

# ( )

the

## abdus salam

international centre for theoretical physics

SMR 1273 - 2

## WORKSHOP ON PLASMA DIAGNOSTICS AND INDUSTRIAL APPLICATIONS OF PLASMAS

12 - 13 OCTOBER 2000

# THE ROLE OF THE IAEA IN PLASMA PHYSICS AND RELATED SCIENCE

## Thomas DOLAN

Head, Physics Section, Division of Physical and Chemical Sciences Department of Nuclear Sciences and Applications Wagramer Strasse 5, P.O. Box 100, A-1400 Vienna, Austria

These are preliminary lecture notes, intended only for distribution to participants.



## **IAEA Fusion Research Activities**

Thomas J. Dolan International Atomic Energy Agency

Workshop on Plasma Diagnostics and Industrial Applications of Plasmas

ICTP, Trieste 12-13 October 2000



## 49 Fusion Research Countries/Organizations



Belerus Cenede Czech France Hungery Ierael Koree Norway Romenie Spain Turkey urstralis Austria
eiglum Brazil
hile China
enmerk EU
leorgia Germar
dda tran
eigrysia Medco
sidstarn Poland
useia Singape
weden Switzer

Bangladeeh Bulgerie Colombie Firland Greece Instand Kazaldesten Netherlands Portugal Slovenie Talwan



## **Need for International Cooperation**

**Avoid duplication** 

Accelerate progress by sharing Understanding Technology Manpower Costs

Encourage governments to support research



## Some IAEA Statistics

Founded 1957

129 Member States

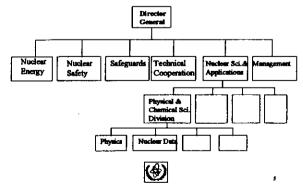
2200 Staff

220 M\$ Regular Budget

60 M\$ Additional for Technical Cooperation



## **IAEA Organization**



## IAEA Objective: To promote fusion energy development

Facilitate international cooperation

Research coordination

Information exchange

Provide public information

Support developing Member States



#### IAEA Fusion Research Activities

Nuclear, atomic, molecular, plasma-material interaction data

#### Research collaborations

Coordinated Research Projects Auspices for ITER

#### information exchange

Fusion Energy Conferences (500-800 people)
Technical Committee Meetings (30-100)
Advisory Group Meetings (5-15)
Journal Nuclear Fusion
Technical Documents

Technology Transfer to developing countries Public information



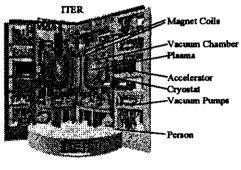
#### International Thermonuclear Experimental Reactor



1988-1992 Conceptual Design Activity 1992-2001 Engineering Design Activity

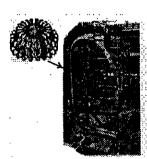
#### IAEA Provides:

Assistance with meetings Publication of reports and documents Monthly newsletter Administration of the ITER Joint Fund.





#### Full-Scale Segment of ITER Vacuum Vessel



Japan Atomic Energy Research Institute (Naka, Japan)

### **IAEA Coordinated Research Projects**

Number of Institutions

8-16

Duration

3-5 Years

Research Coordination Meetings

every 18 months

Advanced Countries: Agreements
Developing Countries: Contracts

travel support
~ 5 k\$/year + travel

Results:

**Technical Document** 

Improved Research Capabilities



## **Coordinated Research Projects**

- Plasma Applications
- · Compact Toroids
- Divertor Modelling
- Charge Exchange Cross Sections
- Plasma-material Interaction
- Data for Plasma Diagnostics
- Molecular Processes in Edge Plasmas
- Incrtial Fusion
- Dense Magnetized Plasmas



2

### Applications of Plasma Physics and Fusion Technology

- · High power microwave sources (plasma production)
- Accelerator development (1 MV, 10 MW beams)
- Surface treatments (wear & corrosion protection)
- · High-performance ceramics
- Hazardous waste treatment (Example: China TC Project)
- Sterilization
- Laser applications (surgery, metal cutting, welding)
- Pulsed x-rays (lithography, medical imaging, gene mapping)
- · Cryogenics (surface cleaning, vacuum pumping)
- · Superconducting cables, magnets, motors

## Automobile Parts Hardening by Plasma Processing



(Drearing from "The World & I", June 1996. Planna processing callaboration of General Motors, Los Alamos National Laboratory, University of Wisconsin)

## **IAEA Fusion Energy Conferences**

	<u>People</u>	
16th. Montreal, 1996	581	
17th. Yokohama, 1998	835	
18th. Sorrento, Italy, 2000 ~ 750		
19th. Lyon, France , 200	)2	



13

## Plasma Treatment of Paper Factory Waste in China

Problem: Nearly 10,000 pulp plants are in operation, most causing pollution.

IAEA Project provided 120 k\$ for plasma diagnostics (temperature & velocity) for a small plasma torch pilot plant, including 2 expert missions, 2 scientific visits, 1 fellowship.

Economic benefits are promising for preventing pollution by recovery of useful chemicals, soda, combustible gases and carbon powder. Now a medium-sized plant will be constructed.



### International Fusion Research Council

Brazil	I. C. Nascimento
China	C. H. Pan
European Commission	E. Canobbio
France	J. G. Jacquinot
Germany	M. Kaufmann
India	P. K. Kaw
Italy	F. De Marco
Japan	N. Inoue
Korea	G. S. Lee
Russia	V. P. Smirnov
Spain	C. Alejaldre
United Kingdom	D. C. Robinson
USA	M Poherts



## International Energy Agency (IEA, Paris)

"Implementing agreements" Large experiments or designs 2-6 countries

- · Large tokamaks
- Poloidal field divertors
- Plasma-wall interaction (TEXTOR)
- Stellarators
- · Reversed field pinches
- Fusion materials
- Nuclear technology
- · Environmental, safety & eonomics aspects

16

## **Evaluation of IAEA Fusion Research Activities**

External Panel

November 2000, Vienna

Questionnaire



## **IAEA Meetings in 2000**

Fusion Reactor Safety	UK/France	13-16 June
Compact Toroids	Vienna	10-14 July
Int'l, Fusion Research Council	Italy	3 Oct
Fusion Energy Conference	Italy	4-10 Oct
Plasma Diagnostics & Industrial Applications (ICTP Workshop)	Italy	12-13 Oct
Applications to Science & Tech.	China	30 Oct-3 Nov



## **IAEA Meetings Planned for 2001**

Power plant design for inertial fusion energy Research using small fusion devices 25-27 June Brezil H-mode physics and transport barriers Toki, Japan September Control, data acquisition & remote participation San Diego July Steady-state operation of magnetic fusion devices France March Energetic particles in magnetic confinement systems Gothenburg October Spherical tori Brazil 28-30 Nov. 10-14 Sep. Divertor concepts France Dermstadt ? High average power drivers International Pusion Research Council Vienna 15 June



21