参考資料５

第１８回ＩＡＥＡ核融合エネルギー会議について

平成１２年１月２８日
科　学　技　術　庁
原子力局核融合開発室

１．概要

核融合エネルギー会議は、核融合研究に関する成果報告及び情報交換を行うことを目的として、ＩＡＥＡの主催により１９６１年から原則として２年毎に開催されている。第１８回の同会議については、平成１２年１０月４日～１０日にイタリアのソレントで開催される。

２．国内論文選考委員会について

(1)概要

標記会合において、核融合研究成果報告が行われることになっており、その対象論文の募集について、ＩＡＥＡから通知がきている（別添資料参照）。我が国として応募論文をとりまとめる必要があるが、毎回多数の国内応募がある（昨年は１０４編）ことから、今回もＩＡＥＡに送付する論文を適切なものとするため、核融合の専門家約１６名から構成される国内論文選考委員会を開催し、論文の選考を行うこととする。

また、あわせてＩＡＥＡで行う論文選考のための審査委員を、我が国から５～６名程度推薦する予定。

(2)今後のスケジュール

２月上旬より国内論文選考委員会を開始し、３月下旬までにはＩＡＥＡへ提出する論文を選考する予定。

（別添）

第１８回ＩＡＥＡ主催核融合エネルギー会議
18th IAEA Fusion Energy Conference

１．期　日：２０００年１０月４日～１０日

２．開催地：イタリア、ソレント

３．参加申し込み方法：

１）論文提出をして参加を希望される場合

(a)参加申込書(Form-A)及び論文提出申込書(Form-B)

提出部数　　両申込書共にオリジナル１部＋コピー１０部

締切期日　　２０００年２月３日（木）　消印有効

提出先　　科学技術庁原子力局核融合開発室

〒１００　東京都千代田区霞が関２－２－１

電話番号：０３－３５８１－５２７１（代）

(b)論文サマリー(英文で８００語以内)

提出部数　　英文オリジナル１部＋ピー２０部

和文(上記対訳したもの)オリジナル１部＋コピー10部

締切期日、提出先共に１）に同じ

２）論文提出をせずに参加のみを希望される場合

参加申込書(Form-A)のみを２０００年３月２４日（金）（消印有効）までに、上記の要領（提出部数、提出先）に従って提出する。

※参考：第１８回ＩＡＥＡ主催核融合エネルギー会議ホームページ

http://www.iaea2000.enea.it

الوكالة الدولية للطاقة الذرية
國 際 原 子 能 机 构
INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNACIONAL DE ENERGIA ATOMICA

WAGRAMER STRASSE 5, P.O. BOX 100, A-1400 VIENNA, AUSTRIA
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IN REPLY PLEASE REFER TO
PRIERE DE RAPPELER LA REFERENCE: f1-CN-77 Circ.

DIAL DIRECTLY TO EXTENSION
COMPOSER DIRECTEMENT LE NUMERO DE POSTE

The Secretariat of the International Atomic Energy Agency presents its compliments to the Ministries of Foreign Affairs of Member States of the Agency and has the honour to request that they draw the attention of the appropriate Governmental authorities to the Agency's intention to hold the 18th IAEA Fusion Energy Conference in Sorrento, Italy, from 4 to 10 October 2000.

Governments to which this note is addressed are invited to designate persons interested in participating in the Conference and to submit papers on the topics listed in the Information Sheet which is attached to this note verbale. The Secretariat would be grateful if the Information Sheet and its annexes could be brought to the attention of the authorities, institutions and persons that might be interested.

The International Atomic Energy Agency has limited funds at its disposal to help meet the cost of attendance of selected specialists, mainly from developing countries with low economic resources. Applications for grants can be considered only if they are submitted in accordance with the procedure described in Section 5 of the Information Sheet.

Governments are requested to inform the designated participants that, if they require visas to enter Italy, they should submit the necessary application to the nearest diplomatic or consular representative of Italy as soon as possible.

The Secretariat of the International Atomic Energy Agency avails itself of this opportunity to renew to the Ministries of Foreign Affairs the assurances of its highest consideration.

7 December 1999

Attachments

COPY : COPIE : COPY : COPIE

INTERNATIONAL ATOMIC ENERGY AGENCY

18th IAEA Fusion Energy Conference

Sorrento, Italy
4 - 10 October 2000

INFORMATION SHEET

1. Introduction

Recognizing the increasingly prominent role that energy plays in the world and the expectation that nuclear fusion can provide an abundant energy source, the International Atomic Energy Agency (IAEA) supports the exchange of scientific and technical information on fusion research. The 18th IAEA Fusion Energy Conference (FEC-2000) provides a forum for elaborating the excellent progress that is being made in plasma theory, experiments, and technology.

Previous conferences in this series were held in Salzburg (1961), Culham (1965), Novosibirsk (1968), Madison (1971), Tokyo (1974), Berchtesgaden (1976), Innsbruck (1978), Brussels (1980), Baltimore (1982), London (1984), Kyoto (1986), Nice (1988), Washington (1990), Würzburg (1992), Seville (1994), Montreal (1996), and Yokohama (1998).

2. Topics

OV	Overview
EX	Magnetic Confinement Experiments
TH	Magnetic Confinement Theory and Modelling
CD	Plasma Heating and Current Drive
ED	ITER Engineering Design Activities
IF	Inertial Fusion Experiments and Theory
IC	Innovative Concepts
FT	Fusion Technology and Power Plant Design
SE	Safety, Environmental and Economic Aspects of Fusion

Papers on these topics will be considered for presentation at the FEC 2000 if clearly relevant to the development of fusion energy. A Programme Committee with a representative international membership will be responsible for the selection of papers, the arrangements of conference sessions and the overall scientific content of the conference. The Programme Committee will meet in May 2000 at IAEA Headquarters in Vienna, Austria.

3. Participation

To participate in the conference, please send a completed Participation Form A (attached) to your appropriate government authority (see Section 12) for subsequent transmission to the IAEA. A participant will be accepted only if the Participation Form A is transmitted by the government of an IAEA Member State or by the ITER organization or by another invited international organization. Participants whose designations have been received by the IAEA will be notified directly two to three months before the conference.

4. Papers and Publication

For economy reasons, a Book of Abstracts (3 abstracts per page) will be provided to participants, instead of a Book of Extended Synopses. Therefore, authors **must** submit both a two-page extended synopsis (to be used in paper selection) and an abstract. All papers (except for overview papers) must present original work that has not been published elsewhere.

(a) Submission of Extended Synopses and Abstracts

Authors must submit the following to their appropriate government authority (see Section 12) for transmission to reach the IAEA by **20 April 2000**:

- Participation **Form A**
- **Form B** for Submission of a Paper
- 2 copies of a two-page (A4 paper) **Extended Synopsis**
- 2 camera-ready copies of a separate short **Abstract** for the Book of Abstracts (see sample)
- **Author notification cards** (Receipt of Abstract/Synopsis; Author Notification).

Specifications for the 2-page Extended Synopsis and Abstract:

- Fonts: 12 point Times New Roman or Helvetica
- Single space typing or equivalent
- Left/right margins = 2.5 cm
- Top/bottom margins (Extended Synopsis) = 2.5 cm
- Title of paper in bold title case
- Topic of the paper (EX, TH,…) written in the upper right hand corner of the Synopsis/Abstract (see sample), as well as on Form A, and Form B.
- Authors' names (capital letters), followed by affiliations (title case) and one email address. (For the Abstract, only one author name is needed)
- Height of Abstract $\leq$ 7.5 cm (Abstracts that are too long will be truncated.)

Please see the example Abstract. Replacement abstracts will not be substituted after 20 April.

Example Abstract

The Spherical Tokamak Programme at Culham OV

A. SYKES, Euratom-UKAEA Fusion Association, Culham, United Kingdom, alan.sykes@ukaea.org.uk

The spherical tokamak (ST) is the low aspect ratio limit of the conventional tokamak and appears to offer attractive physics properties in a simpler device. The START (Small Tight Aspect Ratio Tokamak) experiment provided the world's first demonstration of the properties of hot plasmas in an ST configuration and was operational at Culham from January 1991 to March 1998, obtaining plasma current of up to 300 kA and pulse durations of ~50 ms. Its successor, MAST, is nearing completion and is a purpose built, high vacuum machine designed to have a tenfold increase in plasma volume with plasma currents of up to 2 MA. Current drive and heating will be by a combination of induction-compression as on START, a high performance central solenoid, with 1.5 MW ECRH and 5 MW of NBI. The promising results from START are reviewed and the many challenges posed for the next generation of purpose built STs (such as MAST) are described.

(b) Acceptance of a Paper and Author Notification

Authors will be informed in **June 2000** whether their papers have been accepted for presentation at the conference. Detailed requirements for the camera-ready manuscripts and electronic submission of manuscripts will be specified and sent together with the acceptance notification and will also be available on the conference webpage.

Please complete the attached A-5 format author notification cards and submit them together with the Synopses/Abstracts. These cards will help us to inform you promptly about synopsis/abstract receipt and about paper acceptance.

(c) Submission of Manuscript and Publication of Proceedings

Please note that the papers will be published by the IAEA as unedited proceedings in electronic format only (CD-ROM). Specifications for the formats of the electronic manuscripts and how to submit them will be sent to authors of accepted papers in June 2000 and will also be available on the conference webpage. In addition to the electronic submission of the manuscript, authors **must** send two camera-ready copies to the IAEA Scientific Secretariat (see Section 10). Deadline for receipt of both electronic and hard copies: **30 September 2000**. Authors are encouraged to also publish their paper(s) in the Nuclear Fusion Journal.

5. Expenditures

The costs for the organization of the conference are borne by the IAEA and the Host Government. No registration fee is charged to participants.

As a general rule, the IAEA does not pay for participants' travel and living expenses. However, limited funds are available to help support attendance of selected specialists from **developing Member States** with low economic resources. Usually, not more than one travel grant may be awarded to any one country. To apply for a travel grant, please send **Form C (Grant Application Form)** typewritten or clearly printed through your appropriate government authority (see Section 12) together with the participation form and other relevant material to reach the IAEA by **20 April 2000.** Incomplete or late applications will not be considered. The grants will be lump sums usually covering **only part of the cost** of attendance.

6. Working language

The working language of the conference is English. All communications, synopses, abstracts and papers must be sent to the IAEA in English.

7. Distribution of documents

A preliminary programme and a Book of Abstracts will be sent to participants before the conference. The preliminary programme will be also available on the conference webpage. The final programme will be made available at the conference and on the Internet. Preprints of complete papers will not be available during the conference unless provided by the authors.

8. Accommodation

Detailed information on accommodation and other items will be sent to all designated participants well in advance of the conference.

9. Visa

Please find out whether you need a visa to enter Italy and submit the necessary application to the nearest diplomatic or consular representative of Italy as early as possible. (Please note that this procedure may take three or four weeks).

10. Contact Information

The following persons may be contacted for further information or assistance:

Administrative issues – Conference Organizer

Ms. Hildegard Schmid
MTCD Division
International Atomic Energy Agency
IAEA-CN-77
Vienna International Centre
P.O. Box 100
Wagramer Strasse 5
A-1400 Vienna, Austria

Telephone No.: (+43) 1-2600-21316 (or –21311)
Telefax No.: (+43) 1-26007
Email: Hildegard.Schmid@iaea.org
(General mail for IAEA: official.mail@iaea.org)

Scientific issues – Scientific Secretaries

Ms. Ursula Schneider or **Mr. Thomas Dolan**
NAPC Division
International Atomic Energy Agency
P.O. Box 100
Wagramer Strasse 5
A-1400 Vienna, Austria

Telephone: (+43) 1-2600-21707 or -21756
Telefax No.: (+43) 1-26007
Email: u.schneider@iaea.org or t.dolan@iaea.org

Conference site issues – Host Government Official

Mr. Francesco De Marco
ENEA
Centro Ricerche Frascati
C.P. 65
I - 00044 Frascati (RM) Italy
Tel.: +39/06/940055 19
Fax: +39/06/94005100
Email: de_marco@frascati.enea.it

11. Satellite Meetings

Deadline for Booking Requests: 1 **September 2000**
For booking and information please contact:

Mr. Giuliano Bucci
ENEA
Centro Ricerche Frascati
C.P. 65
I-00044 Frascati (RM), Italy
Tel.: +39-06-94005699
Fax: +39-06-94005100
E-mail: bucci@frascati.enea.it

12. Channels of communication

The Participation Form A, the Paper Submission Form B , the copies of the abstract and synopsis and, if applicable, the Grant Application Form C have to be sent through the competent official authority (Ministry of Foreign Affairs, national atomic energy authority or ITER organization) for subsequent transmission to the IAEA.

13. Conference Webpage

The conference webpage address is:

http://www.iaea2000.enea.it

The following information will be posted on the webpage when available:

- Conference announcements
- Instructions for Submission of Synopses
- Forms A, B and C
- Example of an Extended Synopsis
- Example of an Abstract
- Author Notification Cards
- Instructions for Submission of Manuscripts (June 2000)
- Preliminary Conference Programme (June 2000)
- Conference Site
- Hotel Reservation Form
- Satellite Meetings
- Links to other webpages
- Information about transportation and accommodations.

ECRH and ECCD Experiments in an Extended Power Range with 70 and 140 GHz at the W7-AS Stellarator

V. ERCKMANN, U. GASPARINO, H.P. LAQUA, H. MAAßBERG, W7-AS TEAM
Max-Planck-Institut für Plasmaphysik, EURATOM Association, 85748 Garching, Germany
E-mail: erckmann@ipp.mpg.de

ECRH Group, Institut für Plasmaforschung, Universität Stuttgart, Germany

V. IRKHIN, S. MALYGIN
GYCOM, Nizhny Novgorod, Russia

An overview on physics studies on ECRH and ECCD in an extended parameter range at W7-AS is presented. Experiments were performed with an upgraded ECRH power of up to 1.5 MW at 140 GHz and 0.4 MW at 70 GHz. Both systems have a flexible optical launching system for on/off axis heating and current drive. The power can be modulated with frequencies up to 10 kHz for perturbative studies of heat transport, power deposition and current drive. The 140 GHz system operates in 2nd harmonic X-mode (X2) launch at 2.5 T. Electron temperatures of up to 5.7 keV, which can only be explained by the beneficial effect of positive radial electric fields ('electron root') [1], were measured with 1.3 MW heating power at densities of 2 10^{19} m^{-3}. This electric field is generated by ECRH driven particle losses as experimentally confirmed by the threshold behaviour and the response to heating inside and outside the loss cone. At the highest power densities of about 50 MW/m^3 burst-like instabilities are observed from ECE, which occur on a much faster time scale than the collisional one and are attributed to wave instabilities.

The accessible plasma density with X2 heating is limited by the cut-off condition (<1.25 10^{20} m^{-3}). This restriction is removed with mode conversion heating, where an ordinary mode is converted to an extraordinary and finally to Electron Bernstein Modes (O-X-B process) [2]. Heating via the O-X-B process at densities far above the X2 cut-off was successfully applied for the first time at W7-AS, a thorough analysis of the experiments is presented. The theoretically predicted parameter dependence on the density gradient, launch angle, and magnetic induction was investigated experimentally and good agreement with theory was found. Localized power deposition of the electron Bernstein waves was measured as a function of the magnetic induction as shown in Fig. 1.

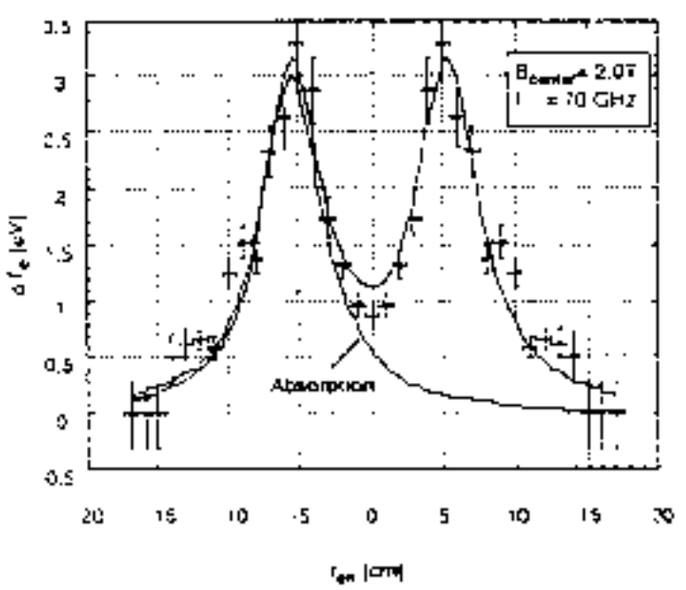

Fig. 1 Localized absorption of Electron-Bernstein waves in experiments with mode conversion heating. The deposition profile is obtained from SX-diagnostics (switch-off technique).

New ECCD experiments were performed at high input power (1.2 MW). The EC driven current can be measured with a high accuracy (±100 A) because it is not masked by a large inductively driven current as in tokamaks. A toroidal launch angle scan was performed at a density of 2.5 10^{19} m^{-3} with inductive compensation of the EC driven current (I_p=0) to maintain net current free conditions with $I_{ind} + I_{boot} + I_{ECCD} = 0$ (I_{ind} is the inductive component, I_{boot} and I_{ECCD} are the bootstrap and the EC-driven components, respectively). The microwaves were injected from low-field-side in X2 mode polarization. During the scan the toroidal magnetic field was adjusted to keep the (Doppler shifted) deposition profile close to the plasma axis ($\Delta B / B \cong 10\%$, for $|\varphi_{inj}| = 30°$). Under these conditions, linear ray-tracing predicts a peaked deposition profile with power densities of the order off 50 MW/m^3. The required inductive loop voltage is shown in Fig. 2 as a function of the launch angle ($\varphi_{inj} = 0°$ corresponds to perpendicular injection, $I_{ind} = - I_{boot}$), together with the linear ECCD-efficiency from ray-tracing [3] using the measured density and temperature profiles. The dependence on the toroidal angle of injection is accurately reproduced. To obtain quantitative agreement, a plasma resistivity of $R \approx 4$ μΩ has to be assumed, which is close to the neoclassical Spitzer value $4 \leq R_{neo}$ [μΩ] ≤ 6 predicted for $Z_{eff} = 2$. No strong discrepancy with linear theory is therefore observed (if trapped particle effects are included), even at these extremely high power densities. The maximum efficiency $\eta_{ECCD} \cong 30$ A/kW corresponds to a normalized efficiency $\gamma_{ECCD} = n_e I_{ECCD} R/P_{ECRH} \cong 0.015\ 10^{20}$ A/Wm^2. One has to notice that due to the low-field-side injection, the EC-waves tend to interact and be absorbed by electrons from the bulk of the distribution function and collisions are sufficient to suppress a strong deformation of the Maxwellian distribution function. A different situation would appear if the power could be deposited to tail electrons. In this case a higher ECCD-efficiency is expected and quasi-linear effects become of importance even at considerably lower power densities.

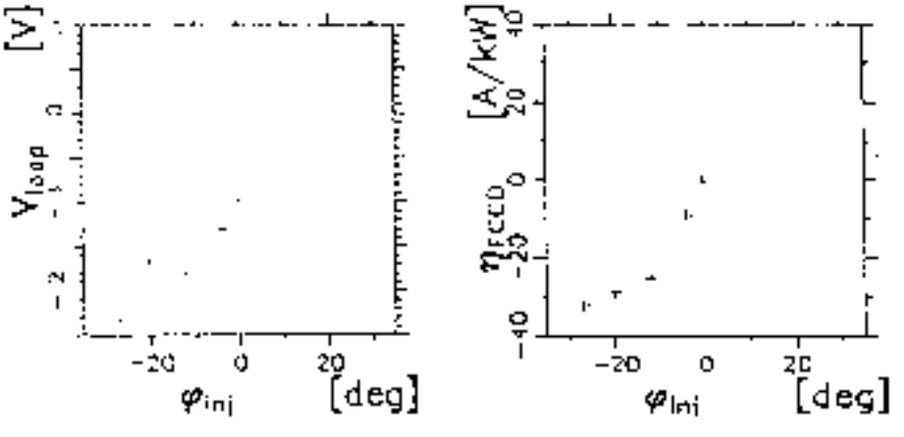

Fig. 2. Left: Loop voltage vs. toroidal angle of injection in net current free discharges, $V_{loop} = -(I_{boot} + I_{ECCD}) / R_0$. $\varphi_{inj} = 0°$ corresponds to perpendicular injection. Right: Theoretically predicted current drive efficiency (linear theory including trapped particle effects).

The different current contributions flow at different radial positions, i.e. the bootstrap current is localized in the pressure gradient region whereas the inductive current follows the plasma conductivity profile and the ECCD is localized around the resonance. Thus the radial profile of the rotational transform can be strongly modified by ECCD. Experiments were performed with negative rotational transform in the plasma centre, i.e. $\iota = 0$ inside the plasma and, for co-CD, central rotational transform well above $\iota > 0.5$. In the latter case strong ECCD driven m=2 tearing mode activity is observed.

[1] R. Brake et al., Plasma Phys. Control. Fusion **39**, (1997) B273-B286
[2] H.P. Laqua et al., Phys. Rev. Lett. **78**, 3467 (1997)
[3] Gasparino, U. et al., Theory of Fusion Plasmas, Varenna, (1990) 195

FORM A
IAEA-CN-77

INTERNATIONAL ATOMIC ENERGY AGENCY

18th IAEA Fusion Energy Conference

4 - 10 October 2000
Sorrento, Italy

To be sent to competent official authority (Ministry of Foreign Affairs, national atomic energy authority) or ITER organization for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria

PARTICIPATION FORM

FAMILY NAME:	ALL INITIALS OF GIVEN NAMES:	Mr./Ms.
INSTITUTION:	FULL ADDRESS:	
	TELEFAX No.: _____ E-Mail: _____	
NATIONALITY:	DESIGNATING GOVERNMENT OR ORGANIZATION:	
MAILING ADDRESS (IF DIFFERENT FROM ADDRESS INDICATED ABOVE):		

DO YOU INTEND TO PRESENT A CONTRIBUTED PAPER? YES NO

PLEASE INDICATE THE CATEGORY OF TOPIC (EX, TH,CD...): _____

FORM B
IAEA-CN-77

INTERNATIONAL ATOMIC ENERGY AGENCY

18th IAEA Fusion Energy Conference

4 - 10 October 2000
Sorrento, Italy

To be sent to competent official authority (Ministry of Foreign Affairs, national atomic energy authority) or ITER organization for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria

FORM FOR SUBMISSION OF A PAPER

TITLE OF THE PAPER AND CATEGORY OF TOPIC (EX,TH,CD.)

AUTHOR(S) INITIAL(S) AND FAMILY NAME(S)	SCIENTIFIC ESTABLISHMENT(S) IN WHICH THE WORK HAS BEEN CARRIED OUT	TOWN/COUNTRY
1.		
2.		
3.		
4.		
5.		

AUTHOR WHO WILL PRESENT THE PAPER	Mailing Address:
Mr./Ms.	
Initial(s):	
Family Name:	Telefax No : E-Mail Telex No..

I hereby agree to assign to the International Atomic Energy Agency
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to publish the above-mentioned paper, and certify that no other rights have been granted which could conflict with the right hereby given to the Agency.

Date: (Signature of Main Author)

FORM C
IAEA-CN-77

INTERNATIONAL ATOMIC ENERGY AGENCY

18th IAEA Fusion Energy Conference

4 - 10 October 2000
Sorrento, Italy

To be sent to competent official authority (Ministry of Foreign Affairs, national atomic energy authority) or ITER organization for transmission to the International Atomic Energy Agency, Vienna International Centre, Wagramerstrasse 5, P.O. Box 100, A-1400 Vienna, Austria

GRANT APPLICATION FORM

(To be completed only by participants from developing countries on whose behalf a grant is requested)

NAME: (MR./MS.):

Mailing Address:

Telex:
Telfax:
Telephone:
E-Mail:

Date of Birth (year/month/day):

Nationality:

1. EDUCATION (Post-Secondary)

Name and Place of Institution	Filed of Study	Diploma or Degree	Years Attended	
			from	to

2. RECENT EMPLOYMENT RECORD (Starting with your present post)

Name and Place of Employer/organization	Title of your position	Type of Work	Years Attended	
			from	to

3. DESCRIPTION OF WORK (Performed over the last three years)

4. INSTITUTE'S/MEMBER STATE'S PROGRAMME IN FIELD OF MEETING

Date..... Signature of applicant.....

Date..... Signature and stamp of responsible Government official.....