

The Max Planck Institute for Gravitational Physics

and

the Indian Institute of Science Education and Research (IISER) Pune

hereby conclude the following

**Contract to Establish a Max Planck Partner Group
of the MPI for Gravitational Physics called the
Partner Group in Quantum Field Theory**
(hereafter referred to as the Partner Group)

The Max Planck Institute for Gravitational Physics and the Indian Institute of Science Education and Research (IISER) Pune agree to set up a *Partner Group* for a fixed term at the Indian Institute of Science Education and Research (IISER) Pune.

The *Partner Group* is intended to strengthen the project-oriented cooperation between the Indian Institute of Science Education and Research (IISER) Pune and the MPI for Gravitational Physics.

This *Partner Group* is co-funded by the Indian Department of Science & Technology (DST). To this extent DST will conclude a separate agreement with the Indian partner institution. Any agreement concluded between DST and the Indian partner institution will relate only to the funding or matching provided by DST and in no way affects the rules and regulations under this agreement concluded with the Max Planck Institute.

**Section 1
Scientific Objectives**

(1) *Brief description of the scientific program*

Three of the four fundamental forces in nature (electromagnetic, weak and strong) are described by quantum Yang-Mills theories. Their collective description is the remarkably accurate Standard Model of Particle Physics. However, we still lack a consistent quantum mechanical description of the fourth force, gravity.

The issue here stems from the apparent incompatibility between quantum mechanics and the general theory of relativity. The Max Planck Partner Group in “Quantum Field Theory” focuses on research themes that relate to our understanding of this issue. Specific themes include:

Perturbative relations between gravity and Yang-Mills theory

There are striking differences between the Lagrangians governing gravity and Yang-Mills theory. It is therefore rather surprising that there exist close perturbative ties between the two theories. In particular, tree-level scattering amplitudes in gravity are the “square” of the corresponding scattering amplitudes in Yang-Mills theory. A precise understanding of this relationship, at the level of the respective Lagrangians, is likely to offer new insights into the structure of gravity theories.

Finiteness and scale-invariance in quantum field theories

Quantum field theories are often plagued by infinities that require renormalization. This makes field theories that are completely free of ultra-violet divergences particularly rare and interesting. In this context, it is important to develop and refine techniques that allow us to identify ultra-violet finite four-dimensional quantum field theories.

Ultra-violet properties of $\mathcal{N}=8$ Supergravity

There is mounting evidence that $\mathcal{N}=8$ Supergravity is far better behaved in the ultra-violet than previously believed. Although the theory appears to possess too much symmetry to be relevant to the real world, it could prove to be the first example of a finite (four-dimensional) quantum theory of gravity. It will be very interesting to see what a systematic study of the divergent nature of $\mathcal{N}=8$ Supergravity reveals.

(2) The parties to the agreement agree to adhere to the scientific program, but note that it has to remain adaptable with regard to general future developments. If changes arise, the parties to the agreement will reach a consensus and record the changes in writing.

Section 2 Duration and Leadership

The Partner Group shall be set up for three years with the possibility of a two-year extension.

Dr. Sudarshan Ananth is the head of the *Partner Group*.

Section 3 Evaluation and Extension

The Max Planck Institute for Gravitational Physics and the Indian Institute of Science Education and Research (IISER) Pune will set up an advisory board for the *Partner Group* consisting of three investigators, one from Germany, one from India and one from a third country. A fourth member, from a third country, may be nominated to the advisory board if the *Partner Group* and the Max Planck Institute so agree. After two years the board will review the *Partner Group*, if possible on site, and put together a written report on the research work of the *Partner Group* and on the proposed and actual use of funds. The board will make a recommendation on the possible extension of the *Partner Group* by two years (years four and five). Any extension beyond five years is not possible.

The advisory board report is to be submitted to the President of the Max Planck Society and to the Department of Science & Technology, DST. A copy of the report is provided to the Director of the Indian Institute of Science Education and Research (IISER) Pune. After five years the advisory board will submit a concluding report. If it is favorable, the advisory board will elaborate on future possibilities open to the *Partner Group*.

The travel and accommodation expenses incurred by the advisory board members for their work on the advisory board will be shared by both institutions involved.

Section 4 Funding

Funding mentioned under Section 4 of this contract or in any of the other sections of this contract refers only to the funding provided by the MPI. The *Partner Group* is co-funded by the Department of Science & Technology (DST). DST will provide matching funding for the activities of the *Partner Group* as per project approval according to standard DST rules and regulations under a separate agreement. Any agreement concluded between DST and the Indian partner institution will relate only to the matching funding provided by DST and in no way affects the rules and regulations covered by this agreement.

(1) For building up the *Partner Group*, performing work on the project and in return for access to and use of the scientific potential, including the scientific technical facilities of the Indian Institute of Science Education and Research (IISER) Pune, the *Partner Group* will receive €20,000 per annum from the MPI in funding. The funding is to be used to cover:

- a) Personnel and travel costs
- b) Material costs and running lab costs
- c) The purchase of minor scientific equipment for the *Partner Group's* work.

The budget of the *Partner Group* may not be used towards salary increments.

The head of the *Partner Group* can dispose of the available funds as required and within the above-mentioned scope.

(2) The salaries for the *Partner Group* leader and the academic and non-academic staff will be guaranteed by the Indian Institute of Science Education and Research (IISER) Pune and be commensurate with qualification and seniority.

The Indian Institute of Science Education and Research (IISER) Pune is responsible for the social insurance for the *Partner Group* leader and other staff and for providing further assistance.

(3) The contribution of the Max Planck Institute is made available in annual installments at the start of the year upon request of the *Partner Group* leader in accordance with the conditions set forth in the *Contract*.

(4) Financial accounts for the funding provided by the MPI will be provided to the MPI on an annual basis. Copies of such accounts will be provided to DST upon request.

(5) All funds that are made available under this contract will be used in full for the *Partner Group* in accordance with this contract. In particular, the Indian Institute of Science Education and Research (IISER) Pune will not charge any overhead costs.

(6) In cases where the portion of the budget of the *Partner Group* allocated towards mobility exceeds 25% p.a., prior approval from MPI is required.

(7) Mobility expenses (travel, accommodation, per diem) shall be directed at junior scientists. International air travel funded through the *Partner Group* is to be undertaken by economy class.

Section 5 Equipment

The items acquired with the financial contribution of the MPI are the property of the Indian Institute of Science Education and Research (IISER) Pune. The MPI reserves the right to request that the value be adjusted for the durable equipment or that it be returned free of charge if the cooperation is terminated early, the *Partner Group* is dissolved and/or terminated in another manner, or if the equipment is not used for the research of the *Partner Group*.

Section 6 Scientific and Administrative Management

Dr. Sudarshan Ananth will carry out his work independently within the scope of the research task at hand and is not subject to any restrictions as to the selection, sequence and execution of scientific activities.

Dr. Sudarshan Ananth is entitled to appoint and dismiss academic and non-academic staff according to the country's regulations and to act within the framework of the approved funding.

Dr. Sudarshan Ananth shall be informed by the management of the Indian Institute of Science Education and Research (IISER) Pune about applications and intentions of the Indian Institute of Science Education and Research (IISER) Pune insofar as this has bearing on finances, planning or the status of the institution.

Section 7

Seat, Legal Status and Financial Year

The seat of the *Partner Group* is at the Indian Institute of Science Education and Research (IISER) Pune.

The *Partner Group* is not a legal entity. The financial year is the calendar year.

Section 8

Accommodation and Infrastructure

The Indian Institute of Science Education and Research (IISER) Pune agrees to provide the rooms and the infrastructure for the *Partner Group* as well as administrative services. Within the scope of this cooperation agreement, the Indian Institute of Science Education and Research (IISER) Pune agrees to grant the investigators in the *Partner Group* cost-free use of the scientific and technical facilities and infrastructure at the Indian Institute of Science Education and Research (IISER) Pune.

Section 9

Confidentiality

(1) The parties to the agreement undertake to preserve the confidentiality of all scientific technical information communicated to them even after the end of the contract, which the other party to the agreement identifies as confidential, and to preserve the confidentiality of business and company secrets unless the confidentiality restriction has been waived in writing.

(2) Confidential records, documentation, and data media made available are to be handled with care. They are to be kept in a manner appropriate to their confidential nature until returned and used only for the purpose for which they are communicated.

(3) The parties to the agreement undertake to require staff members involved in the project to agree to confidentiality restrictions provided this is not already handled in a general clause in the employment contract.

Section 10 Publications

(1) Publishing results stemming from the cooperation carried out in accordance with this agreement will be done jointly and reference shall be made to both the Max Planck Institute and the *Partner Group*.

(2) If one party to the agreement intends to publish alone, prior authorization from the other party to the agreement is required. Authorization may only be declined for pertinent reasons and is considered granted if it is not refused in writing within three weeks after the submission of the draft publication.

(3) When publishing results stemming from project information, data, or software, the name of the party to the agreement who developed the results is always to appear in the publications.

Section 11 Protective Rights, Rights of Use

(1) Should patentable inventions be generated from the agreed scientific project, and the inventors are exclusively employed by one of the parties to the agreement, that party to the agreement is entitled to the inventions. In the case of joint inventions both parties to the agreement are equally entitled to the inventions. The share in the invention will be determined according to the significance of the contribution to the joint invention. No party to the agreement is entitled to dispose of its share in the joint invention without prior authorization of the other party to the agreement. The parties to the agreement are obliged to register the inventions at their own cost or to assume their share of the costs in joint inventions. The parties to the agreement agree to inform each other of their own and joint patent applications and to offer their shares to the other party to the agreement first if they intend to relinquish shares.

(2) When selling, licensing, and exploiting know-how, work results, findings, technical suggestions for improvement, and inventions resulting from the scientific project and to which one party of the agreement is entitled, the respective statutory and legal regulations for each party to the agreement are applicable. If both parties to the agreement are entitled to shares, they agree to make arrangements according to respective statutory and legal regulations. Before selling and/or licensing patent rights, each party to the agreement agrees to ensure that any existing rights the parties to the agreement may have are not infringed upon.

For inventions stemming from the MPI, Max Planck Innovation GmbH, as a commission agent, is only entitled to conclude sales, licensing and similar exploitation contracts (know-how and software development, etc.) and is party to the agreement.

(3) The parties to the agreement agree to make use of inventions, shares in inventions, or qualified suggestions for improvement in accordance with legal stipulations on

employee inventions resulting from the scientific project and according to respective statutory and legal regulations.

(4) For the purpose of research and teaching, the parties to the agreement grant each other non-exclusive, non-transferable, and cost-free rights of use to existing and resulting findings, know-how, patent rights, and patent registrations that are required for performing the scientific project. When it comes to existing and new research results and publications, which are copyrighted according to German law or the law of other countries, to which the parties to the agreement as employers have cost-free access, the parties to the agreement undertake to grant each other non-exclusive, non-transferable and cost-free rights of use for the purpose of research and teaching.

Section 12 Duration, Termination

(1) The contract is concluded for three years and commences on March 15, 2009 and ends on March 15, 2012. An extension of this contract for two years based on the recommendation of the advisory board will be enacted by letter from the Max Planck Society.

(2) The parties to the agreement can terminate the agreement in writing with no prior notice for substantial reasons particularly if situations arise that make a continuation of the agreement unreasonable. In this case both parties have to come to a mutual agreement on the outstanding liabilities.

Section 13 Differences

(1) Should differences arise in interpreting or fulfilling this agreement, the institutions involved are obliged to attempt to settle the differences mutually outside of court.

(2) If the Partner Institutions fail to settle the differences, the Indian Institute of Science Education and Research (IISER) Pune and the MPS are obliged to hand over the matter to an arbitration board. The Indian Institute of Science Education and Research (IISER) Pune and the MPS each name one member to this board. These two designated members then name a third arbitrator to function as chairperson who is not from India or Germany. The arbitration board sets the regulations for the proceedings and makes decisions in accordance with international codes of practice.

Section 14 Changes and Amendments

Changed and alterations to this agreement are to be marked as such and require the written form.

Section 15
Other

(1) All rights and duties stemming from this agreement with respect to confidentiality, publications, and registering and claiming inventions, findings, know-how, technical suggestions for improvement that are generated throughout the life of the agreement while working on the research program are valid up to five years after the end of the agreement.

(2) Should one provision of this agreement become ineffective or unworkable, it will not affect the validity of the agreement as a whole. A supplementary provision to replace the ineffective one is to be agreed upon that comes as close as possible to the ineffective provision as far as this is legally possible.

The partners should draw up individual regulations to cover specific issues of their scientific work in the *Partner Group*.

Signed at Potsdam on
4 March, 2009

H. Nicolai

Director,
Max Planck Institute for
Gravitational Physics
Potsdam, Germany

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Signed at Pune on
Feb. 25, 2009

K. N. Ganesh

Director,
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