



INSTITUTE OF PLASMA PHYSICS

ACADEMY OF SCIENCES OF THE CZECH REPUBLIC



- **Website:**

<http://www.ipp.cas.cz>

- **Location:**

Za Slovankou 3
182 00 Praha 8
Czech Republic

- **Founded 1959**

- **Scientific Departments:**

Tokamak (COMPASS D)
Pulsed Plasma Systems
Thermal Plasma
Materials Engineering
Optical diagnostics
Laser Plasma (PALS - with IoP)

- **Shops: Optical, Mechanical**



The Institute carries out research in the following fields:

- **edge plasma in tokamaks, ELMs, additional heatings in tokamaks, turbulences, plasma diagnostics**
- **pulsed capillary discharge (coherent XUV radiation) and corona discharges in gases and liquids**
- **generation of chemically active non-equilibrium plasma**
- **plasma chemistry studies**
- **focused shock waves in water for non-invasive destruction of kidney stones and other medical applications**
- **generation of equilibrium plasma with the water-stabilized arc discharges WSP[®]**
- **interaction of plasma with other states of matter as a basis for plasma gasification and**
- **plasma spraying, plasma decomposition or synthesis**
- **materials research connected with plasma technologies for wide applications and materials for fusion devices**
- **optical diagnostics and design of optical elements**
- **Prague Asterix Laser System (PALS)**
 - **joint laboratory with the Institute of Physics AS CR**

General comments

- **More than 1/3 of IPP's capacity goes to the "Fusion related research" integrated under Euratom Association IPP.CR**
 - **The goal: science and engineering needed for future fusion energy**
- **Other research: various plasma discharges
generation of thermal plasma
materials engineering related to plasma**
 - **The goal: development of scientific foundation of plasma technologies (plasma chemistry, decomposition, synthesis, spraying...)**
- **Smaller scientific but large administrative capacities joined with the Institute of Physics AS CR, v.v.i. in PALS (Prague Asterix Laser System)**

Fusion-relevant research of magnetized plasmas

- ~30 years long tradition in experiments and theory
- Key experimental device today – tokamak **COMPASS D**

ITER relevant Research Program
(focused towards particular topics of fusion research)

Edge Plasma Physics

Plasma turbulence
Plasma - Wall interaction

Wave - Plasma Interaction

Fast particle generation
Propagation of waves

Diagnostics Development

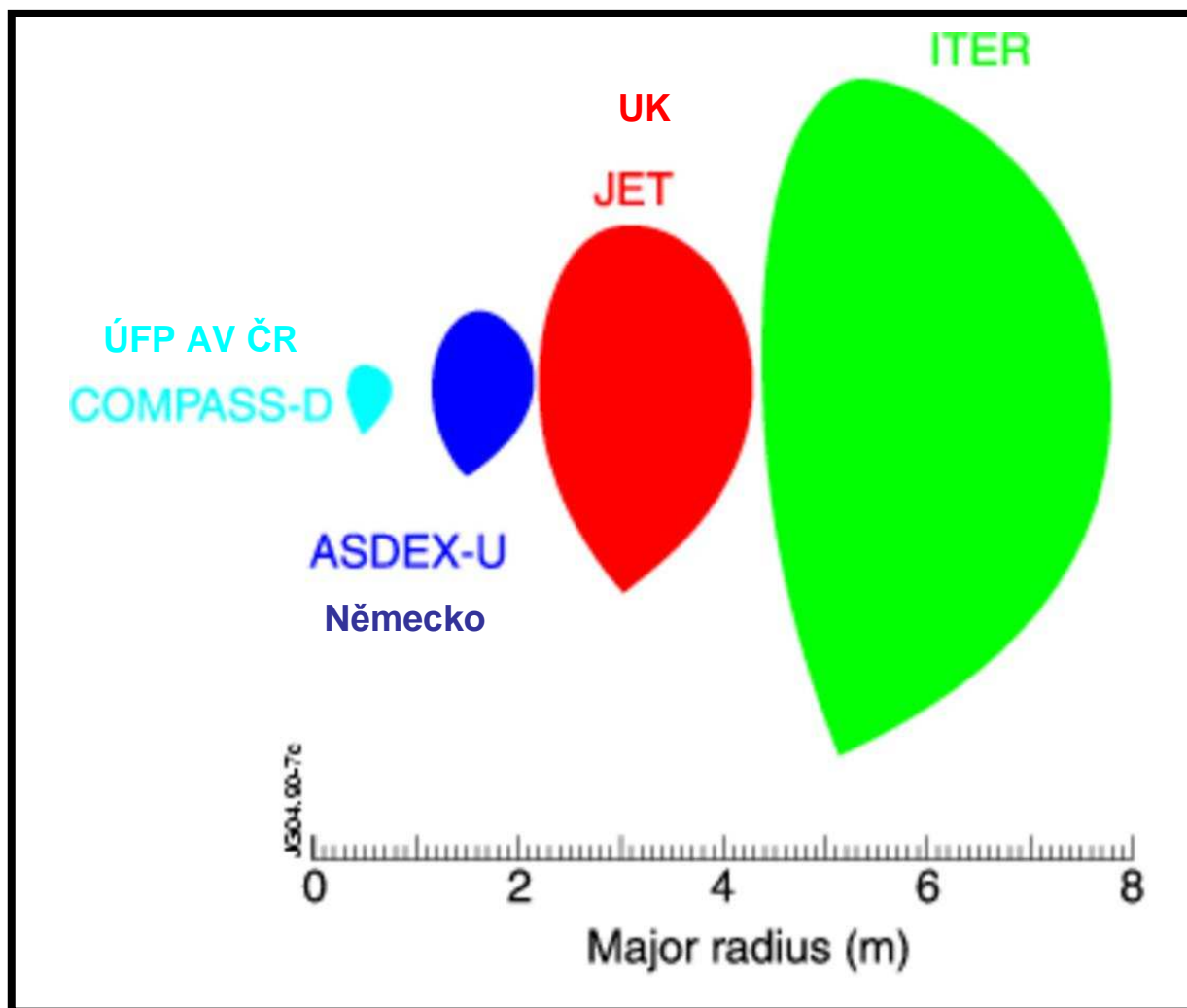
Soft X-Ray spectroscopy
Advanced probes

Education

Diploma & PhD thesis
Lectures & Summer school

TOKAMAK

Průřez prstence plazmatu



COMPASS-D
je relativně
malý tokamak,
ale má
geometrii
podobnou ITER
(1:10)

Association EURATOM/IPP.CR

ČR „vstoupila“ do EURATOM XII/1999 a vytvořila „asociaci“ =
7 institucí koordinovaných **Ústavem fyziky plazmatu AV ČR, v.v.i.**

Fyzikální výzkum

Tokamak CASTOR/COMPASS, teorie/modelování, srážkové procesy

- *Ústav fyzikální chemie, AV ČR*
- *Matematicko-fyzikální fakulta, UK*
- *Fakulta jaderná a fyzikálně inženýrská, ČVUT*
- *Ústav jaderné fyziky, AV ČR*

Vývoj nových technologií (obecně i pro ITER)

Cyklotron, ozařování ve štěpném reaktoru, materiálový výzkum

- *Ústav jaderného výzkumu, a.s. Řež*
- *Ústav aplikované mechaniky a.s, Brno*

Celkem - cca 70 pracovníků (VŠ i technici)

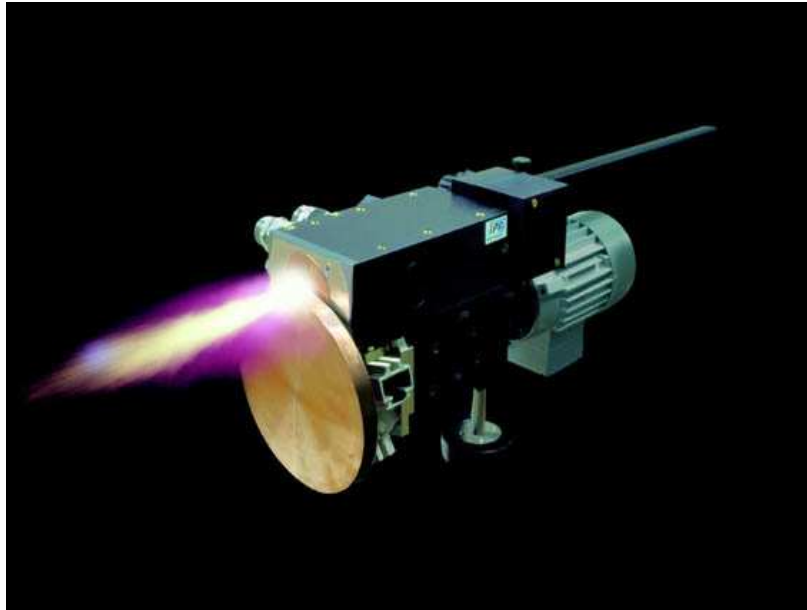
Non-equilibrium Plasma Discharges in Gasses and Water

- **Capillary discharges**
- **Shock wave generation by spark discharges**
- **Pulsed electrical discharges in water**
 - *needle-plate or coaxial rod-tube electrode geometry*
 - *generation of focused shock waves*

Possible applications:

- **plasmachemistry, waste treatment**
(degradation of organics by OH radicals and hydrogen peroxide)
- **medical applications** (**lithotripsy**, destruction of soft tissue by focused shock waves, sterilization)
- **generation of coherent X-rays**





Facilities:

- **Water stabilized plasma torch**
- **Hybrid torch**
(unique, patented)

Thermal (equilibrium) plasma in arc discharges, its properties and utilization

- **Generation of equilibrium plasma** in water-stabilized and hybrid arc discharges
- Modeling of processes in electric arcs
- Interaction of plasma with other states of matter as a basis for plasma spraying, plasma decomposition or synthesis
- Plasma based waste disposal
- **Gassification, vitrification**

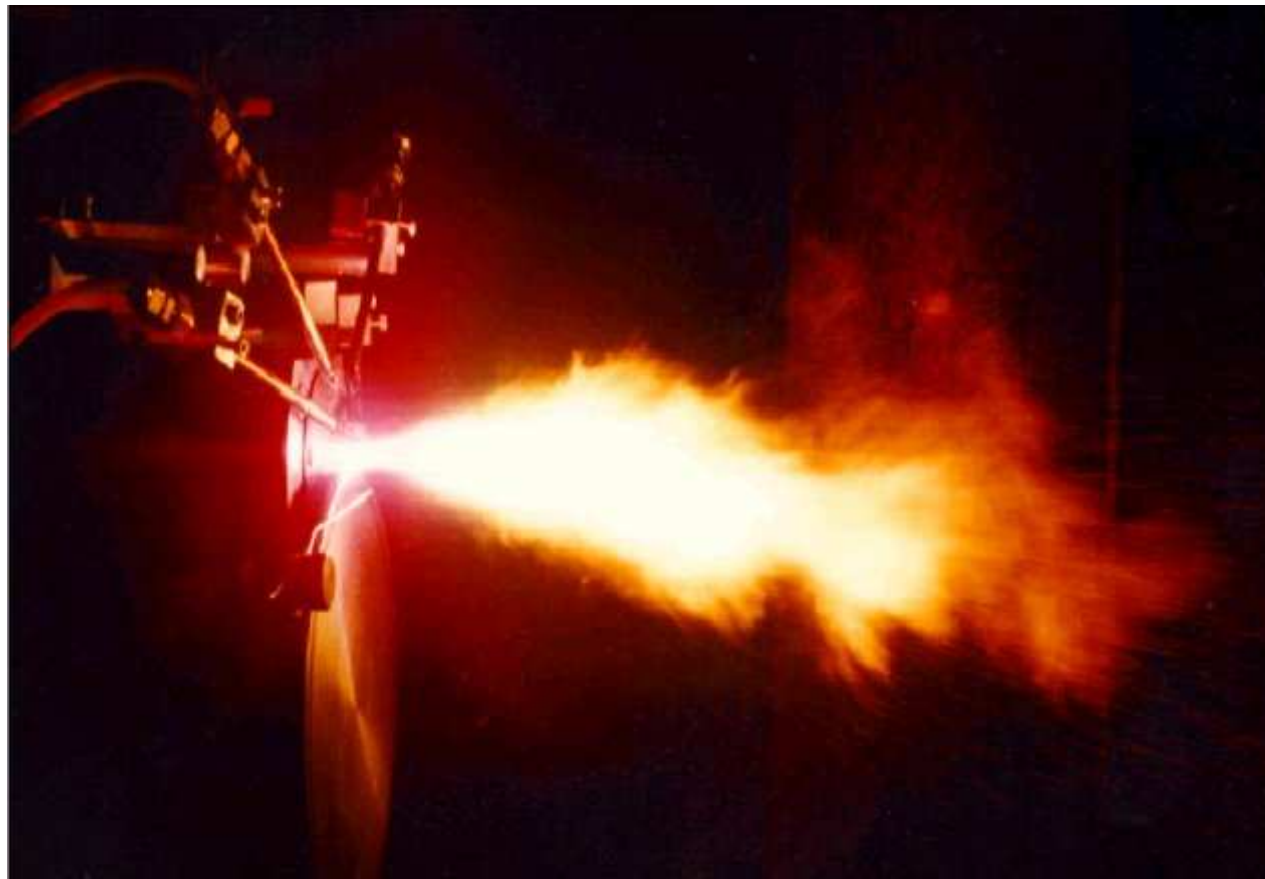
Research areas: Interaction of plasma with matter, plasma spraying, materials characterization

- Development of optimized plasma sprayed deposits using a detailed microstructure control and characterization
- Amorphous and Nanocrystalline coatings
- Oxidation of metals and alloys during plasma spraying
- Plasma spraying of novel materials (silicates, titanates, etc.)
- Plasma spraying of ceramic self-supporting bodies
- Plasma sprayed materials for fusion applications (boron carbide, tungsten)

MATERIALS ENGINEERING

Applications center

- **Materials processing with WSP® torch**
- **Special plasma spraying for industrial applications**



Dept. of OPTICAL DIAGNOSTICS

- Design of special „classical“ optical parts;
- **Future:** XRD optics, non-spherical optics, etc.;

Optical development workshop

- Production of special (unique) optical parts on orders

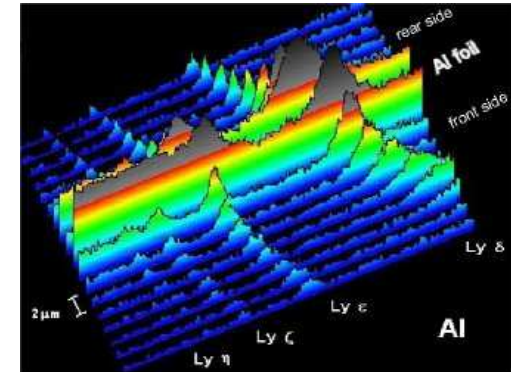
Both from the former „Vývojová optická dílna AV ČR“ (since 2006)

PALS – joint center of IPP and IoP AS CR

A users facility, providing transnational access, member of **LASERLAB-EUROPE**

Laser soft x-ray sources

Time- and space-resolved x-ray spectroscopy
Contact XUV microscopy
XUV ablations studies

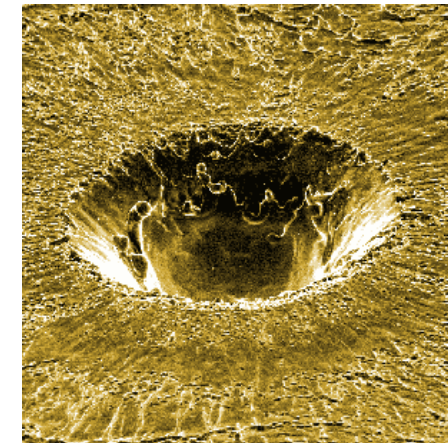
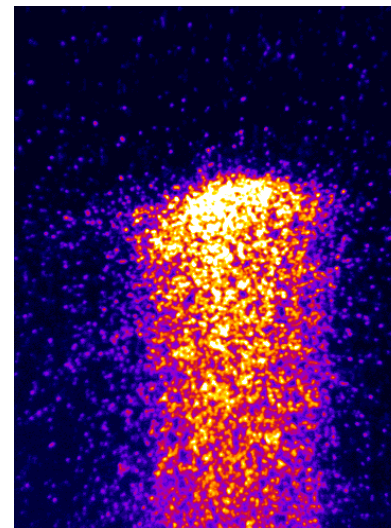


Neon-like zinc x-ray laser (21.2 nm)

the most bright electromagnetic source ever built in laboratory
XUV interferometry of surfaces

Laser ion sources

Ion implantation studies
Crater formation studies
Multiframe laser interferometry



Shock wave studies