

AGREEMENT TO AMEND AND EXTEND THE JOINT RESEARCH AGREEMENT
RELATED TO SINGLE ELECTRON TUNNELING DEVICES
BETWEEN
THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY,
DEPARTMENT OF COMMERCE,
UNITED STATES OF AMERICA
AND
THE NIPPON TELEGRAPH AND TELEPHONE CORPORATION,
JAPAN

The National Institute of Standards and Technology, Department of Commerce, United States of America, and the Nippon Telegraph and Telephone (hereinafter referred to as the "Parties"),

In view of the continuing need for the Joint Research Agreement (Appendix 1),

Have agreed as follows:

1. The Joint Research Agreement shall not be "Joint Research" for the purposes of any other agreements between the Government of the United States and the Government of Japan,
2. The Project Manager in NTT Basic Research Laboratories designated in Article 7.2 of the existing Joint Research Agreement shall be changed from Dr. Hiroshi Inokawa as noted in the last amendment to Dr. Akira Fujiwara,
3. The existing Joint Research Agreement may be modified or extended further by written agreement of the Parties.

This Agreement shall enter into force on the day of the last signature and shall remain in effect for five years upon agreement by the Parties.

Signed in Washington this 26th day of
November, 2007.

For the National Institute of Standards
and Technology, Department of
Commerce, United States of America

Katharine B. Gebbie

Katharine Gebbie
Director, Physics Laboratory
NIST

Signed in Tokyo this 30th day of
November, 2007.

For Nippon Telegraph and Telephone
Corporation of Japan

Junji Yumoto

Junji Yumoto, Director, Basic Research
Laboratories, NTT

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JOINT RESEARCH AGREEMENT RELATED TO SINGLE ELECTRON TUNNELING DEVICES

This Agreement is made and entered into this 20th day of November 2003 by and between NIPPON TELEGRAPH AND TELEPHONE CORPORATION, a corporation duly established under the Laws of Japan (hereinafter called "NTT") and National Institute of Standards and Technology, a corporation duly established under the Laws of United States of America (hereinafter called "NIST").

WHEREAS, NTT and NIST have entered into an AGREEMENT FOR COOPERATION BETWEEN NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY AND NIPPON TELEGRAPH AND TELEPHONE CORPORATION dated as of June 10, 1994 and an AGREEMENT TO AMEND AND EXTEND THE AGREEMENT FOR COOPERATION BETWEEN THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY DEPARTMENT OF COMMERCE UNITED STATES OF AMERICA AND NIPPON TELEGRAPH AND TELEPHONE CORPORATION JAPAN dated as of July 16, 1999 (collectively "AGREEMENT FOR COOPERATION").

WHEREAS, NTT and NIST respectively have been engaged in the research of certain products and/or services and are desirous of conducting the joint research of single electron tunneling devices so that single electron tunneling devices will be efficiently developed.

WHEREAS, the purpose of the Joint Research is to carry out the research of single electron tunneling devices. Toward the purpose of the Joint Research, NTT and NIST intend to conduct mutual exchange of information and discussion and communication by holding meetings from time to time, thereby the research of single electron tunneling devices will be effectively carried out.

WHEREAS, NTT agrees to give authority to use results of research and development activity, including that from this Joint Research activities, to the subsidiary operation company designated in Attachment 1.

Now THEREFORE, NTT and NIST hereby agree based on AGREEMENT

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FOR COOPERATION with respect to smooth furtherance of the Joint Research activities, treatment of information related to the Joint Research and use of the results of the Joint Research as follows:

Article 1 Definition

In this Agreement, the following terms shall have the meanings hereby respectively assigned to them except where the context otherwise requires:

- (1) "Joint Research " shall mean the research and development activities jointly carried out hereunder by NTT and NIST.
- (2) "Project Manager" shall mean the person appointed by each of the parties hereto as set forth in Article 7 hereof.
- (3) "In connection with the Joint Research " shall mean "regarding any and all matters which are reduced in writing in the exchange of technical information, discussion and communication between the parties and the matters falling under the subject matter of the discussion or debate and thereafter confirmed in the minutes."
- (4) "SET" shall mean single-electron tunneling.
- (5) "Operation Company" shall mean the subsidiary operation company designated in Attachment 1.
- (6) "Parties Concerned" shall mean concerned parties hereto and concerned Operation Company or Companies.

Article 2 Purpose and Scope of the Joint Research

2.1 The purpose of the Joint Research is to carry out the research of single electron tunneling devices by the cooperation of NTT and NIST.

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2.2 The scope of the Joint Research shall be the research of single electron tunneling devices and researches necessary for such research. Research items and tasks to be assigned to each of the parties are agreed as Attachment 2.

2.3 In case where it is necessary to modify the research items and tasks mentioned in Attachment 2 for unavoidable reasons, the parties may modify such matters by executing a memorandum of agreement setting forth the modification of the research items and tasks and/or this Agreement upon mutual agreement between the parties hereto.

Article 3 Results of the Joint Research and Publication thereof

3.1 Any information generated from the Joint Research which is useful for resolution of certain research problems covered by the scope of the Joint Research described in Article 2.2 shall be considered as the results of the Joint Research and said results shall be mutually disclosed in writing and confirmed by the parties hereto. NTT and NIST shall consult each other as to which information should be treated as confidential, subject to the relevant statutory and regulatory constraints, and as to which information should be published.

3.2 From time to time during the term of the Joint Research, either party may officially publish information developed by such party regarding the results of the Joint research and the matters regarding this Agreement. A party may also publish information developed by the another party of this Agreement upon mutual agreement between the parties hereto.

Article 4 Non-disclosure of Confidential Information

4.1 (Information solely owned by a party) Any information deemed by a party hereto to be confidential and disclosed hereunder in writing to the other party shall be appropriately labeled as "NTT Confidential" or "NIST Confidential", as the case may be. Any confidential information disclosed hereunder orally or visually shall be confirmed by reducing the same, without omission, to written form, by the party disclosing the same within thirty (30) days from the date of the disclosure. Such written information

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shall be appropriately labeled as "NTT Confidential" or "NIST Confidential", as the case may be. Any doubts as to whether the disclosed information qualifies as being confidential shall be determined by consultation in good faith between the parties hereto.

4.2 (Information jointly owned by the parties) Any new technology jointly acquired during the course of the Joint Research by NTT and NIST shall, upon jointly confirming by NTT and NIST that such information is novel and should be kept in confidence, be labeled with an appropriate indication by, for example, affixing the word "Joint NTT/NIST Confidential" on the document wherein such information is described. Notwithstanding the foregoing, the parties understand and agree that information generated by NIST employees working under this Agreement may be subject to governmental disclosure laws and regulations.

4.3 (Confidentiality obligation) To the extent permitted by law, each of the parties hereto shall keep any confidential information solely owned by the other party as set forth in Article 4.1 and any confidential information jointly owned by the parties as set forth in Article 4.2 in confidence and shall not disclose, publish or leak the same to any party other than the recipient party for a period of 1 years from the date of the disclosure, unless otherwise agreed upon by the parties hereto. NTT may disseminate any confidential information received from NIST and NIST may disseminate any confidential information received from NTT, respectively in its own company exclusively on a need-to-know basis for the purpose of this Agreement and shall not disseminate to the persons other than those having "need-to-know".

4.4 It is hereby confirmed that the receipt of confidential information of the other party hereunder shall not entail an obligation of the recipient party to restrict or limit in any way whatsoever the appointment, relocation, transfer, retirement or other changes of the officers and employees within NTT or the officers and employees within NIST.

4.5 Each of the parties may make reasonable numbers of copies of the written materials or documents containing the confidential information or abstracts thereof described in Articles 4.1 and 4.2 but shall disseminate such material only on a "need to know" basis and use the same degree of care in safeguarding such material as it would for its own information of similar nature.

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4.6 Notwithstanding the other provisions contained herein, the obligations stipulated in any of the provisions above shall not apply to the following information:

- (1) Information already owned by the recipient party at the time of disclosure without confidentiality obligation to the disclosing party;
- (2) Information developed by the recipient party independently of the Joint Research without using the proprietary information disclosed by other party hereto;
- (3) Information which is in the public domain or which hereafter becomes part of the public domain through no fault of the party concerned ;
- (4) Information duly received by the recipient party from a third party; or
- (5) Information, disclosure of which to a third party is approved in advance by the disclosing party in writing.

4.7 Notwithstanding anything to the contrary in this Agreement, the recipient party may disclose confidential information if required by any judicial or governmental request, requirement or order; provided that the recipient party will immediately take reasonable steps to give the disclosing party prior written notice.

Article 5 Making Use of Confidential Information

5.1 The recipient party who was disclosed the confidential information by the disclosing party under Article 4.1 may freely make use of the disclosed information, including reports and documentary materials prepared by the recipient party and containing the disclosed information, and the idea, concept or technology contained in such disclosed information for its own business subject to the confidentiality obligation of Article 4.3. NIST agrees that Operation Company may freely make use of the disclosed information same as NTT, subject to confidential obligation imposed on Operation Company pursuant to Article 4.3. Provided, however, that in case where the disclosed information was independently developed from the Joint Research, and the disclosing party expressly states at the time of disclosure thereof that prior consent

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of the disclosing party is needed for making use of the same by the recipient party (hereinafter called the "Designated Confidential Information"), the parties hereto shall separately negotiate as to how the Designated Confidential Information is to be treated.

5.2 Any party hereto may freely make use of the jointly owned confidential information set forth in Article 4.2 for its own business. Both parties hereto agree that Operation Company may make use free of the jointly owned confidential information set forth in Article 4.2 for Operation Company's products and/or development of services, and for Operation Company's own business.

5.3 Each of the parties hereto may enter into an agreement with a third party for having that third party make the products for its own use, developed during the course of the Joint Research and may thereby disclose to that third party confidential information set forth in Articles 4.1 and 4.2, subject to Article 5.4. Each party hereto agrees that Operation Company may enter into an agreement with a third party for having that third party make the products for Operation Company's own use, during the course of the Joint Research and may thereby disclose to that third party confidential information set forth in Articles 4.1 and 4.2, subject to Article 5.4. In the event it appears difficult for that third party to enter into such a "have made" agreement without securing the right to use such confidential information for the benefit of that third party, then NTT, NIST and Operation Company shall consult in good faith to determine whether suitable licensing terms can be agreed upon that would permit the disclosure of such confidential information to that third party taking into consideration the respective proprietary interests in such information of both NTT and NIST, and the potential consequences to both NTT, NIST and Operation Company or disclosing such information to that third party, and on the basis of the principle that neither party hereto nor Operation Company will be unduly prevented from using or deriving the benefits of the results of the Joint Research. In the application of this Article 5.3 to the Designated Confidential Information as defined in Article 5.1 above, consultation between the parties shall be subject to the separate agreement pursuant to Article 5.1.

5.4 Any party, including Operation Company, hereto may disclose confidential information to a third party when such party have that third party make products by operation of the provision of Article 5.3 notwithstanding the confidentiality obligation

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provided in Article 4.3, subject to obtaining a written commitment by that third party stating that it shall observe the same confidentiality obligation as imposed on the party hereto concerned.

5.5 If a copyrighted work falls within the definition of "confidential information", the provision of Article 6, in addition to this provision of Article 5, shall apply to the use and license of such copyrighted work.

Article 6 Rights to Copyrighted Works Except for Computer Program

6.1 It may be necessary the parties to use copyrightable works created by the other party. Pursuant to Title 17 United States Code Section 105, works of NIST employees are not subject to copyright within the United States. NIST will not copyright works developed in whole or part by NIST employees working under this Agreement. NIST will make available to NTT and NTT's Operation Company, subject to any applicable laws and regulations, copyrightable works created by NIST employees, which NIST judges are necessary for NTT to complete work under this agreement. NTT will also make such NTT works available to NIST, subject to the terms of a separate agreement, if necessary.

Article 7 Project Manager

7.1 Each of the parties hereto shall appoint a Project Manager who shall be responsible for the coordination of the Joint Research of the party concerned.

7.2 The Project Managers for the respective parties and the addresses thereof shall be:

NTT: Basic Research Laboratories

Dr. Yasuo Takahashi

NIST: Electrical and Electronics Engineering Laboratory

Dr. Neil Zimmerman

7.3 Any notice, request or demand, which one party hereto is obliged or entitled to

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make to the other party hereunder, shall be made from the Project Manager of the party concerned to the Project Manager of the other party. Such notice, request or demand shall be made in writing and any such notice, request or demand made by telefax shall be deemed to be valid.

7.4 Either party hereto may, at any time during the term of this Agreement, change its appointed Project Manager by notifying the other party at the address previously designated.

Article 8 Term and Termination

This Agreement shall come into effect as of 20th of November, 2003 and shall continue in effect until 28th of October, 2004; provided, however, that either of the parties hereto may, upon giving advance explanation in good faith, terminate this Agreement by thirty (30) days' written notice addressed to the other party if the purpose of the Joint Research is deemed to have been achieved prior to the expiration of this Agreement or unavoidable circumstances preventing the parties from continuing the Joint Research should occur. Upon expiration or earlier termination of this Agreement (hereinafter called the "termination hereof"), all rights, privileges and obligations hereunder shall cease, except for the following provisions:

- (1) Provisions of Articles 3 hereof shall continue in effect for 1 years from the termination hereof.
- (2) Provisions of Articles 4 and 5 hereof shall continue in effect as long as the period set forth in the first sentence of Article 4 after the termination hereof.
- (3) Provisions of Article 6 and 9 shall continue in effect after the termination hereof.

Article 9 Settlement of Dispute

Any dispute under this Agreement will be settled by the parties in an amicable manner. If a dispute cannot be resolved in a manner acceptable to both parties, either party

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may terminate the agreement upon 30 days advanced Notice.

Article 10 Miscellaneous Provisions

10.1 No modification or extension of this Agreement shall be effective and binding unless made in writing and executed by the parties hereto.

10.2 Neither of parties hereto shall assign or transfer any right or obligation accrued herefrom.

10.3 Any party hereto shall not officially or unofficially publish this Agreement or the Joint Research without prior written consent of the other party.

10.4 Neither party will obligate funds under this Agreement. Each party is responsible for its own expenses.

10.5 This Agreement shall be governed by the laws of the United States.

IN WITNESS WHEREOF, this Agreement is prepared in duplicate and each party hereto shall affix its name and seal hereto and retain one copy hereof.

Dated: 6 of Aug, 2003

3-1, Ootemachi 2-Chome Chiyoda-Ku,
Tokyo, Japan

Gaithersburg, MD 20899

For NIPPON TELEGRAPH AND
TELEPHONE CORPORATION

For NATIONAL INSTITUTE OF
STANDARDS AND TECHNOLOGY

Name: 高柳 英明
Hideaki Takayanagi

Name: William E. Anderson
William E. Anderson

Title: Director,
Basic Research Laboratories

Title: Director,
Electrical and Electronics Engineering
Laboratory

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Attachment 1

List of Operation Company;

- 1) East Nippon Telegraph and Telephone corporation
- 2) West Nippon Telegraph and Telephone corporation
- 3) NTT Communications corporation
- 4) NTT Data corporation
- 5) NTT DoCoMo, Inc. and its subsidiaries

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Attachment 2

The scope and research items of the Joint Research

The charge offset is a long-standing problem in the SET field which prohibits integration/parallelization of SET devices:

NTT's Basic Research Laboratory has developed a type of SET transistor which has no long-term drift of the charge offset. These devices are made of SOI (silicon on insulator) material.

NIST has a particular interest in parallelizing SET pumps to provide a fundamental current standard with a large value of current, and a project led by Dr. Neil Zimmerman has been investigating the charge offset drift in metal-based devices.

NIST has a desire to perform the same types of short-term noise and long-term drift measurements on one of the NTT SET transistors, to confirm the lack of long-term drift, and to assess other aspects of the noise performance.

If this initial experiment succeeds, NIST and NTT researchers would continue the work by exploring: 1) which aspects of the NTT fabrication/materials system are important for the charge offset drift; 2) the possibility of fabricating multi-junction devices; 3) running a multi-junction device as a SET pump; 4) parallelizing a large number of pumps (perhaps one thousand) to increase the value of the current, 5) exploring other possible integration issues/possibilities which may arise as a result of successes in this research.