ICTS | International Centre for Theoretical Sciences

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

Solving Problems of this Century through Big Data and Computing - A New Data and Computational Science Initiative at ICTS-TIFR

ICTS envisages growing an institute along the lines of the Flatiron Institute (of the Simons Foundation) to address multiple fundamental questions through the computational lens.

The seed for this ambitious goal will be a special **ICTS Data and Computational Science** Initiative which will build on the intellectual and physical infrastructure already in place. This will be a chance for India to take a leadership role playing to its strengths in the mathematical and physical sciences, at the same time making a deep impact on society.

1 ADDRESSING KEY PROBLEMS THROUGH COMPUTATION

High performance computing, big data, and artificial intelligence playing a transformative role in understanding fundamental questions across disciplines. We share two examples where ICTS scientists can have an outsized impact.

The Indian Monsoon and Climate Studies: A Novel Approach

- The standard climate models do not work for India
- ICTS has initiated a multidisciplinary research program to:
  - Decipher the mechanisms responsible for the monsoon;
  - Build much better models using ML techniques
- Build large-scale high-performance computing (HPC) models to:
  - Predict how cloud turbulence impacts green-house energy budgets;
  - Model coupling of the Indian ocean and atmospheric systems

Black Holes and Extreme Gravity: A New Window into the Universe

- One of of the biggest sources of data is going to be from astronomy.
- ICTS has played a major role in the epochal discovery of Gravitational Waves (GW).
- Current and future GW observations require sophisticated computational techniques involving:
  - Big-data analytics (including ML) and high-throughput computing
  - Modeling of astrophysical phenomena through large-scale simulations solving Einstein's equations

2 WHAT WILL THIS INITIATIVE SUPPORT?

Upgradation of Computing Clusters

- An ***upgrade*** of the available dedicated computing clusters with more CPUs and GPUs, and the associated ***human resources*** to manage it.

Special International Workshops and Collaborations

- ***Focused programs & workshops*** on topics at the intersection of computer science with physics and mathematics. These will be fostered by in-house researchers and the Visiting Chair Professors in key thrust areas.
- ***Collaborative exchanges*** with a focus on emerging algorithms, computer technologies, hardware, with the close involvement of industry.

Visiting Chair Professorships

- Host some of the ***world's top experts*** in computer and data science to interface with our researchers and engage in problems ranging from extreme astrophysics to oceanography, the Indian monsoon and climate change, quantitative biology and quantum matter

Internships and Graduate Program

- An ***active internship program*** in collaboration with industry for two-way know-how transfer.
- A ***graduate training program*** for graduate students across India to train them in data and computer science

3 REQUEST FOR SUPPORT

The current computing facility at ICTS includes four HPC clusters with a total of ~6000 CPU cores. The research problems that we plan to address in the next ten years will require additional computing resources of **~16000** modern CPU cores and **~200** general-purpose GPUs. For flexibility, a fraction of the CPUs and a good portion of the GPUs will be on the cloud.

	Research Program			
	Monsoon and Climate Studies	Black Holes & Extreme Gravity	Complex Systems	Total Equipment
CPU cores (GPUs)	7200 (80 GPUs)	4800 (60 GPUs)	4000 (60 GPUs)	**16000**
Physical memory	24 TB	20 TB	16 TB	**60 TB**
Storage	1800 TB	1200 TB	1000 TB	**4000 TB**
Expected Cost	1.8 million USD	1.2 million USD	1.0 million USD	**4 M USD**
Operating costs (10 yrs)*				**1 M USD**
Total				**5M USD**

Budgetary requirements over 10 years = ***5M USD***

First-year target - ***2M USD***
Second-year target - ***2M USD***
Third-year target - ***1M USD***

*Operating cost breakdown (100,000 USD per year)
50,000 USD: Visiting Chair Professorships
10,000 USD: Internships
15,000 USD: Workshops
25,000 USD: Human Resources

4 DONOR RECOGNITION AND NAMING OPPORTUNITIES

As a donor, you will become a 'Friend of ICTS' and will receive our newsletters, invitations to our events, campus visits and interactions with our extended research community which includes eminent scientists and laureates from across the world.

1) Support the ***entire initiative*** with a contribution of ***USD 5 million.***
(Such support will include naming rights for a period of 10 years. The donor will be part of a special advisory committee that will meet twice a year to provide inputs and review progress.)

2) Fund the ***Monsoon and Climate Studies Program*** with a contribution of ***USD 2 million.***

3) Fund the ***Black Holes and Extreme Gravity Program*** with a contribution of ***USD 1.5 million.***

4) Fund the ***Complex Systems Program*** with a contribution of ***USD 1 million.***
(Supporting each of the above three program initiatives includes naming rights for 10 years and half yearly meetings with the head of the program)

5) Support ***Named Visiting Chair Professorships*** with a contribution of ***USD 500,000.***

6) Fund ***Named Internship or Training programs*** with a contribution of ***USD 100,000.***

7) Fund the ***Rooftop Solar Power Plant*** to meet the energy requirements of the Computing Centre with a contribution of ***USD 100,000.***

8) Fund ***individual workshops*** with a contribution of ***USD 40,000.***

9) Support a ***Visiting Program*** for a year for ***USD 20,000.***

10) Support a ***Graduate Training Program*** for a year for ***USD 10,000.***

11) Support ***individual interns*** with a contribution of ***USD 5,000.***

- We welcome your valuable partnership in supporting this initiative and furthering our goals.
- Your contributions, small or large, will be appropriately acknowledged.
- Anyone giving USD 1K or above will be acknowledged with a plaque at our computing centre.

Your gift is eligible for tax benefits in India and the US.

Call to Action

Join us in building a high-quality data and computational science initiative that will serve India for several decades to come. Such foundational support will go a long way in creating an ecosystem of high-quality research and thought leadership for the country.

We look forward to discussing how we may engage your support in this exciting initiative.

Contact Us

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