spectral and Timing Properties of MAXI J1535-571 during its 2017 outburst** by Shang, J. R., **D. Debnath**, Chang, H. K., et al. in the proceeding of *42nd COSPAR*, 2018 [cosp, 42E, 3069 (2018)].

52. **New Galactic Black Hole Candidate MAXI J1535-571 : Analysis with the TCAF model** by Shang, J. R., **D. Debnath**, Chang, H. K., et al. in the proceeding of *42nd COSPAR*, 2018 [cosp, 42E, 3070 (2018)].

53. **Understanding Accretion Flow Properties of Black Hole Candidates After Implementation of The TCAF Solution in XSPEC** by **D. Debnath**, S. K. Chakrabarti, S. Mondal, A. Jana, D. Chatterjee, A. A. Molla, K. Chatterjee, R. Bhowmick in the proceeding of *XVth Marcel Grossmann* (MG15) meeting from 1-7 July, 2018 at University of Rome "La Sapienza", Rome, Italy.

54. **Accretion Flow Properties of Transient Black Holes** by **D. Debnath**, S. K. Chakrabarti, A. Jana, D. Chatterjee, H.-K. Chang, J.-R. Shang, K. Chatterjee, R. Bhowmick, A. Bhattacharjee, S. K. Nath, B. Banerjee in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1553 (2021)]
55. **Accretion and Ejection Properties of Short Orbital Period Transient Black Holes** by **D. Debnath**, S. K. Chakrabarti, A. Jana, D. Chatterjee, K. Chatterjee, R. Bhowmick, A. Bhattacharjee, S. K. Nath, B. Banerjee, in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1685 (2021)]
56. **New MAXI Transient Black Hole Candidate: Properties of MAXI J1348-630 during its 2019 Outburst** by A. Jana, **D. Debnath**, S. K. Chakrabarti, S. Naik, D. Chatterjee, K. Chatterjee, R. Bhowmick, A. Bhattacharjee, S. K. Nath, B. Banerjee, in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1565 (2021)]
57. **Studying the Properties of MAXI J1535-571 using Swift, MAXI and AstroSat data** by D. Chatterjee, **D. Debnath**, S. K. Chakrabarti, A. Jana, A. Banerjee, A. Bhattacharjee, H.-K. Chang, J.-R. Shang, T. Katoch, H. M. Antia, in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1712 (2021)]
58. **Highly Turbulent Outbursts of V404 Cygni, Swift J1858.6-081 and V4641 Sgr : Magnetic Origin?** by D. Chatterjee, **D. Debnath**, S. K. Chakrabarti, A. Jana, K. Chatterjee, R. Bhowmick in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1562 (2021)]
59. **X-ray Properties of Black Hole Candidate XTE J1752-223 during its 2009-10 Outburst** by K. Chatterjee, **D. Debnath**, S. K. Chakrabarti, A. Jana, D. Chatterjee in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1558 (2021)]
60. **Outburst Profiles and Triggering Mechanism of Transient Black Holes** by R. Bhowmick, **D. Debnath**, S. K. Chakrabarti, A. Jana, D. Chatterjee, S. Nagarkoti, K. Chatterjee, A. Bhattacharjee, S. K. Nath in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1707 (2021)]
61. **Comparative Study of the Class Variabilities of GRS 1915+105 and Igr 17091-3624 in the Tcaf Paradigm** by A. Banerjee, **D. Debnath**, S. K. Chakrabarti, A. Bhattacharjee in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1561 (2021)]
62. **Astrosat Observation of Class Variable Source GRS 1915+105: AN Analysis in the Light of Two Component Advective Flow Model** by A. Banerjee, **D. Debnath**, S. K. Chakrabarti, D. Chatterjee, A. Bhattacharjee in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1711 (2021)]
63. **How to Determine the Mass of a Black Hole using the TCAF solution? A case study with Cygnus X-1 and other sources** by I. Banerjee, **D. Debnath**, S. K. Chakrabarti, A. Banerjee, A. Bhattacharjee, in the proceeding of *43rd COSPAR*, 2021 [cosp, 43E, 1566 (2021)]

Books / Chapter in Books:

1. Chapter **"Evolution of Flow Properties Around Black Holes from Observations: Developments over the Past Decades"** in Springer Book *"Exploring the Universe: From Near Space to Extra-Galactic"*, Editors: Banibrata Mukhopadhyay & Sudipta Sasmal, 2018, ASSP, 53, 229 (DOI: 10.1007/978-3-319-94607-8) [Book ISBN : 978-3-319-94606-1 (hardcopy); 978-3-319-94607-8 (ebook)]

In Astronomers Telegram:

1. **Preliminary Result on MAXI J1348-630 using Swift data: Detection of 0.56 Hz QPO and Mass Estimation** by Arghajit Jana, **Dipak Debnath**, Debjit Chatterjee, Sandip K. Chakrabarti, Kaushik Chatterjee, Riya Bhowmick in **ATel, 12505, 1 (2019)**.

In GCN Circular Archive:

1. **Detection of GRB 090618 by RT-2 Experiment onboard the CORONAS-PHOTON Satellite** by A. R. Rao, J. P. Malkar, M. K. Hingar, V. K. Agrawal, S. K. Chakrabarti, A. Nandi, **D. Debnath**, T. C. Kotoch, T. R. Chidambaram, P. Vinod, S. Sreekumar, Y. D. Kotov, A. S. Buslov, V. N. Yurov, V. G. Tyshkevich, A. I. Arkhangelskij, R. A. Zyatkov in *GCN circulars archive* [GCN no. 9665 (2009)].
2. **GRB 090820: detection of a strong burst by RT-2 on board CORONAS PHOTON** by S. K. Chakrabarti, A. Nandi, **D. Debnath**, T. C. Kotoch, A. R. Rao, J. P. Malkar, M. K. Hingar, V. K. Agrawal, T. R. Chidambaram, P. Vinod, S. Sreekumar, Y. D. Kotov, A. S. Buslov, V. N. Yurov, V. G. Tyshkevich, A. I. Arkhangelskij, R. A. Zyatkov in *GCN circulars archive* [GCN no. 9833 (2009)].
3. **RT-2 observation of the bright GRB 090926A** by S. K. Chakrabarti, A. Nandi, **D. Debnath**, T. C. Kotoch, A. R. Rao, J. P. Malkar, M. K. Hingar, V. K. Agrawal, T. R. Chidambaram, P. Vinod, S. Sreekumar, Y. D. Kotov, A. S. Buslov, V. N. Yurov, V. G. Tyshkevich, A. I. Arkhangelskij, R. A. Zyatkov in *GCN circulars archive* [GCN no. 10009 (2009)].
4. **Detection of a short GRB 090929A by RT-2 Experiment** by S. K. Chakrabarti, A. Nandi, **D. Debnath**, T. C. Kotoch, A. R. Rao, J. P. Malkar, M. K. Hingar, V. K. Agrawal, T. R. Chidambaram, P. Vinod, S. Sreekumar, Y. D. Kotov, A. S. Buslov, V. N. Yurov, V. G. Tyshkevich, A. I. Arkhangelskij, R. A. Zyatkov in *GCN circulars archive* [GCN no. 10010 (2009)].

Technical Reports:

1. Prepared status reports of Laboratory, Qualification and flight models of RT-2 payloads (RT-2/S, G, CZT, E) as a RT-2 team member during 2005-2008. These were presented in front of the project-management board (PMB) members of ISRO and senior scientists, engineers from various academic institutions of India.
2. Test & Evaluation report of RT-2 payloads in different stages of the development had been prepared as an active RT-2 team member during 2006-2008.
3. Prepared user manuals for operation, coupling of RT-2 scientific payloads (RT-2/S, G, CZT) with electronic payload (RT-2/E) using LabVIEW program, which were mostly coded by me.
4. User manual for raw data analysis of RT-2 scientific payloads using LabVIEW and IDL programs.
5. Report of channel-energy calibration of RT-2 spectra, using programs written by IDL. These are later included in instrumentation papers in refereed journal (Experimental Astronomy, published in 2011).

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Softwares known; commonly used in Scientific Researches:

1. **FTOOLS**; used for scientific analysis of data of RXTE, Swift, NuSTAR, ASTROSAT and other astronomy satellites. With the help of this HeaSARC's software package we can also fit timing and spectral data of astrophysical objects in different in-build or local (our TCAF) models according to our scientific understandings and demands.
2. **SAS**; used for scientific data analysis of XMM-Newton astronomy satellite.
3. **CIAO**; used for scientific data analysis of astronomy satellite Chandra.
4. **SSW IDL**; used for scientific data analysis of solar astronomy satellite RHESSI, GOES.
5. **FORTRAN**; used for scientific calculations, simulations, data modifications etc. It also helped me to modify TCAF code and write fits file generation programs.

6. **IDL**; used for Monte Carlo simulations of Fresnel Zone Plates, RT-2 channel energy calibrations and various 2D, 3D ploddings etc. Also it is used to analyze the scientific data of the solar satellite RHESSI. I have also written a code in this language for image processing; reducing the noise of image data etc. Also I can use this language for analyzing archival data of astronomy satellites, such as RXTE, NuSTAR, XMM-Newton, SWIFT, etc.
7. **C++**; used for doing background simulations with the help of **GEANT4** toolkit. We made background calculations for RT-2 (S, G & CZT) and ASTROSAT/CZT payloads with the help of CERN software package GEANT4.
8. **ROOT**; used for scientific analysis and model fitting of the timing and spectral data. We can also easily write our own model in this language and fit data with that new model.
9. **Linux Shell Programming:**; used for running multiple tasks from a single macro file, which can call other sub-macros or programs written in other languages (for e.g., FORTRAN, IDL etc.). I have written a robust code to download archival data of RXTE or other satellites from data archive and make spectral & timing analysis of using that data.
10. **LabVIEW**; used for Laboratory Test & Evaluations of RT-2 and other payloads and instruments. I have written entire test & evaluation codes for testing RT-2 payloads from their card level test to Flight model. Also I have written entire laboratory or flight data analysis programs for analyzing RT-2 scientific raw data using this language. All the scientific papers published so far, were analyzed using my code.

Major International Visits :

1. Visited **the Abdus Salam International Centre for Theoretical Physics (ICTP), Italy** for one year, divided into two 6 month periods starting from 5^{th} May 2008, and from 1^{st} September 2009 respectively as a **Visiting Scientist** to work on XDXL (X-ray Drift-detector eXtra Large) project to *"characterize and develop of a large area, high resolution (temporal and spatial) Silicon Drift Detector (SDD)"*.
2. Visited **NASA's Goddard Space Flight Center (GSFC)**, Greenbelt, Maryland, 20771, USA to work with Prof. Keith A. Arnuad for 4 weeks duration as a **Visiting Scientist** starting from 1^{st} September 2014 on *"improvement of TCAF model fit statistics by its inclusion in HEASARC's spectral analysis software package XSPEC as a local/in-build model"*.
3. Visited **Institute of Astronomy, National Tsing Hua University** (NTHU), 101, Sec 2, Kuang-Fu Road, Hsinchu, 30013, Taiwan to work with Prof. Hsiang-Kuang Chang from April 28, 2016 to July 22, 2016 as a *Visiting Assistant Professor* on sabbatical leave from ICSP, Kolkata. For the successful completion of the India-Taiwan joint scientific co-operation project DST/GITA, visited during Sep. 2-30, 2018; Oct. 31 - Nov. 12, 2019.

Seminars, Schools, Conferences, Workshops or Meetings attended:

1. **RT-2 Satellite Preliminary Design Review (PDR) meeting***on 2nd February, 2006 at Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, India; and presented a lecture on preliminary results of RT-2/S Laboratory Test & Evaluation.*
2. **RT-2 Satellite Project Management Board (PMB) meeting***on 20th April, 2006 at Tata Institute of Fundamental Research (TIFR), Mumbai, India; and presented a lecture on RT-2/S Laboratory Test & Evaluation and Channel-Energy Calibration results.*
3. **RT-2 Satellite Project Management Board (PMB) meeting***on 31st July, 2006 at Indian Space Research Organisation (ISRO) Headquarters, Bangalore, India; and presented a lecture on RT-2/CZT Laboratory Test & Evaluation and Channel-Energy Calibration results.*
4. **Winter School on AstroParticle Physics (WAPP)***during December 20-28, 2006 at Cosmic Ray Laboratory (CRL), Ooty, India.*

5. 4^{th} ASTROSAT Workshop on **"Study of emission from hot diffuse gas with ASTROSAT"** *from December 27^{th}, 2006 to January 3^{rd}, 2007 at Christ College, Bangalore, India.*
6. Mini School on **"Hydrodynamic** & **Radiative process in Astrophysics"***from January 31^{st} to February 3^{rd}, 2007 at S.N. Bose National Centre for Basic Science, Kolkata, India.*
7. **XXVth Meeting of the Astronomical Society of India (ASI)** *during February 7-9, 2007 at Department of Astronomy, Osmania University, Hyderabad-500007, India.*
8. International Heliophysical Year (IHY) Workshop on **"Super Active Regions of Solar Cycle 23 and their Geo-Space Impact"** *during May 7-10, 2007 at ATI, Nainital - 263129, India; organized by Aryabhatta Research Institute of Observational Sciences (ARIES) and co-sponsored by CAWSES-India (ISRO) and NCRA-TIFR.*
9. **International School on Astrophysical Fluid Dynamics** *during October 15-26, 2007 at Giambiagi Lecture Hall, ICTP, Trieste, Italy;* organized by the Abdus Salam International Centre for Theoretical Physics, Italy.
10. Second Kolkata Conference on **"Observational Evidence for Black Holes in the Universe"** *during February 10-15, 2008 at Vedic village and Radisson fFort, Kolkata, India;* organized by S.N. Bose National Centre for Basic Sciences, Kolkata, India.
11. Satellite Meeting jointly with ICRANET on **"Black Holes, Neutron Stars and Gamma Ray Bursts"** *during February 16-17, 2008 at Lecture Hall 2, S.N. Bose National Centre for Basic Sciences, Kolkata, India;* organized by S.N. Bose National Centre for Basic Sciences, Kolkata, India.
12. Advanced Training Course on **"FPGA Design and VHDL for Hardware Simulation and Synthesis"** *from October 26 to November 20, 2009 at Adriatico Guest House, ICTP, Trieste, Italy;* organized by the Abdus Salam International Centre for Theoretical Physics, Italy.
13. International conference on **"Accretion and Outflow in Black Hole Systems"** *during October 11-15, 2010 at Hotel Radisson, Kathmandu, Nepal;* organized jointly by INAF, INAR/OAR, ASI/ADSC, INAF/IASF, Warsaw and Dept. of Physics, Tribhuvan University.
14. International conference on **"Wideband X-ray Astronomy: Frontiers in Timing & Spectroscopy"** *during January 13-16, 2011 at Baskara-3, IUCAA, Pune, India;* organized by IUCAA.
15. **"First ICTP Regional Microelectronics Workshop on VHDL for Hardware and FPGA Design in South Asia"** *from January 31 to February 18, 2011 at North South University campus, Dhaka, Bangladesh;* jointly organized by ICTP and NSU.
16. The Indo-Russian bi-lateral Workshop on **"Gamma-ray bursts, evolution of massive stars and star formation at high redshifts"** *during March 2-4, 2011 at ARIES, Nainital, India;* organized by ARIES.
17. The workshop on **"Role of Small Telescopes in Modern Astronomy Research"** *during November 7-8, 2011 at S.N. Bose National Centre for Basic Sciences, Kolkata, India;* organized by S.N. Bose National Centre for Basic Sciences.
18. The Thirteenth Marcel Grossmann (MG13) Meeting on **"Recent Developments in Theoretical and Experimental General Relativity, Gravitation, and Relativistic Field Theory"** *during July 1-7, 2012 at the Stockholm University, Stockholm, Sweden.*
19. **The 39th COSPAR (Committee On SPAce Research) Scientific Assembly** *at GEC2, Infosys Training Centre, Mysore, Karnataka, India, during July 14-22, 2012;* organized by ISRO.
20. National Conference on **"Recent Trends in the Study of Compact Objects: Theory and Observation"** (RETCO) *at IIT, Guwahati, Assam, India, during March 11-13, 2013.*
21. International workshop on **"COSPAR Capacity Building Workshop on High Energy Astrophysics"** *at Xuyi Observatory Station (XOS), Jiangsu Province, China, during September 2-13, 2013.*

22. **The 40th COSPAR (Committee On SPAce Research) Scientific Assembly** *at Moscow, Russia, during August 2-10, 2014*; organized by Lomonosov Moscow State University.

23. National workshop on **"Science with LAXPC/ASTROSAT"** during December 15-17, 2014 *at TIFR Balloon Facility, Hyderabad.*

24. Annual Review Meeting of **ISRO-RESPOND projects** *at PRL, Ahmedabad during March 12-13, 2015* to defend project entitled **"Study of timing properties of few outbursting black hole candidates"**.

25. National Conference on **"Recent Trends in the Study of Compact Objects: Theory and Observation"** (RETCO-II) during May 6-8, 2015 *at ARIES, Nainital, India.*

26. The Fourteenth Marcel Grossmann (MG14) meeting on **"Recent Developments in Theoretical and Experimental General Relativity, Gravitation, and Relativistic Field Theory"** *from July 12-18, 2015 at University of Rome "La Sapienza", Rome, Italy.*

27. National workshop on **"TIMING & SPECTROSCOPY: WIDEBAND X-RAY ASTRONOMY"** during January 12-14, 2016 *at TIFR Balloon Facility, Hyderabad.*

28. Annual Review Meeting of **ISRO-RESPOND projects** *at PRL, Ahmedabad during March 3-4, 2016* to defend project entitled **"Study of timing properties of few outbursting black hole candidates"**.

29. **2016 ASROC Annual Meeting** at *National Cheng Kung University, Tainan, Taiwan* during May 13-16, 2016.

30. International symposium on **"7 years of MAXI : monitoring X-ray transients"** at Suzuki Umetaro Hall, RIKEN 2-1 Hirosawa, Wako, Saitama, 351-0198, Japan during 5-7 December, 2016; organized by RIKEN.

31. International conference on **"Wide Band Spectral and Timing Studies of Cosmic X-ray Source"** during January 10-13, 2017 *at TIFR, Mumbai, India*; organized by TIFR.

32. **XXXVth Meeting of Astronomical Society of India** (ASI) during 6-10 March 2017, at *B. M. Birla Auditorium, Jaipur, India*; organized by ASI.

33. National Conference on **"Recent Trends in the Study of Compact Objects: Theory and Observation"** (RETCO-III) during June 5-7, 2017 *at IIST, Thiruvananthapuram, India*; organized by IIST.

34. **"INTEGRAL Symposium 2017: Energetic Time Domain Astrophysics"** at Centro Culturale Don Oriore Artigianelli, Venice, Italy during 15-20 October, 2017; organized by INTEGRAL Team.

35. **The Astronomical Observatory**, vicolo dell'Osservatorio 3, Padova, Italy to present lecture on invitation of Prof. Roberto Turolla, Dept. of Physics and Astronomy, University of Padova, Italy on 18th Oct., 2017.

36. The Fifteenth Marcel Grossmann (MG15) meeting on **"Recent Developments in Theoretical and Experimental General Relativity, Gravitation, and Relativistic Field Theory"** *during July 1-7, 2018 at University of Rome "La Sapienza", Rome, Italy.*

37. **The 42nd COSPAR (Committee On SPAce Research) Scientific Assembly** in *Pasadena, California, USA, during July 14-22, 2018*; hosted by Caltech.

38. NCTS Summer School on Astrophysics on **"Accretion and Emission of Accreting Black Hole"** in *Institute of Astronomy, National Tsing Hua University, Hsinchu, Taiwan* during Sep 2-7, 2018.

39. **"Exploring the Universe: Near Earth space science to extragalactic astronomy"** (EXPUNIV2018) at *S. N. Bose National Centre for Basic Sciences, Kolkata, India* during Nov. 14-17, 2018.

40. National Conference on **"Recent Trends in the Study of Compact Objects: Theory and Observation"** (RETCO-IV) during April 17-20, 2019 *at IUCAA, Pune, India*; organized by IUCAA.
41. **The 43rd COSPAR (Committee On SPAce Research) Scientific Assembly** in *Sydney, Australia, during 28 January - 4 February, 2021*; hosted by Australian Academy of Science via hybrid mode.
42. National Conference on **Astrophysical jets and observational facilities : National perspective** via hybrid mode (Google Meet) during 5 - 9 April, 2021; hosted by *ARIES, Nainital, India*.
43. **NICER Science & Analysis Workshop** via hybrid mode (Zoom Platform) during May 10-14, 2021; hosted by NICER team.

Public Outreach Activities:

i. **State Level Quiz Competition on Astronomy, Astrophysics and Space Science** *on September, 2005 at Bidhan Nagar Govt. High School, Salt Lake, West Bengal, India.*

ii. Article on **"Grativational Lensing"** in *Mahabiswa-o-Ami (March, 2007 Issue) – A Bengali Book issued twice a year for popularization of Astrophysics and Space Science in Bengali community.*

iii. **District-wise Space Science Symposium** for the popularization of space science *on 17th May 2007 at Burdwan Town Hall, Burdwan, West Bengal, India and on 18th May 2007 at Birbhum DRDA Hall, Birbhum, West Bengal, India.*

iv. **Live Expert comments** on *Space Shuttle Atlantis Landing (2:30 hrs) in TV Channel 24 Ghanta on 22nd June 2007.*

v. **District-wise Space Science Symposium for the popularization of space science** *on 17th January 2008 at Rabindra Bhaban, Krishnagar, Nadia, West Bengal, India.*

Major Contributions so far in Black Hole X-ray Astronomy :

1. **Propagating Oscillatory Shock (POS) model :** In general low-frequency (0.01 - 30 Hz) quasi-periodic oscillations (LFQPOs) are observed in power density spectra during outburst phases of transient black hole candidates (BHCs). More precisely, these QPOs are observed during hard and intermediate (hard-intermediate or soft-intermediate) spectral states. Our past study (Chakrabarti et al., 2005, 2008; Debnath et al., 2010, 2013; Nandi et al., 2012) on Galactic transient black hole candidates (for e.g., GRO J1655-40, GX 339-4, H 1743-322) shows that during the rising phases (mainly during hard and hard-intermediate spectral states) QPO frequencies are observed to be increasing monotonically and during declining phases (during same spectral states as of rising) the sources show a monotonically decreasing nature of QPO frequencies. There are many models available in literature to explain the origin of QPOs, but one satisfactory model, namely, shock oscillation model (SOM) was introduced by Chakrabarti and his collaborators in mid-90s stated that the oscillation of X-ray intensity is actually due to the oscillation of the post-shock (Comptonizing) region. According to this SOM, shock wave oscillates either because of a resonance (where the cooling time of the flow is approximately the infall time; or because the Rankine-Hugoniot condition is not satisfied to form a steady shock and the QPO frequency is inversely proportional to the infall time in post-shock region. In 2005, in order to explain evolution of QPO frequencies during the rising and the declining phases of the outbursts, we have developed a model, namely Propagating Oscillatory Shock (POS) model, which is in reality, time varying version of SOM model. From the POS model fit of the QPO evolutions during outburst phases, one can make a concrete remark on physical parameters (instantaneous shock location, velocity and acceleration values of the moving shock wave, instantaneous shock strength etc.) of the propagating shock wave, which is believed to be responsible for the QPO evolutions. According to our successful model fit of QPO frequency evolutions, it has been observed that during the outbursts of transient black hole candidates that shock wave moves slowly toward the black hole horizon during the rising phases and the scenario is reversed during the declining phases of the outbursts.

2. **Inclusion of Two Component Advective Flow (TCAF) model in XSPEC :** It has been long understood that the black hole spectral properties can not be explained by a single Keplerian disk component, and one necessarily requires a Keplerian component and a Compton cloud. Such simplified phenomenological models are already in XSPEC (Arnaud, 1996), such as a combination of disk black body (for thermal photons) and power-law (for non-thermal photons) models. In this project, we make an effort to include most generalized transonic astrophysical flow solution of Chakrabarti and his collaborators (Chakrabarti & Titarchuk 1995, Chakrabarti 1997), namely TCAF (Two Component Advective Flow) solution into HEASARC's spectral analysis software package XSPEC as a local additive table model to get direct observational evidences of physical accretion flow parameters. In this solution, the so-called 'Compton cloud' or 'hot corona' is replaced by a low angular momentum sub-Keplerian flow. This flow becomes hot close to the black hole where the centrifugal pressure starts dominating and an accretion shock may or may not form depending on whether or not the shock condition is satisfied. The jets are also produced from this hot region according to the TCAF model. As a whole this low angular momentum flow, be it in the *CENBOL* (CENtrifugal pressure supported BOundary Layer) or in the jet, collectively behave like the Compton cloud. This model was developed by Chakrabarti and his collaborator since mid-90s based on theoretical solutions of viscous transonic flows. Our effort was to create a first user-friendly version for XSPEC which can extract two component (Keplerian disk and Sub-Keplerian halo) mass accretion rates, shock locations etc. One can also extract other parameters such as the unknown black hole masses and distances using this TCAF model.

   Recently after the successful inclusion of TCAF solution into XSPEC as a local additive table model (Debnath, Chakrabarti & Mondal, 2014; Mondal, Debnath & Chakrabarti, 2014; Debnath, Mondal & Chakrabarti, 2015a; Debnath, Molla, Chakrabarti & Mondal, 2015b; Jana et al., 2016, Chatterjee et al. 2016), our understanding about the physics of accretion flow dynamics of black holes are more clear. The model requires only six physical parameters, such as, two types (Keplerian disk and sub-Keplerian halo) of accretion rates, two types (location which depicts size of the CENBOL, shock compression ratio, which is the ratio between post- and pre-shock densities) of shock parameters, mass of the black hole and normalization to fit a spectrum from a BHC.

3. **Study of Accretion Flow Dynamics of Black Holes and Estimation of Intrinsic Source Parameters:** From our recent study, we obtained more accurate pictures of accretion flow dynamics of several transient and persistent BHCs (e.g., H 1743-322, GX 339-4, MAXI J1659-152, MAXI J18361-94, MAXI J1543-564, XTE J1118+480, Swift J1753.5-0127, Cygnus X-1, GRS 1915+105, IGR J17091-3624, GRO J1655-40, V404-Cygni, XTE J1817-330) during their X-ray outbursts. From the TCAF model fitted spectrum, one can not only directly obtain amounts of instantaneous accretion rates from two components of mass accretion, but also obtain information about shock parameters (instantaneous location and strength of the shocks), which allow us to estimate frequencies of the dominating QPOs (if observed in PDS; see, Debnath et al., 2014, Chatterjee et al. 2016). Various spectral states are observed during an outburst epoch of a transient BHC, can easily be explained from variations of *accretion rate ratio* (ARR; ratio between halo to disk rates) and QPOs (shape, frequency, Q value, rms%). A strong correlation between temporal and spectral properties are found in ARR-intensity diagram (ARRID), where different spectral states are observed in different branches of the hysteresis diagram (Jana et al., 2016). Each TCAF model fitted spectrum provide us one best fitted mass value of the black hole. But to estimate probable mass range of an unknown BHC, we use *'constant normalization'* method, since in TCAF model, normalization should be constant for a particular black hole, since it only depends on intrinsic source parameters, such as mass, distance, and disk inclination angle. Our estimated mass values also could be verified from that obtained from other methods, such as the POS model fitted QPO frequency evolution (Molla et al. 2016, Chatterjee et al. 2016). One can also estimate X-ray flux contributions coming from Jets or outflows (if present) from detailed spectral analysis using current version of the TCAF model *fits* file (Jana et al. 2017).

Involvement in X-ray Space Instrumentation Projects:

1. **RT-2 project:** RT-2 (named after Röntgen) payload is a part of Russian Solar mission satellite Coronas-Photon, launched into ∼550 Km polar LEO (Low Earth Orbit) on 30^{th} January, 2009 from Plesetsk Cosmodrome, Russia. The main objective of the RT-2 Experiment was to study (i) time resolved hard X-ray spectra of solar flares, (ii) Galactic and extra-Galactic sources near the ecliptic plane, (iii) gamma-ray bursts (GRBs) and (iv) diffused cosmic X-ray background, in a wide energy band of 15 keV to $\sim$ 1 MeV. I participated in the development, test & evaluation and calibration of RT-2 payloads from their very initial stages to their final flight model stages in laboratories of different Indian institutes, namely, VSSC (Thiruvananthapuram), PRL (Ahmedabad), TIFR (Mumbai), ICSP (Kolkata), and SAC (Ahmedabad). I also participated in theoretical works related to the research & development (R&D) of RT-2 payloads, such as *i*) background simulations of RT-2 payloads using GEANT-4 toolkit, and *ii*) Monte Carlo simulations of Fresnel Zone Plates (FZPs) and Coded Aperture Masks (CAMs) for hard X-ray imaging of RT-2/CZT payload.

2. **XDXL project:** I worked on ICTP-INFN collaborative project X-ray Drift-detector eXtra Large (XDXL) during my two times visit of ICTP, Trieste, Italy as a 'visiting-scientist' position. This project involves the characterization and development of large area, high resolution (temporal and spatial) Silicon Drift Detector (SDD). This high resolution drift detector can be used in future X-ray Astronomy missions or in balloon experiments. Our main goal was to build a large area, high sensitive and high resolution SDD detector for low-energy X-ray (0.5-30 keV) spectroscopic study for the astronomical objects, such as Black Holes, neutron stars, GRBs etc. For this project, I had worked on 'Multidisciplinary Laboratory' of ICTP, Trieste and 'Silicon detectors laboratory' of INFN (Istituto Nationale di Fisica Nucleare), Trieste.

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