

To,
Dean R&D
Tezpur University

Date: 13/06/2023

Sub: Project completion report and related documents
Ref: Your e-mail, dated: 12/06/2023, requesting the same

Dear Sir,

In reference to your above e-mail, the project completion report and the necessary documents on the recently concluded DST-SERB project are enclosed herewith for your needful consideration and action. The details of the project are given as:

Title: Stability analysis of astrophysical complex plasmas
Grant no: EMR/2017/003222
Dean R& D ref no: DoRD/Phy/PKK/20-398/1897-A
Total budget: 16,93,560.00/-
Budget released: 14,50,000.00/-

Thanking you,
Sincerely,



Dr. Pralay Kumar Karmakar
Professor and PI
Department of Physics
Tezpur University
Phone: 9954431753, 94351177002
E-mail: pkk@tezu.ernet.in

- Enclosed copies: 1. Final UC Recurring (CA Verified)
2. Final UC Non-recurring (CA verified)
3. Final SE (CA verified)
4. Demand draft drawn in favour of SERB
5. Extension orders (2 nos)
6. Closure report (First page)

Received
P. K. Karmakar
13/6/23



तेजपुर विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय)

नयाम, तेजपुर - 784 028 अरुम, भारत

TEZPUR UNIVERSITY
(A Central University)

Napaam Tezpur - 784 028 Assam, India

विश्वविद्यालय के लिए, तेजपुर विश्वविद्यालय द्वारा प्रदान की गई सेवाएं और शिक्षा प्रदान करने के लिए।
Awarded as India's Best University Award 2019, 2018 and India's Top 100 Universities MHRD/NFE Ranking 2016 (A Grade) / C Accredited (A Grade)

NOTIFICATION
(For circulation via e-mail)
Dated 28/08/2020

This for information of all Principal Investigators of sponsored research projects that the University is going to update the Project Completion Reports portal in the Tezpur University website (http://www.tezu.ernet.in/project_reports/project_completion_reports.htm) in order to comply with RTI Transparency audit requirement.

Under the circumstances, the Principal Investigators are hereby requested to provide the soft copies of the Project Completion Report along with final UC and SoE duly signed, to the Dean, R&D via email (deanrd@tezu.ernet.in) for uploading the same in the TU website. The Principal Investigators are also requested to provide a hard copy of the aforementioned document to Dean, R&D office, for record in the concerned project files. Those who have already submitted the hard copies may provide soft copies only.

Principal Investigators are requested to co-operate for smooth implementation of the task.

Sd/-
Registrar
Tezpur University

Date: 28/08/2020

Memo No. DoRD/PCR/10-78/1350-A

Copy to:

1. Pro Vice Chancellor, Tezpur University.
2. All Deans, Tezpur University.
3. Heads of all Teaching Departments, Tezpur University.
4. All Faculty Members, Tezpur University
5. All Non Teaching staff, Tezpur University
6. Finance Officer, Tezpur University.
7. Secretary to the Vice Chancellor, Tezpur University, for kind information of the Vice-Chancellor.
8. Concerned file.

Registrar
Tezpur University

GFR 12 - A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2022 (01.04.22-13.08.22)
in respect of RECURRING
as on 13.08.2022 be submitted to SERB
the is UC Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization: **Tezpur University**
2. Name of Principal Investigator (PI): **Dr. Praloy Kumar Karmakar**
3. SERB Sanction order no. & date: **EMR/2017/003222 & 29-08-2018**
4. Title of the Project: **Stability Analysis of Astrophysical Complex Plasma**
5. Name of the SERB Scheme: **EMR**
6. Whether recurring or non-recurring grants: **RECURRING**
7. Grants position at the beginning of the financial year

- (i) Carry forward from previous financial year : **Rs. -3,275 /-**
- (ii) Others, if any :
- (iii) Total : **Rs. -3,275/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

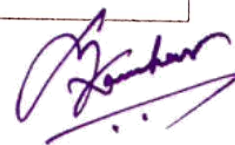
Unspent balance of grants received previous years [figure as at Sl. No. 7(ii)]	Interest earned thereon	Interest deposited back to the SERB	Grants received during the year			Total available funds (1+2+3+4)	Expenditure incurred	Closing balances (5-6)
			Sanction No (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
			EMR/2017/003222	15.04.2021	Rs. 3,50,000/-			
Rs. -3,275/-	NA	NA				Rs. 3,46,725/-	Rs. 3,42,427/-	Rs. 4,298/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
1. Manpower costs: Rs. 3,10,352/- 2. Overhead: Rs. 32,075/-		Rs. 3,42,427/-

Details of grants position at the end of the year

- (i) Balance available at end of financial year : **Rs. 4,298/-**
- (ii) Unspent balance refunded to SERB (if any) : **NIL**
- (iii) Balance (Carried forward to next financial year) if applicable : **Rs. 4,298/-**





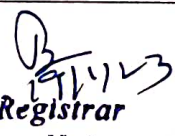
GFR 12 - A
[(See Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2022 (01.04.22-13.08.22)
in respect of RECURRING
as on 13.08.2022 be submitted to SERB
the is UC Audited
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under EMIR (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure- I duly enclosed
- (viii) The utilization of the fund resulted in outcomes given at Annexure – II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure –II (to be formulated by the Ministry/Department concerned as per their requirements/specifications)

Date: 10/01/23

Place: Tezpur University

 Signature of PI:	 Finance Officer Tezpur University Signature with Seal : Name: Chief Finance Officer (Head of Finance)	 Registrar Tezpur University Signature with Seal: Name: Head of Organization
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For Shekhar Agarwal & Associates
Chartered Accountants

Shekhar Agarwal
 Proprietor
 Membership No.-310479
 ICAI FRN 329706E

UDIN - 23310479B02VYZX4574

GFR 12 - A
[(See Rule 238 (D))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2022 (01.04.22-13.08.22)
In respect of NON-RECURRING
grants on 13.08.2022 is submitted to SERB
the UC is Audited
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization: **Tezpur University**
2. Name of Principal Investigator (PI): **Dr. Pralay Kumar Karmakar**
3. SERB Sanction order no. & date: **EMR/2017/003222 & 29-08-2018**
4. Title of the Project: **Stability Analysis of Astrophysical Complex Plasma**
5. Name of the SERB Scheme: **EMR**
6. Whether recurring or non-recurring grants: **NON-RECURRING**
7. Grants position at the beginning of the financial year
 - (i) Carry forward from previous financial year : **Rs. 89,576/-**
 - (ii) Others, If any : **NIL**
 - (iii) Total : **Rs. 89,576/-**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of grants received previous years [figure as at SI No. 7(ii)]	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year			Total Available funds (1+2+3+4)	Expenditure incurred	Closing Balances (5-b)
			Sanction No (i)	Date (ii)	Amount (iii)			
1	2	3	4			5	6	7
Rs. 89,576/-	2158/-	NA	EMR/2017/003222	29/08/2018	Rs. 0/-	Rs. 91,734/-	Rs. 63,200/-	Rs. 28,534/-

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
Equipment(s)	1 Computer 2 Battery	Rs. 63,200/-

Details of grants position at the end of the year

- (i) Balance available at end of financial year : **Rs. 28,534/-**
- (ii) Unspent balance refunded to SERB (If any) : **NIL**
- (iii) Balance (Carried forward to next financial year) if applicable : **Rs. 28,534/-**



GFR 12 - A
[(Sec Rule 238 (1))]
UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2022 (01.04.22-13.08.22)
in respect of NON-RECURRING
as on 13.08.2022 is submitted to SERB
the UC is Audited

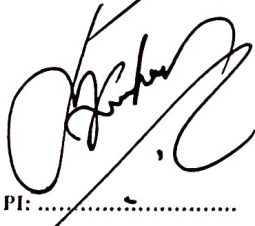

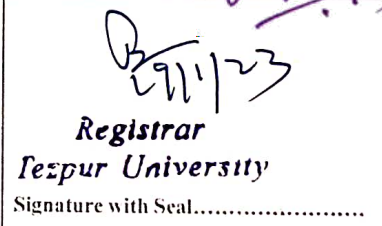
(To be given separately for each financial year ending on 31st March)

Certified that I have satisfied that the conditions on which grants were sanctioned have been duly fulfilled/are being fulfilled and that I have exercised following checks to see that the money has been actually utilized for the purpose for which it was sanctioned:

- (i) The main accounts and other subsidiary accounts and registers (including assets registers) are maintained as prescribed in the relevant Act/Rules/Standing instructions (mention the Act/Rules) and have been duly audited by designated auditors. The figures depicted above tally with the audited figures mentioned in financial statements/accounts.
- (ii) There exist internal controls for safeguarding public funds/assets, watching outcomes and achievements of physical targets against the financial inputs, ensuring quality in asset creation etc. & the periodic evaluation of internal controls is exercised to ensure their effectiveness.
- (iii) To the best of our knowledge and belief, no transactions have been entered that are in violation of relevant Act/Rules/standing instructions and scheme guidelines.
- (iv) The responsibilities among the key functionaries for execution of the scheme have been assigned in clear terms and are not general in nature.
- (v) The benefits were extended to the intended beneficiaries and only such areas/districts were covered where the scheme was intended to operate.
- (vi) The expenditure on various components of the scheme was in the proportions authorized as per the scheme guidelines and terms and conditions of the grants-in-aid.
- (vii) It has been ensured that the physical and financial performance under EMR (Name of the scheme has been according to the requirements, as prescribed in the guidelines issued by Govt. of India and the performance/targets achieved statement for the year to which the utilization of the fund resulted in outcomes given at Annexure - I duly enclosed
- (viii) The utilization of the fund resulted in outcomes given at Annexure - II duly enclosed (to be formulated by the Ministry/Department concerned as per their requirements/specifications.)
- (ix) Details of various schemes executed by the agency through grants-in-aid received from the same Ministry or from other Ministries is enclosed at Annexure - II (to be formulated by the Ministry/Department concerned as per their requirements/specifications).

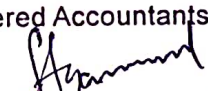
Date: 10/01/23

Place: Tezpur University

 Signature of PI:	 Finance Officer Tezpur University Signature with Seal : Name: Chief Finance Officer (Head of Finance)	 Registrar Tezpur University Signature with Seal..... Name: Head of Organization
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For Shekhar Agarwal & Associates
Chartered Accountants


 Shekhar Agarwal
 Proprietor
 Membership No.-310479
 ICAI FRN 329706E

UDIN - 23310479B6VY2X4574

REQUEST FOR ANNUAL INSTALMENT WITH UP-TO-DATE STATEMENT OF EXPENDITURE

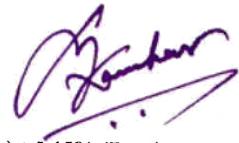
Annexure-I

1. SERB Sanction Order No and date : EMR/2017/003222 & 29-08-2018
2. Name of the PI : Dr. Pralay Kumar Karmakar
3. Total Project Cost : Rs. 16,93,560/-
4. Revised Project Cost :
5. Date of Commencement : 14.09.2018
6. Statement of Expenditure :

(Month wise expenditure incurred during current financial year)

Month & year	Expenditure incurred/ committed
April, 2022	Rs. 20,000/-
May, 2022	Rs. 20,000/-
June, 2022	Rs. 20,000/-
July, 2022	Rs. 20,000/-
August, 2022	Rs. 20,000/-

1. Grant received in each year:
 - a. 1st Year : Rs. 7,00,000/-
[Rs. 2,10,000/- (non-recurring) + Rs. 4,90,000/- (recurring)]
 - b. 2nd Year : NIL
 - c. 3rd Year : NIL
 - d. 4th Year : Rs. 4,00,000/-
 - e. 5th Year : Rs. 3,50,000/-
 - f. Interest, if any : Rs. 2,692/- (First year) + 9,140/- (Second Year) + 6,267/- (Third year) + 2,158/- (Fourth year)
 - g. Total (a + b + c + d) : Rs. 20,257/-



Statement of Expenditure

S. No (I)	Sanctioned heads (II)	Total funds allocated (sanctioned) (III)	Expenditure Incurred					Total expenditure till 31.03.22 (IX = IV + V + VI + VII + VIII)	Balances on (date) (X = III - IX)	Requirement of funds
			1 st Year (14.09.18 to 31.03.19) (IV)	2 nd Year (01.04.19 to 31.03.20) (V)	3 rd Year (01.04.20 To 31.03.21) (VI)	4 th Year 01.04.21 To 31.03.22 (VII)	01.04.22 To 13.08.22 (VIII)			
1.	Manpower costs	10,29,600/-	58,065/-	2,25,000/-	NIL	3,85,714/-	3,10,352/-	9,79,131/-	50,469/-	None
2.	Travel	3,00,000/-	NIL	57,879/-	28,253/-	NIL	NIL	86,132/-	1,53,112/-	None
3.	Contingencies		NIL	NIL	53,379/-	7,377/-	NIL	60,756/-		
4.	Others, if any		NIL	NIL	NIL	NIL	NIL	NIL		
5.	Equipment	2,10,000/-	NIL	NIL	NIL	1,32,481/-	63,200/-	1,95,681/-	14,319/-	None
6.	Overhead expenses	1,53,960/-	32,075/-	NIL	NIL	51,575/-	32,075/-	1,15,725/-	38,235/-	None
7.	Bank Interest	2692 (1 st year) + 9140 (2 nd year) + 6267 (3 rd year) + 2158 (4 th year)	NIL	NIL	NIL	NIL	NIL	NIL	20,257/-	None
8.	Total	17,13,817/- (With bank interest)	90,140/-	2,82,879/-	81,632/-	5,77,147/-	4,05,627/-	14,37,425/-	2,76,392/-	None

Prady Kumar Karan

Name and Signature of Principal Investigator:

Date: 10/01/23

h.r.
Finance Officer 16/1/23
Jaspur University

Signature of Competent financial authority:
(with seal)

Date:

For Shekhar Agarwal & Associates
Chartered Accountants

Note:

1. Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB i.e. Figures in Column (VIII) should not exceed corresponding figures in Column (III)



Shekhar

Shekhar
Shekhar Agarwal
Proprietor
Membership No.-310479
ICAI FRN 329706E

UDIN-23310479 BGLVYZX4574

From: "PK Karmakar" <pkk.766@live.com>
Subject: Fw: SERB-Notification for extension
Date: Tue, March 15, 2022 12:20 am
To: "pkk@tezu.ernet.in" <pkk@tezu.ernet.in>,"pkk@tezu.ac.in"
<pkk@tezu.ac.in>,"pkk.766@rediffmail.com" <pkk.766@rediffmail.com>

From: SERB_Administrator@serbonline.in <SERB_Administrator@serbonline.in>
Sent: Monday, March 14, 2022 12:01 PM
To: serbinfo1@gmail.com <serbinfo1@gmail.com>
Subject: SERB-Notification

Science and Engineering Research Board

(Statutory Body Established Through an Act of Parliament : SERB Act 2008)
Department of Science and Technology, Government of India

SCIENCE & ENGINEERING RESEARCH BOARD (SERB)
(Statutory Body Established Through an Act of Parliament : SERB Act 2008)

Science and Engineering Research Board
3rd & 4th Floor, Block II
Technology Bhavan, New Mehrauli Road
New Delhi - 110016

File Number: EMR/2017/003222

Dated: 14-Mar-2022

Subject: Project titled "Stability analysis of astrophysical complex plasmas".

Dear Dr. Pralay Kumar Karmakar,

I am pleased to inform you that the SERB has no objection in extending the duration of above mentioned project by **eight months** i.e. from **14.09.2021** to **13.05.2022** without any additional funds.

Yours sincerely,
(Dr. Nilotpal Ghosh)

MS

Ph: Ph: 911140000396

Email: nilotpal@serb.gov.in

Dr. Pralay Kumar Karmakar

Department Of Physics

Tezpur University , Distt. sonitpur p.b.no.72 napaam, tezpur, Tezpur, Assam-784011

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SERB-Notification

SERB_Administrator@serbonline.in <SERB_Administrator@serbonline.in>

Thu 5/26/2022 4:23 AM

To: serbinfo1@gmail.com <serbinfo1@gmail.com>

**Science and Engineering Research Board**

(Statutory Body Established Through an Act of Parliament : SERB Act 2008)

Department of Science and Technology, Government of India

SCIENCE & ENGINEERING RESEARCH BOARD (SERB)

(Statutory Body Established Through an Act of Parliament : SERB Act 2008)

Science and Engineering Research Board
3rd & 4th Floor, Block II
Technology Bhavan, New Mehrauli Road
New Delhi - 110016File Number: EMR/2017/003222

Dated: 26-May-2022

Subject: Project titled "Stability analysis of astrophysical complex plasmas".

Dear Dr. Pralay Kumar Karmakar,

I am pleased to inform you that the SERB has no objection in extending the duration of above mentioned project by another **three months** i.e. from **14-05-2022** to **13-08-2022** without any additional funds.

Yours sincerely,

(Dr. Nilotpal Ghosh)

MS

Ph: Ph: 911140000396

Email: nilotpal@serb.gov.in

Dr. Pralay Kumar Karmakar

Department Of Physics

Tezpur University , Distt. sonitpur p.b.no.72 napaam, tezpur, Tezpur, Assam-784011

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कोड नं. /CODE No: 14259
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A/C Payee

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DEMAND DRAFT

Key: SUDHIQ
Sr. No: 114193

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IOI 000536847131
Name of Applicant

Key: SUDHIQ Sr. No: 114193
TEZPUR UNIVERSITY R & D

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BRANCH MANAGER

Bhaskardeep Das

भारतीय स्टेट बैंक

प्राधिकृत हस्ताक्षरकर्ता
AUTHORISED SIGNATORY

STATE BANK OF INDIA

अवकर्ता शाखा / DRAWEE BRANCH: NEW DELHI MAIN BRANCH

कोड नं. /CODE No: 00691

₹ 1,50,000/- एवं अधिक के निकुत दो अधिकारियों द्वारा हस्ताक्षरित होने पर ही वैध है।
INSTRUMENTS FOR ₹ 1,50,000/- & ABOVE ARE NOT VALID UNLESS SIGNED BY TWO OFFICERS

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केवल 3 महीने के लिए वैध
VALID FOR 3 MONTHS ONLY

⑈847131⑈ 000002000⑈ 000536⑈ 16

Closure Report

File Number : EMR/2017/003222
Project Title : Stability analysis of astrophysical complex plasmas
Principal Investigator : [Dr. Pralay Kumar Karmakar](#)
Tezpur University
Distt. sonitpur p.b.no.72 napaam, tezpur, Tezpur, Assam-784011
Total Sanctioned Amount : 16,93,560 (INR)
Total Released Amount : 14,50,000 (INR)
Start Date of the Project: 14 Sep, 2018
Date of completion: 13 Aug, 2022 (47 months)
Approved Objectives :

- Stability of nonuniform complex astrophysical fluids in the JWKB framework.
- Revisiting the above with turbo-magnetic and tidal fields.
- Higher-order analyses in similar environments of starforming clouds.

Deviation made from original objectives (If Any) :

None

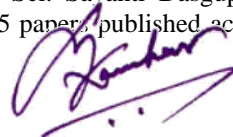
Ph.D. Produced/ Likely to be Produced : 2

Technical Personnel Trained : 2

Total Expenditure : 14,37,425 (INR)

Concise Research Accomplishment :

The research accomplishment can be observed from the number of research papers published acknowledging the grant number EMR/2017/003222 along with the funding agency. Some of the published works are given as follows- 1. Dutta, S., Karmakar, P.K. Fireball sheath instability. J Astrophys Astron 43, 64 (2022). <https://doi.org/10.1007/s12036-022-09850-7> 2. Subham Dutta & Pralay Kumar Karmakar (2023) A multi-order nonlinear meta-analysis of bifluidic fireball sheath fluctuations, Waves in Random and Complex Media, DOI: 10.1080/17455030.2023.2178826 3. Astrophys Space Sci. Savanti Dasgupta and P K Karmakar, (2019) 364:213 <https://doi.org/10.1007/s10509-019-3706-x> There are more than 15 papers published acknowledging the DST-SERB. They can be manually searched from the Research gate account of the PI.



Closure Details

Experimental/ Theoretical Investigation carried out

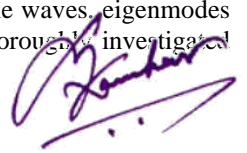
The investigation carried out from the funding was purely theoretical, some of which can be enumerated as mentioned below- 1. High-order nonlinear instability in the laboratory plasma chamber. 2. Linear formulation of the sheath plasma instability. 3. Study of various wave dynamics in the white dwarves. 4. Study of solar plasma, etc.

Detailed Analysis of result

The detailed analysis of the same is given as follows 1. The steady plasma fireball instability (PFS) dynamics evolving around a spherical electrode realizable in the ambient plasmas is theoretically explored in a bifluidic model framework on the relevant laboratory scales of space and time. An applied quasi-linear perturbative analysis (relative to a well-defined hydrostatic homogeneous equilibrium) reduces the perturbed PFS system under test into a unique construct of a second-order linear ordinary differential equation (ODE) with variable coefficients. The formation of peakon-type potential and electric field structures around the electrode is numerically investigated. The peakonic features are confirmed in color spectral phase space as well. It is shown that peakonic structures could result even from a linear ODE system against the traditional peakonic picture of fully nonlinear dynamical systems. The representation of peakon structures herewith the exponential functions is quite in agreement with the earlier predictions reported in the literature. As a consequence, it may be fairly conjectured that our analysis provides a theoretical platform to support the experimentally observed PFS potential structures from the bifluidic perspective. The atypical eigen-patterns are fairly consistent and correlative with experimental findings reported elsewhere. Thus, our analysis could be additionally applicable to understand the coupling stability scenarios of plasma sheath, fireball and double layer on the usual laboratory scales. This PFS instability analysis may indeed be efficacious in diversified plasma processing systems alongside the sheath-induced instability evolutionary phenomena of applied value in varied astrolabplasmic circumstances. In a broader sense, the plasma fireballs exert substantial pressure on the neutral and ionic components; thereby, inducing a macroscopic bulk gaseous flow in the test space-plasma medium taken under consideration, resulting in a number of plasmajet phenomena. As a result, a fair understanding of the plasma fireballs and instabilities could enable us in developing a low-cost jet propulsion device for spacebased technical explorations. A comprehensive plasma concept of various associated instabilities is still in infancy stage as far as seen. It is believed that this analysis could be a promising element for highlighting this important direction having both laboratory and astrophysical plasma significances. Lastly, extended application of our dynamic fireball model in explaining the astronomical expanding gamma-ray bursts effectively could be another future scope of high explorative relevancy.

Conclusions

The research conducted through the financial help from this project helped us in understanding multiple instabilities occurring both in the laboratory as well as astrophysical plasmas, their functioning, theoretical formulation, and finally the corroboration of the result with the experimental findings. The novel Gravitoelectrostatic sheath (GES) model was also explored during the project tenure and yielded publications. It widened our understanding about the sun like stars and multiple waves, eigenmodes and instabilities possible in the system. The steady state evolution of the instabilities have also been thoroughly investigated with published results in reputed journals like Journal of astrophysics and astronomy, MNRAS, etc.



Scope of future work

A number of instabilities active both in the laboratory as well as astropasmas are planned to be explored in the future, such as sheath plasma instability, streaming ion instability, Rayleigh Taylor instability, ionization instability, etc. Moreover, the GES model is planned for deeper exploration in the future with inevitable publishable outcomes.

List of Publications (only from SCI indexed journals):

Title of the Paper	List of Authors	Journal Details	Month & Year	Volume	Status	DOI No	Impact Factor
Nonlinear dynamics of gravitational instability in complex viscoelastic astrofluids	D. Kalita and P. K. Karmakar	AIP Advances (International)	Aug-2018	8 (085207)	Published	https://doi.org/10.1063/1.5043301	1.62
The Jeans instability in viscoelastic spherical astrophysical fluid media	S. Dasgupta and P. K. Karmakar	ASTROPHYSICS AND SPACE SCIENCE (International)	Jan-2020	364 (213)	Published	https://doi.org/10.1007/s10509-019-3706-x	1.62
Dynamics of gravoviscothermal instability in complex astroclouds and cosmic radiation moderation effects	P. Dutta and P. K. Karmakar	ASTROPHYSICS AND SPACE SCIENCE (International)	Jan-2020	364 (217)	Published	https://doi.org/10.1007/s10509-019-3704-z	1.62
Dynamics of gravitational instability excitation in viscoelastic polytropic fluids	P. K. Karmakar and D. Kalita	ASTROPHYSICS AND SPACE SCIENCE (International)	Oct-2018	363 (239)	Published	https://doi.org/10.1007/s10509-018-3460-5	1.54
Nonlinear dynamics of structure formation in protoplanetary disks	P. Sarma and P.K. Karmakar	CHINESE JOURNAL OF PHYSICS (International)	Oct-2021	74 (9)	Published	https://doi.org/10.1016/j.cjph.2021.09.006	3.31
Relativistic ion-acoustic waves in electrospherically confined gyromagnetoactive quantum plasmas	Sayanti Dasgupta and Pralay Kumar Karmakar	CHINESE JOURNAL OF PHYSICS (International)	Feb-2022	76 (299)	Published	https://doi.org/10.1016/j.cjph.2021.12.005	3.23
Nonlinear nucleoacoustic waves in strongly coupled degenerate quantum plasmas	P. Das and P. K. Karmakar	EPL (International)	May-2019	126 (10001)	Published	10.1209/0295-5075/126/10001	1.95
Bimodal instability dynamics in nonthermal complex tridust astroclouds towards structure formation	P. K. Singha and P. K. Karmakar	EPL (International)	Jan-2020	128 (35001)	Published	10.1209/0295-5075/128/35001	1.96
Adapted instabilities excited in spherical magnetized viscoelastic astroclouds with extreme dust-fugacity moderations	Dhrubajit Kalita and Pralay Kumar Karmakar	European Physical Journal Plus (International)	Apr-2021	136 (479 (1-25))	Published	https://doi.org/10.1140/epjp/s13360-	3.22

						021-01479-9	
Jeans instability in non-ideal MHD plasma clouds with geometric curvature effects	Dhrubajit Kalita and Pralay Kumar Karmakar	IEEE TRANSACTIONS ON PLASMA SCIENCE (National)	Mar-2022	99 (1-6)	Published	10.1109/TPS.2021.3082811	1.32
Fireball Sheath Instability	Subham Dutta and P K Karmakar	JOURNAL OF ASTROPHYSICS AND ASTRONOMY (National)	Mar-2021	43 (64)	Published	https://doi.org/10.1007/s12036-022-09850-7	1.61
Non-planar magnetoactive GES-based solar plasma stability	Souvik Das and P K Karmakar	JOURNAL OF ASTROPHYSICS AND ASTRONOMY (National)	Mar-2021	43 (44)	Published	https://doi.org/10.1007/s12036-022-098	1.61
A theoretic analysis of magnetoactive GES-based turbulent solar plasma instability	Souvik Das, Ahmed Atteya, and Pralay Kumar Karmakar	MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY (International)	Jun-2023	(50)	Published	https://doi.org/10.1093/mnras/stad1664	5.23
Analyzing the instability dynamics of spherical complex astroclous in a magnetized meanfluidic fabric	D. Kalita and P. K. Karmakar	PHYSICS OF PLASMAS (International)	Feb-2020	27 (022902)	Published	https://doi.org/10.1063/1.5143267	1.94
Instability dynamics in gyrogravitating astroclouds with cosmic moderation in non-ideal MHD fabric	Pranamika Dutta and P. K. Karmakar	PRAMANA-JOURNAL OF PHYSICS (International)	Dec-2020	95 (169)	Published	https://doi.org/10.1007/s12043-021-02199-6	2.71
Astromodal wave dyanmics in multifluidic structure-forming cloud complexes (in Press)	A. Haloi and P. K. Karmakar	PRAMANA-JOURNAL OF PHYSICS (National)	Jan-2021	(00)	Published	doi.org/10.1007/s12043-020-02031-7	1.11
Astromodal wave dynamics in multifluidic structure-forming cloud complexes	Archana Haloi and Pralay Kumar Karmakar	PRAMANA-JOURNAL OF PHYSICS (National)	Sep-2021	95 (17)	Published	https://doi.org/10.1007/s12043-020-02031-7	1.68
A theoretical study of heavy nucleus-acoustic waves in white dwarf core environments	Sayanti Dasgupta and Pralay Kumar Karmakar	PRAMANA-JOURNAL OF PHYSICS (National)	May-2023		Accepted	PRAM-D-23-00230R2	2.21
Propagatory dynamics of nucleus-acoustic waves excited in gyrogravitating	S. Dasgupta and P.K. Karmakar	Scientific Reports (International)	Oct-2021	11 (19126)	Published	https://doi.org/10.1007/s12043-021-02199-6	4.37

degenerate quantum plasmas electrostatically confined in curved geometry						1038/s41598-021-98543-2	
Nonlinear Jeans-Buneman instability in gravitating complex plasmas	Tanushree Bezbaruah & Pralay Kumar Karmakar	Waves in Random and Complex Media (International)	Apr-2023	(1-23)	Published	DOI: 10.1080/17455030.2023.2213029	4.05
Nonlinear streaming instability in viscoelastic quantum dusty plasmas	Smriti Roy, Tanushree Bezbaruah and Pralay Kumar Karmakar	Waves in Random and Complex Media (International)	Jan-2023	(1-23)	Published	DOI: 10.1080/17455030.2023.2177503	4.05

List of Papers Published in Conference Proceedings, Popular Journals:

Title of the Paper	List of Authors	Journal Details	Month & Year	Volume	Status	DOI No	Impact Factor
Nonlinear nucleus-acoustic waves and possible equivalent conservation laws	P. Das and P. K. Karmakar	Advances in Nuclear Physics and Condensed Matter (National)	Jan-2020	1 (248)	Published	0-0	
Gyrokinetic influence on star-forming bimodal cloud stability	A. Haloi and P. K. Karmakar	Advances in Nuclear Physics and Condensed Matter (National)	Jan-2020	1 (104)	Published	978-93-88881-20-3	
Evolution of conjugational hybrid mode in partially ionized astropasmas	P. Dutta and P. K. Karmakar	Nuclear Physics and Condensed Matter (National)	Jan-2020	1 (112)	Published	0	

List of Patents filed/ to be filed:

Patent Title	Authors	Patent Type	Country/Agency Name	Patent Status	Application No.
Not Available					

Equipment Details:

Equipment Name	Cost (INR)	Procured	Make & Model	Utilization %	Amount Spent (INR)	Date of Procurement
Workstation for advanced computation	2,10,000	Yes	Accer Ryzen 3 4 GB RAM	90	1,32,481	08 Apr, 202

Plans for utilizing the equipment facilities in future:

The plans are given as follows-

1. Writing more manuscripts,
2. Doing light calculation,
3. Literature survey, etc.

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Technology Bhavan, New Mehrauli Road
New Delhi - 110016File Number: EMR/2017/003222

Dated: 13-Jun-2023

Subject: Project titled "Stability analysis of astrophysical complex plasmas".

Dear Dr. Pralay Kumar Karmakar,

SERB acknowledges the receipt of the below mentioned,

Amount(in rupees)	32832
Credited on	07-06-2023
Cheque/ NEFT/ DD Number	847131

Yours sincerely,

(Dr. Under Secretary)

DDO

Ph:

Email: finance@serb.gov.in

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