

MEMORANDUM OF UNDERSTANDING

BETWEEN

INTER-UNIVERSITY CENTRE FOR ASTRONOMY AND ASTROPHYSICS

AND

THE INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

One of the main objectives of the Inter-University Centre for Astronomy and Astrophysics (IUCAA) is to facilitate the growth and strengthening of teaching and research in Astronomy and Astrophysics (A&A) in the University Sector. To coordinate and facilitate the interaction between the Indian Institute of Technology (IIT), Kharagpur and IUCAA, a formal understanding is needed between the two institutions which is spelt out by this document termed as the "Memorandum of Understanding" between IIT, Kharagpur and IUCAA.

The Terms of Memorandum of Understanding

IIT, Kharagpur and IUCAA, through the Director of IIT, Kharagpur and the Director of IUCAA are hereby entering into an agreement set forth in this Memorandum of Understanding to achieve the above mentioned goals and objectives.

(a) The Teaching of Astronomy and Astrophysics

(i) IIT, Kharagpur will strive to incorporate Astronomy and Astrophysics as a part of the course \*curriculum\* and IUCAA agrees to extend cooperation from its academic staff to formulate courses in this stream as well as for other academic activities, if required. IUCAA may also provide visiting faculty to teach specific parts of such courses. The participating IUCAA staff members will be recognized by IIT, Kharagpur as Visiting

Professors/\*Adjunct Faculty\* subject to the \*Institute rules and regulations.\*

(ii) \*IUCAA agrees to extend their Associateship Programme to the faculty members of IIT, Kharagpur. IIT, Kharagpur agrees to treat the duration of visits by IIT, Kharagpur faculty, under the Associateship Programme, to IUCAA as per rules. "The working details regarding this programme will be finalized by the Apex Committee formed under item (e) below.\*

**(b) Research in Astronomy and Astrophysics**

\*IIT, Kharagpur will extend necessary facilities to research scholars attached to IUCAA for registration at IIT, Kharagpur as applicable to such scholars attached to other institutes.\*

IUCAA and IIT, Kharagpur agree to encourage exchange visits of research scholars (working towards Ph.D. in the respective institutions) for periods of 3-6 months at a time. These visits could be for taking courses or collaborating with the faculty on research projects and the students will be treated as on duty during these visits.

**(c) The Sharing of Facilities**

IUCAA agrees to extend free access to its library, laboratory, computing and guest house facilities to staff members of IIT, Kharagpur during their visits to IUCAA. IIT, Kharagpur agrees to permit IUCAA's Associates and sponsored visitors to use their library, computing and guest house facilities. IUCAA will take care of their travel and other necessary expenses for this purpose. A faculty member from IIT, Kharagpur could be nominated to coordinate these visits. This coordinator has to keep a record of visits by the authorized visitors and certify his/her expenses on a form supplied by IUCAA, which will be forwarded by the visitor to IUCAA for direct reimbursement.

**(d) Joint Workshops/Schools, etc.**

IUCAA and IIT, Kharagpur agree to explore the possibility of holding joint workshops, schools and conferences in areas of mutual interest, based on the proposals received from the staff members of these institutions.

**(e) Modus Operandi**

Both IIT, Kharagpur and IUCAA feel that there should be an Apex Committee for the smooth functioning of various programmes and fostering fruitful interaction between participating institutions. The committee may consist of two scientists from each of the participating institutions and the Director of IIT, Kharagpur as Chairperson and the Director of IUCAA as ex-officio member and Co-chairperson of the committee.

The term of the nominated members will be three years. The committee will meet at least once a year, review and monitor the functioning of the bilateral interaction and programmes.

For and behalf of IUCAA

*J. V. Narlikar*

Director

31/7/2008

**JAYANT V. NARLIKAR**  
Director  
Inter-University Centre  
for Astronomy and Astrophysics

For and behalf of Director, IIT, Kharagpur

*Q. Shwast*

Director

Witness :

1. *Alkeshwari*  
2. *Worulw*

1. *Chellalt*  
2. *Shankar*

To

Professor A. Chakraborty

Dean, Alumni Affairs and International Relations

Subject: MoU between IIT Kharagpur and IUCAA Pune

Dear Professor Chakraborty,

Please find attached the required documents (as requested by you) in connection with the signing of a fresh MoU between IIT Kharagpur and IUCAA, Pune. The documents are:

- (i) Summary of activities carried out in the last seven years.
- (ii) Documentary evidence from IUCAA regarding willingness to collaborate and activities of interest.
- (iii) A projection on activities to be carried out in the next three years (prepared after informal consultation with IUCAA personnel).

We would be grateful if you could kindly let us know the decision regarding the signing of a fresh MoU, at your earliest convenience.

Thanking you

Sincerely yours

 6/9/07

Professor Soumitro Banerjee

Dept. of Electrical Engineering and Centre for Theoretical Studies

Member, IUCAA IIT Kharagpur MoU Committee

Dated : 03. 09. 2007

**Memorandum of Understanding**  
**between**  
**Inter-University Centre for Astronomy and Astrophysics, Pune**  
**and**  
**Indian Institute of Technology Kharagpur**

**Summary of Activities: August 1, 2000 to July 31, 2007**

**Short-term projects/participation in summer school by IITKgp students**

A total of **28** students (list available on request) from various Departments (primarily Physics) of IIT Kharagpur have done summer/winter projects and/or participated in the biennial summer school on Astronomy and Astrophysics at IUCAA, Pune.

Research scholars working on topics related to Gravitation and Cosmology have visited IUCAA several times to participate in workshops, symposia and conferences held there.

**Workshops/School organised at IITKgp on topics of mutual interest**

1. International Workshop on **Contemporary Cosmology**, January 16-17, 2001, held at IIT Kharagpur Extension Centre, Kolkata.
2. International Workshop on **Mach's Principle and the Origin of Inertia**, February 6-8, 2002, held at IIT Kharagpur.

Proceedings of this workshop is published as: Mach's Principle and the Origin of Inertia (Ed. M. Sachs and A. R. Roy), Aperion, Montreal, Canada (2003)

3. SERC School on **Astrophysics**, June 3, 2002 to July 3, 2002
4. IUCAA-IITKgp Workshop on **High Energy Astrophysics**, Feb 23-25, 2004, held at IIT Kharagpur.

All the above three workshops had significant participation (faculty as well as students) from IUCAA and IIT Kharagpur

### Visits/Seminars by IUCAA faculty and associates to/at IITKgp (after 2004)

1. Professor Ajit Kembhavi, lecture on **Virtual observatories**, February 25, 2006.
2. Professor Ranjan Gupta, lecture on **Effects of Earth's atmosphere on astronomical observations and new generation telescopes**, February 25, 2006
3. Professor Naresh Dadhich, lecture on **Gravity in higher dimensions**, April 25, 2007
4. Dr. Sanjay Pandey, LBSS College, Gonda, UP and an IUCAA Associate is a regular visitor to IIT Kharagpur and has an ongoing collaboration with Dr. Somnath Bharadwaj.
5. Dr. Saibal Roy, Barasat Government College, Kolkata is an IUCAA Associate and a regular visitor to IIT Kharagpur.
6. Dr. Supratik Pal, currently a post-doctoral fellow at IUCAA has ongoing collaborations with Dr. Sayan Kar, IIT Kharagpur
7. Dr. Biswajit Pandey, currently a post-doctoral fellow at IUCAA has ongoing collaborations with Dr. Somnath Bharadwaj, IIT Kharagpur

### Visits by IITKgp faculty to IUCAA

Drs. S. Bharadwaj, S. Kar and S. Konar have visited IUCAA, Pune several times either as participants in their workshops/conferences or as regular visitors. Prof S. Banerjee and Prof P. K. Raina have also visited IUCAA on a couple of occasions.

### Participation by IITKgp faculty in events organised by IUCAA

Drs S. Bharadwaj, S. Kar and S. Konar have lectured on topics related to Astrophysics, Gravitation and Cosmology in workshops/schools organised by IUCAA between August 2000 and July 2007 at the following venues:

- (a) Utkal University, Bhubaneswar (twice, SB and SK).
- (b) Osmania University, Hyderabad (once, SB).
- (c) North Bengal University, Jalpaiguri (once, SB).
- (d) Siliguri College (once, SB).
- (e) Jadavpur University (once, SB and SK).
- (f) Statistics Department, University of Calcutta (SB).

## The teaching of Astronomy and Astrophysics at IITKgp

The following MSc and Phd level elective courses were introduced and taught several times by Dr. S. Bharadwaj, Dr. S. Konar and Dr. S. Kar during the last seven years.

1. PH58036: Introduction to Astronomy and Astrophysics
2. PH58002: Physical Cosmology
3. PH58024: General Relativity
4. PH58025: Advanced topics in field theory and gravitation
5. PH60033: Astrophysics and Cosmology

**Note:** The courses have been taken as credit not only by students of Physics but also by students from other Departments (eg. EE, ECE, CSE, AE, MA etc. Several students from Physics as well as other Departments (list available on request) are currently doing their Phd or pursuing post-doctoral research in the field of Astrophysics, Gravitation and Cosmology in universities/insitutes in India as well as abroad. )

20 MSc projects (one year) have been supervised by Drs. S. Bharadwaj, S. Kar and S. Konar. One of these projects was done under the joint supervision of Dr. Bharadwaj and Dr. Souradeep (IUCAA).

## Astronomy club activities at IITKgp

An amateur astronomy club at IIT Kharagpur has organised:

- (a) Skywatching with 3 inch telescope.
- (b) Introductory lectures on astronomy by students and faculty at IIT Kharagpur
- (c) Observation sessions with a 14 inch telescope made available temporarily through the Positional Astronomy Centre, Kolkata.
- (d) Lectures and observations during special astronomical events (such as eclipses, meteor showers etc.) have been carried out on a regular basis under the leadership of Prof. S. Banerjee and interested students.

## Collaborative research

Collaborative research, involving faculty at both institutions, on topics in Gravitation and Cosmology have been carried out over the last seven years. This has resulted in the following output in terms of publications in international journals.

### I. Publications with IUCAA faculty/associates:

1. T. D. Saini (IUCAA), S. Bharadwaj (IITKgp), S. K. Sethi, Using gravitational lensing to study HI clouds at high redshift, *Astrophysical Journal* **557**, (2001), 421.
2. N. Dadhich (IUCAA), S. Kar (IITKgp), S. Mukherjee, M. Visser,  $R=0$  spacetimes and self-dual Lorentzian wormholes, *Phys. Rev. D* **65** (2002) 064004.
3. M. Visser, S. Kar (IITKgp) and N. Dadhich (IUCAA), Traversable wormholes with arbitrarily small energy condition violations, *Phys.Rev.Lett.* **90** (2003) 201102.
4. S. Bharadwaj (IITKgp), S. K. Pandey (IUCAA associate), HI fluctuations at large redshifts: II - the signal expected for GMRT, *J.Astrophys.Astron.* **24** (2003), 23.
5. S. Bharadwaj (IITKgp), Suketu Bhavsar, J. V. Sheth (IUCAA), The size of the longest filaments in the universe, *Astrophysical Journal* **606** (2004), 25.
6. S. Kar (IITKgp), N. Dadhich (IUCAA) and M. Visser, Quantifying energy condition violations in traversable wormholes, *Pramana* **63** (2004), 859.
7. S. Bharadwaj (IITKgp), S. K. Pandey (IUCAA Associate), Probing non-Gaussian features in the HI distribution at the epoch of reionization, *Mon.Not.Roy.Astron.Soc.* **358** (2005), 968.
8. S. S. Ali (IITKgp), S. Bharadwaj (IITKgp), S. K. Pandey (IUCAA Associate), Probing the bispectrum at high redshifts using 21 cm HI observations, *Mon.Not.Roy.Astron.Soc.* **366** (2006), 213.
9. R. D. Ray Mandal, M. Sinha, M. Bagchi, S. Konar (IITKgp), M. Dey (IUCAA associate), J. Dey (IUCAA associate), Strange Pulsar Hypothesis, *Mon.Not.Roy.Astron.Soc.* **365** (2006), 1383.
- 10.. T. Ghosh (IITKgp), A. Hajian (IUCAA), T.Souradeep (IUCAA), Unveiling Hidden Patterns in CMB Anisotropy Maps, *Phys. Rev. D***75** (2007), 083007.
11. M. Bagchi, S. Konar (IITKgp), G. Bhattacharya, J. Dey (IUCAA associate), M. Dey (IUCAA associate), Remarkable possibility of detecting double strange stars using radio

waves (submitted for publication in December 2006)

12. S. Pal (IUCAA), S. Kar (IITKgp), de Sitter branes with bulk tachyon matter. (submitted for publication in June 2007)

13. S. Pal (IUCAA), S. Kar (IITKgp), Gravitational lensing in braneworld gravity: formalism and applications (submitted for publication in June 2007)

## II. Publications on Gravitation and Cosmology by IITKgp faculty

Besides the abovementioned articles there have been, in addition 45 publications in the last seven years, in internationally reputed journals in the field of gravitation and cosmology by faculty members at IIT Kharagpur working in this area of research.

### IITKgp alumni at IUCAA, Pune

IITKgp MSc students doing Phd at IUCAA: Mr. Sharanya Sur, Mr. Tuhin Ghosh, Mr. Tapan Naskar.

IITKgp Phd students/visitors as IUCAA postdocs: Dr. Ratna Koley, Dr. Supratik Pal and Dr. Biswajit Pandey.

### IITKgp presence in IUCAA Council and Governing Board

Since the signing of the MoU, the Director, IIT Kharagpur has been made a permanent member of the Council and Governing Board of IUCAA, Pune.

## Projection for the future: next 3 years

### Astronomy–Astrophysics Initiative

*under*

### IUCAA–IIT Kharagpur MoU

Tentative Programme: October 1, 2007 to July 31, 2008

Dates	Programme	Organisers (O) Lecturers (L)	Funding
October end 2007	Lectures: Astronomical techniques	A. N. Ramaprakash (L)	TA (IUCAA)
November beg. 2007	Data Analysis	and A. K. Kembhavi (L)	LH (IITKgp)
Jan. end 2008	Workshop: Physics of	Sayan Kar (O)	IUCAA,
Feb. 1st wk. 2008 (3 days)	warped extra dimensions	S. Bharadwaj (O)	DST, CSIR etc.
		N. Dadhich (O)	
March 2008 (4-5 days)	Topical lectures	T. Padmanabhan (L)	TA (IUCAA)
			LH (IITKgp)
March 2008 (1 day)	Workshop: Telescope making	A. Paranjpye (L, O)	TA (IUCAA)
		S. Banerjee (O)	LH (IITKgp)

Tentative Programme: August 1, 2008 to July 31, 2009

Dates	Programme	Organisers (O) Lecturers (L)	Funding
Oct. Nov 2008 (2-3 days)	Lectures: Astronomical techniques and Data Analysis	To be decided	IUCAA (TA) IITKgp (LH)
March 2009 (3 days)	Discussion meeting on Horizon entropy	Topic suggested by T. Padmanabhan	IUCAA, CSIR, DST etc.

Tentative Programme: August 1, 2009 to July 31, 2010

Dates	Programme	Organisers (O) Lecturers (L)	Funding
December 2009 (2 weeks)	IITKgp-IUCAA School on A & A	S. Bharadwaj (O), S. Kar (O) T. Souradeep (O)	IUCAA, DST, CSIR etc
Feb. 2010 (4 days)	Workshop: Cosmology: observations confront theories	S. Bharadwaj (O) S. Kar (O), T. Souradeep (O)	IUCAA, DST,CSIR etc.

In addition to the above the following activities will be carried out.

- (a) Visits by IUCAA associates to CTS, IITKgp.
- (b) Exchange visits by faculty, postdocs and students from both institutions.
- (c) Joint MSc projects by final year MSc students at IITKgp
- (d) Topical courses by IITKgp faculty at IUCAA depending on requirement and interest.

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In addition there will be a request for the usual JRF/SRF/RA/JPO positions.

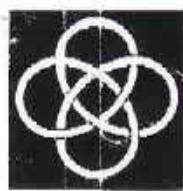
(f) Summer training (to be of 2 credits and compulsory in the MSc (Intg.) programme at IITKgp from last year, will be effective for the batch entering 4th yr in 2009-2010) for students at IITKgp on concrete projects at IUCAA.

This will be in addition to the regular VSP.

'A' Dean (UG) to certify. Project is being prepared.  
Will be submitted in  
due course.  
Contact: Prof. Sayan Kar  
As Under  
'B' Dean (SRIC) to certify. Project is being prepared.  
Will be submitted in  
due course.  
Contact: Prof. Sayan Kar  
As Under  
*D. S. Kar*

Yes. The students will have to do summer training as per new UG curricula proposal (2006 onwards). These students entering 4th year in 2009-2010 will undergo summer training during May-June 2010.

*Y.S.K  
11 Sept 09*



अंतर-विश्वविद्यालय केंद्र : खगोलविज्ञान और खगोलधीतिकी

IUCAA

An Autonomous Institution of the University Grants Commission

Naresh Dadhich  
Director

August 9, 2007

Ref: NKD/2007/D-MOU/ 8619

Fax No. : 03222-282700

Kind Attn : Dr Sayan Kar, Department of Physics and Meteorology, and Centre for Theoretical Studies, Indian Institute of Technology, Kharagpur – 721 302.

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that the Inter-University Centre for Astronomy and Astrophysics, Pune, is willing to collaborate (i) in the teaching and dissemination of knowledge in Astronomy and Astrophysics and (ii) in research in areas of mutual interest with the Indian Institute of Technology, Kharagpur for a period of five years beginning from the date of signing of the Memorandum of Understanding (MoU).

Activities related to (i) may include short-term courses and projects in and related to Astronomy and Astrophysics. In addition, the focus of (ii) would be to promote research collaboration through long-term projects including joint supervision of Ph.D. theses and joint organization of seminars/workshops/conferences on currently important areas of research.

Further details on the above-mentioned activities can be spelt out by an APEX committee which will monitor the programmes under the MoU for the next five years.

*Naresh Dadhich*

Naresh Dadhich  
Director

**Mailing Address :** Iucaa, Post Bag 4, Ganeshkhind, Pune - 411 007, India  
**Location :** Meghnad Saha Road, Pune University Campus, Pune - 411 007

**Phone :** 91-20-25691513 (Direct), 25691414, 25604100 (General). **Fax :** 91-20-25604698 (Direct), 25604699 (General)  
**E-mail :** nkd@iucaa.ernet.in, dadhich@iucaa.ernet.in **URL :** <http://www.iucaa.ernet.in>

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For and behalf of IUCAA



Director

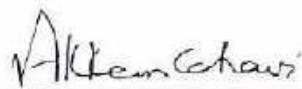
**JAYANT V. NARLIKAR**

31/7/2012

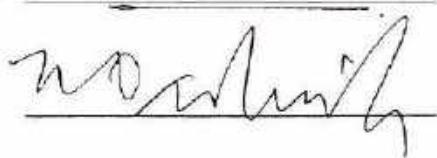
Director  
Inter-University Centre  
for Astronomy and Astrophysics

Witness :

1.



2.

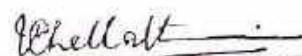


For and behalf of Director, IIT, Kharagpur



Director

1.



2.



To

Professor Damodar Acharya

Director, IIT Kharagpur

Dear Professor Acharya,

In the year 2000, a Memorandum of Understanding was signed between IIT Kharagpur and the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune with the aim of promoting collaboration in the teaching and research of Astronomy and Astrophysics, between the two institutions. The organisation of workshops, seminars and discussion meetings on topics of mutual interest and opportunities for students at IIT Kharagpur to work in short-term projects at IUCAA also featured in the goals of the MoU. A committee was set up to take care of the MoU activities. The committee included two faculty from IIT Kharagpur and two from IUCAA, who have monitored the MoU activities over the past few years.

In April 2007, the IUCAA Director, Prof N. Dadhich visited IIT Kharagpur and suggested that we propose a set of activities for the next three years and carry them out to the best of our abilities. Prof. Dadhich discussed with the Director, IIT Kharagpur and the concerned faculty members, and a draft titled 'IUCAA IITKgp Astronomy Astrophysics Initiative' was framed.

The draft has now been signed by the concerned faculty in IUCAA and their Director. It has been sent to us for the signatures from our side.

We are attaching a copy of the original MoU and the recent proposal by the MoU Committee. We request you for an appointment so that the matter can be discussed with you, the formalities can be completed and the objectives of the proposal can be carried out appropriately.

Thanking you

Sincerely yours

  
31/7/07

Soumitro Banerjee

Dept. of Electrical Engineering and Centre for Theoretical Studies  
Member, IUCAA IIT Kharagpur MoU Committee

Astronomy-Astrophysics Initiative

under

IUCAA-IIT Kharagpur MoU

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In addition to the above the following activities will be carried out.

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In addition there will be a request for the usual JRF/SRF/RA/JPO positions.

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Signatories

Dr. Tarun Souradeep, IUCAA  
MoU Committee Member

Dr. S. Banerjee, IITKgp  
MoU Committee Member

Dr. A. N. Ramaprakash, IUCAA  
MoU Committee Member

Dr. S. Konar, IITKgp  
MoU Committee Member

Prof. Naresh Dadhich, Director, IUCAA, Pune

Prof. Damodar Acharya, Director, IIT Kharagpur

Centre for Theoretical Studies

To

Professor S. K. Dube  
Director,  
IITKgp

*Received by 23/11/02*

November 28, 2002

Through : Professor S. Sahu Dean, PG Studies, IITKgp

Subject: MoU between IUCAA, Pune and IITKgp

Dear Prof. Dube,

A Memorandum of Understanding exists between the Inter-University Centre for Astronomy and Astrophysics, Pune and IIT Kharagpur. A copy of this is attached. It is now required (as stated in the MoU) that a committee comprising of two nominated members from IIT Kgp and two from IUCAA be formed in order to activate the possibilities outlined in the MoU. I request you to kindly look into this matter and take necessary action as soon as possible.

Thanking you

With regards

Yours sincerely

The following names are proposed.

Any two may be recommended.

1. Dr. Sayan Kar (Phys)
2. Dr. Sushan Konar (Phys)
3. Dr. Souniito Banerjee (EE)
4. Dr. Somnath Bharadwaj (Phys)

*S. Banerjee*  
S. Banerjee, Convenor  
Centre for Theoretical Studies  
IIT Kharagpur

*Dean (PGS)*

*Convenor (CTS)*

*R. G. A.*  
R. G. A.  
D.S.O.I.

Kind

The following issues may kindly be addressed.

- ① Activities and action report for last 7 years.
- ② Terms of the MOU
- ③ documentary evidence of the willingness of the counterpart to continue still collaborate and if so what activities are of interest
- ④ If ①, ② & ③ are suitably addressed  
fresh MOU may kindly be made as per prevailing institute template.

Attn: Deans  
2-8-07.

To Prof. S. Banerjee.

CTS  
IIT Kharagpur.

All faculty &  
NB.  
Johnson  
14/6/07

Indian Institute of Technology  
Kharagpur



No. : Estt/Genl/1-14/Misc  
Dated : June 13, 2007

The undersigned is to convey that the Director will meet the members of Faculty of the Institute on **21<sup>st</sup> June, 2007 at 4.00 p.m. in the Kalidas Auditorium.**

All Faculty members are requested to make it convenient to attend the same.



Registrar

To  
All Faculty Members

Copy to:

1. All Deans
2. All Heads of the Departments/Centres/Schools
3. All Chairmen/Professors-in-Charge
4. Chairman, CWISS
  - with a request to provide audiovisual facilities in the Kalidas Auditorium on the aforesaid date and time.
  - with a request to provide AC facilities in the Kalidas Auditorium on the aforesaid date and time.
5. Professor-in-Charge  
Refrigeration & AC Unit
6. Supdt. Engineer (Civil)
7. Shri S.B. Das, TA, AV Cell, CWISS
8. Shri T. Sasmal, Sanitary Inspector (SG), New Academic Complex
9. Special Officer - Security
  - for information and necessary action.
10. Secretary to the Director
11. Secretary, Deputy Director's Office
12. Secretary, Registrar's Office

## MEMORANDUM OF UNDERSTANDING

BETWEEN

INTER-UNIVERSITY CENTRE FOR ASTRONOMY AND ASTROPHYSICS

AND

THE INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

One of the main objectives of the Inter-University Centre for Astronomy and Astrophysics (IUCAA) is to facilitate the growth and strengthening of teaching and research in Astronomy and Astrophysics (A&A) in the University Sector. To coordinate and facilitate the interaction between the Indian Institute of Technology (IIT), Kharagpur and IUCAA, a formal understanding is needed between the two institutions which is spelt out by this document termed as the "Memorandum of Understanding" between IIT, Kharagpur and IUCAA.

### The Terms of Memorandum of Understanding

IIT, Kharagpur and IUCAA, through the Director of IIT, Kharagpur and the Director of IUCAA are hereby entering into an agreement set forth in this Memorandum of Understanding to achieve the above mentioned goals and objectives.

(a) The Teaching of Astronomy and Astrophysics

(i) IIT, Kharagpur will strive to incorporate Astronomy and Astrophysics as a part of the course \*curriculum\* and IUCAA agrees to extend cooperation from its academic staff to formulate courses in this stream as well as for other academic activities, if required. IUCAA may also provide visiting faculty to teach specific parts of such courses. The participating IUCAA staff members will be recognized by IIT, Kharagpur as Visiting

Professors/\*Adjunct Faculty\* subject to the \*Institute rules and regulations.\*

(ii) \*IUCNA agrees to extend their Associateship Programme to the faculty members of IIT, Kharagpur. IIT, Kharagpur agrees to treat the duration of visits by IIT, Kharagpur faculty, under the Associateship Programme, to IUCNA as per rules. "The working details regarding this programme will be finalized by the Apex Committee formed under item (e) below.\*

**(b) Research in Astronomy and Astrophysics**

\*IIT, Kharagpur will extend necessary facilities to research scholars attached to IUCNA for registration at IIT, Kharagpur as applicable to such scholars attached to other institutes.\*

IUCNA and IIT, Kharagpur agree to encourage exchange visits of research scholars (working towards Ph.D. in the respective institutions) for periods of 3-6 months at a time. These visits could be for taking courses or collaborating with the faculty on research projects and the students will be treated as on duty during these visits.

**(c) The Sharing of Facilities**

IUCNA agrees to extend free access to its library, laboratory, computing and guest house facilities to staff members of IIT, Kharagpur during their visits to IUCNA. IIT, Kharagpur agrees to permit IUCNA's Associates and sponsored visitors to use their library, computing and guest house facilities. IUCNA will take care of their travel and other necessary expenses for this purpose. A faculty member from IIT, Kharagpur could be nominated to coordinate these visits. This coordinator has to keep a record of visits by the authorized visitors and certify his/her expenses on a form supplied by IUCNA, which will be forwarded by the visitor to IUCNA for direct reimbursement.

**(d) Joint Workshops/Schools, etc.**

IUCAA and IIT, Kharagpur agree to explore the possibility of holding joint workshops, schools and conferences in areas of mutual interest, based on the proposals received from the staff members of these institutions.

**(e) Modus Operandi**

Both IIT, Kharagpur and IUCAA feel that there should be an Apex Committee for the smooth functioning of various programmes and fostering fruitful interaction between participating institutions. The committee may consist of two scientists from each of the participating institutions and the Director of IIT, Kharagpur as Chairperson and the Director of IUCAA as ex-officio member and Co-chairperson of the committee.

The term of the nominated members will be three years. The committee will meet at least once a year, review and monitor the functioning of the bilateral interaction and programmes.

For and behalf of IUCAA

*J. V. Narlikar*

Director

31/7/2010

**JAYANT V. NARLIKAR**  
Director  
Inter-University Centre  
for Astronomy and Astrophysics

Witness :

1. *Alkesh Chawla*

1. *Chellappa*

2. *Worrell*

2. *Shankar*

To

Professor Damodar Acharya

Director, IIT Kharagpur

Dear Professor Acharya,

In the year 2000, a Memorandum of Understanding was signed between IIT Kharagpur and the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune with the aim of promoting collaboration in the teaching and research of Astronomy and Astrophysics, between the two institutions. The organisation of workshops, seminars and discussion meetings on topics of mutual interest and opportunities for students at IIT Kharagpur to work in short-term projects at IUCAA also featured in the goals of the MoU. A committee was set up to take care of the MoU activities. The committee included two faculty from IIT Kharagpur and two from IUCAA, who have monitored the MoU activities over the past few years.

In April 2007, the IUCAA Director, Prof N. Dadhich visited IIT Kharagpur and suggested that we propose a set of activities for the next three years and carry them out to the best of our abilities. Prof. Dadhich discussed with the Director, IIT Kharagpur and the concerned faculty members, and a draft titled 'IUCAA IITKgp Astronomy Astrophysics Initiative' was framed.

The draft has now been signed by the concerned faculty in IUCAA and their Director. It has been sent to us for the signatures from our side.

We are attaching a copy of the original MoU and the recent proposal by the MoU Committee. We request you for an appointment so that the matter can be discussed with you, the formalities can be completed and the objectives of the proposal can be carried out appropriately.

Thanking you

Sincerely yours

  
31/7/07

Soumitro Banerjee

Dept. of Electrical Engineering and Centre for Theoretical Studies  
Member, IUCAA IIT Kharagpur MoU Committee

**Astronomy-Astrophysics Initiative**

*under*

**IUCAA-IIT Kharagpur MoU**

Tentative Programme: August 1, 2007 to July 31, 2008

Dates	Programme	Organisers (O) Lecturers (L)	Funding
October end 2007	Lectures: Astronomical techniques	A. N. Ramaprakash (L)	TA (IUCAA)
November beg. 2007	Data Analysis	and A. K. Kembhavi (L)	LH (IITKgp)
Jan. end 2008	Workshop: Physics of	Sayan Kar (O)	IUCAA
Feb. 1st wk. 2008 (3 days)	warped extra dimensions	S. Bharadwaj (O)	DST,CSIR etc.
		N. Dadhich (O)	
March 2008 (4-5 days)	Topical lectures	T. Padmanabhan (L)	TA (IUCAA)
			LH (IITKgp)
March 2008 (1 day)	Workshop: Telescope making	A. Paranjpye (L,O)	TA (IUCAA)
		S. Banerjee (O)	LH (IITKgp)

Tentative Programme: August 1, 2008 to July 31, 2009

Dates	Programme	Organisers (O) Lecturers (L)	Funding
Oct. Nov 2008 (2-3 days)	Lectures: Astronomical techniques and Data Analysis	To be decided	IUCAA (TA) IITKgp (LH)
March 2009 (3 days)	Discussion meeting on Horizon entropy	Topic suggested by T. Padmanabhan	IUCAA, CSIR, DST etc.

Tentative Programme: August 1, 2009 to July 31, 2010

Dates	Programme	Organisers (O) Lecturers (L)	Funding
December 2009 (2 weeks)	IITKgp-IUCAA School on A & A	S. Bharadwaj (O), S. Kar (O) T. Souradeep (O)	IUCAA, DST, CSIR
Feb. 2010 (4 days)	Workshop: Cosmology: observations confront theories	S. Bharadwaj (O) S. Kar (O), T. Souradeep (O)	IUCAA, DST,CSIR

In addition to the above the following activities will be carried out.

- (a) Visits by IUCAA associates to CTS, IITKgp.
- (b) Exchange visits by faculty, postdocs and students from both institutions.
- (c) Joint MSc projects by final year MSc students at IITKgp
- (d) Topical courses by IITKgp faculty at IUCAA depending on requirement and interest.
- (e) A DST project (PI from both institutions) with a telescope as an equipment.

In addition there will be a request for the usual JRF/SRF/RA/JPO positions.

- (f) Summer training (to be of 2 credits and compulsory in the MSc (Intg.) programme at IITKgp from last year, will be effective for the batch entering 4th yr in 2009-2010) for students at IITKgp on concrete projects at IUCAA. This will be in addition to the regular VSP.

Signatories

Dr. Tarun Souradeep, IUCAA  
MoU Committee Member

Dr. S. Banerjee, IITKgp  
MoU Committee Member

Dr. A. N. Ramaprakash, IUCAA  
MoU Committee Member

Dr. S. Konar, IITKgp  
MoU Committee Member

Prof. Naresh Dadhich, Director, IUCAA, Pune

Prof. Damodar Acharya, Director, IIT Kharagpur

Centre for Theoretical Studies

To

Professor S. K. Dube  
Director,  
IITKgp

*Received by Prof. Dube*  
November 28, 2002

Through : Professor S. Sahu Dean, PG Studies, IITKgp

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Thanking you

With regards

Yours sincerely

The following names are proposed.

Any two may be recommended.

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*R. G.*  
R. G.  
DB. of