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From jets to cosmos to cosmic censorship

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1. Introduction

At the outset, I should like to acknowledge that part of the title above, which tries to capture the main flavour of this meeting, and has been borrowed from one of the plenary talks at the conference. When we set out to make the programme for the conference, we thought of beginning with observations on the Universe, but then we certainly wanted to go further and address deeper questions, which were at the very foundations of our inquiry, and understanding on the nature and structure of the Universe. I believe, we succeeded to a good extent, and it is all here for you in the form of these Conference Proceedings, which have been aptly titled as `Vishwa Mimansa', which could be possibly translated as 'Analysis of the Universe'!

It is my great pleasure and privilege to welcome you all to the ICGC-2011 meeting at Goa. The International Conference on Gravitation and Cosmology (ICGC) series of meetings are being organized by the Indian Association for General Relativity and Gravitation (IAGRG), and the first such meeting was planned and conducted in Goa in 1987, with subsequent meetings taking place at a duration of about four years at various locations in India. So, it was thought appropriate to return to Goa to celebrate the 25 years of the ICGC meetings. The recollections from that first meeting have been recorded elsewhere here in these Proceedings.

The research and teaching on gravitation and cosmology was initiated quite early in India, by V V Narlikar at the Banares Hindu University, and by N R Sen in Kolkata in the 1930s. In course of time, this activity grew and gained momentum, and in early 1969, at the felicitation held for the 60 years of V V Narlikar at a conference in Ahmedabad, P C Vaidya proposed the formation of the IAGRG society, with V V Narlikar being the first President. This was how IAGRG was born, and currently the association has about 350 members, both from within India and abroad.

2. The IAGRG

The main goal and activities of the IAGRG have been to connect the Indian researchers in the field of gravitation and cosmology to the latest developments in this area of knowledge, and to the latest international research streams and avenues [1]. Towards this aim, the organization holds the national IAGRG meetings once in about every two years at various locations in India, and also it organizes the international level ICGC meetings taking place every four years, which have been apparently quite popular and useful. Furthermore, specialized meetings, workshops and schools are organized when possible, and when certain interesting developments in the field warrant the same.

An important activity of the IAGRG has been the organization of the Vaidya-Raychaudhuri lectures [2]. This lecture series was established by the association to celebrate and honour the seminal scientific contributions that P C Vaidya and A K Raychaudhuri have made in the fields of gravitation and cosmology, in the form of what are well-known today as the Vaidya metric, and the Raychaudhuri equation. These lectures have been generally held at the time of the biannual national conferences of IAGRG until recently. However, with the pace of rapid developments in the field, and with the need to reach out to a larger student body and the university faculty, these are now being held annually, once at the time of conference, and the next at a suitable college or university, where a wide body of students, faculty and general public also may be able to participate.

All these activities are supposed to enhance and add quality to the research as well as teaching of gravity and cosmology within the country, while aiming at an increasing international participation.

3. The gravity research scenario in India

It may be relevant here to summarize the current scene on gravitation and cosmology research in India, and the main interests and focus areas at the research frontier that various groups are pursuing. During the earlier decades, the Indian relativists had pursued mainly exact solutions to Einstein's equations, and certain related applications, and the scenario has changed quite considerably in past two or three decades, with many new directions emerging in both theoretical and observational or experimental activities. I mention below some of these activities briefly: My aim here is, of course, to be indicative and not to be exhaustive on all that is happening, and the idea being just to provide a few indications on main streams of research.

Cosmology has been a field pursued in India from early decades of the twentieth century, at both mathematical and theoretical levels. As is well-known, the Raychaudhuri equation in cosmology, found and published in 1955, has played an important role in the theoretical developments in the field, leading us to a much deeper understanding on the structure of spacetime, and especially on the occurrence of spacetime singularities in both gravitational collapse of massive stars and cosmology within the framework of the general theory of relativity. Over the years, the Indian researchers reported many useful solutions to the Einstein's equations, which have been useful in relativistic astrophysics as well as cosmology. More recently, with the observations getting much more precise and accurate, there is a considerable interest developed in India in various research groups to examine various topics in physical cosmology, such as the cosmic microwave background research, structure formation in the universe and related simulations, theoretical connections to the Planck and other missions and related issues. At the mathematical and theoretical levels, there have been progress on the causal and topological structures of the universe, and understanding the structure of spacetime singularities in cosmology.

Another major area that has drawn attention in India is the gravitational waves research. This has been connected with the data analysis aspects and techniques mainly, and the related developments, but also there has been much attention in recent years to get actively involved in the gravity waves detection efforts happening at the international level. Such a possibility should provide an active thrust to both theoretical as well as observational and experimental activities in gravity physics related areas in India.

Relativistic astrophysics and theoretical gravitation are other important areas, where much activity has taken place in India in recent decades. In particular, the issue of final fate of a massive star collapsing continually on exhausting its internal nuclear fuel at the end of its life cycle, and the related issue of the cosmic censorship hypothesis have been investigated extensively. These are problems fundamental to the theoretical developments in black hole physics and also its modern astrophysical applications today. The new results obtained over a past couple of decades show that under physically reasonable conditions, both black holes and visible singularities result as collapse end states, the later being super-ultra dense regions in the universe, where important quantum gravity effects may be taking place.

The other major areas being pursued include quantum gravity research. In this case, there is no unique pathway available as yet, and various approaches including the string theory, loop quantum gravity, and other approaches are being pursued.

While exciting new results have been obtained in certain areas of research mentioned above, in some other arenas a beginning is being made. I think, the key point here would be to emphasize that all these fields of research, even if they may look disconnected at times, are deeply inter-connected at another level. It is clear that a much deeper understanding of gravity and the spacetime physics is necessary to make any sustainable and path breaking progress in any of these. The tendencies seen at times to see and consider various fields in a very isolated manner have to be avoided, and that is where broad based meetings such as ICGC could be of great help.

4. Universities versus research institutions

If the research is to prosper and progress well, an important issue that has to be addressed within the Indian context is the dichotomy observed between the so called 'Institutes', where focus is

essentially on research only, and the 'Universities', where both teaching and research are supposed to take place simultaneously. In the past decades, especially after the independence, most of the research resources and probably talent also have focused in the Institutes mainly, whereas the Universities have been neglected to a great extent.

An effort is being made now to recover the balance and that needs to be intensified. One possible way out of this dilemma would be to directly encourage the individuals, in terms of funds as well as facilities, who have shown already certain research strengths in terms of good research results and publications, which are or have been taken note of. If such persons are offered a reward or help in terms of research grants directly, with a minimum of bureaucracy involved, that could be a help, and would encourage more such cases, building up a good research pool in due course of time. It will be the most beneficial, of course, if all new research institutes of future will be located within one or the other University campuses. Such a geographical vicinity will provide a great opportunity to bright young students to possibly interact and learn directly with active researchers in various fields.

5. Our future vision and goals

Emerging from the strength of a strong tradition as well as background, the Indian researcher in gravitation and cosmology today will clearly like to make the best of the international opportunities available presently. Within the Indian context, talent has not been a problem any time. The key issue has been nurturing and projecting the same, so that the talent develops and flourishes to make an international impact. With very many organizations and agencies in India working today towards this goal, it is all the more possible that such a vision would become a reality.

A key concern voiced many times is that the science endeavour today has become too much of a big project driven phenomenon. That young individual researcher with bright new ideas finds much less help and support unless they are part of a big project science team. Do we really need big science and management, or is science actually about key intellectual breakthroughs on our understanding of the Universe?

Perhaps both are needed in the prevailing environment today, and I personally think that while big science is frequently and certainly needed for major international projects to come through, not necessarily all have to fall in a project mode.

It is an arduous task, however, to chart out a trajectory and path, which balances the requirements of both the big science as well as individual creativity. That is where probably the real advantage of a community such as the one gathered here lies. The true benefit of such an association in my view would be, we try together so that the stream of scientific creativity continues, develops, and is always nourished.

I am sure the wonderful academic menu just ahead of us will no doubt help us achieve these targets and clarify our vision and the goals ahead. I am very happy to initiate the ICGC-2011, a very special meeting that celebrates completing twenty five years of the ICGC series.

I would like to take this opportunity to warmly thank the colleagues, who have put in a great effort to make this meeting a success. In particular, my warm thanks go to the Scientific Organizing Committee and the Local Organizing Committee. Without their hard work and keen efforts, the meeting in this format would not have been possible. Our special thanks go to the International Center for Theoretical Sciences (ICTS) of TIFR for their keen interest in this meeting, and for the great encouragement and support they have given us through out, without which this meeting would not have been possible.

References

[1] For further details on IAGRG and its activities, please see, http://www.imsc.res.in/~iagrg/
[2] For a complete list of the Vaidya-Raychaudhuri lectures given so far, please see the above website .