Pulsed Plasma Generator as Laboratory Source of axions or ALPs.

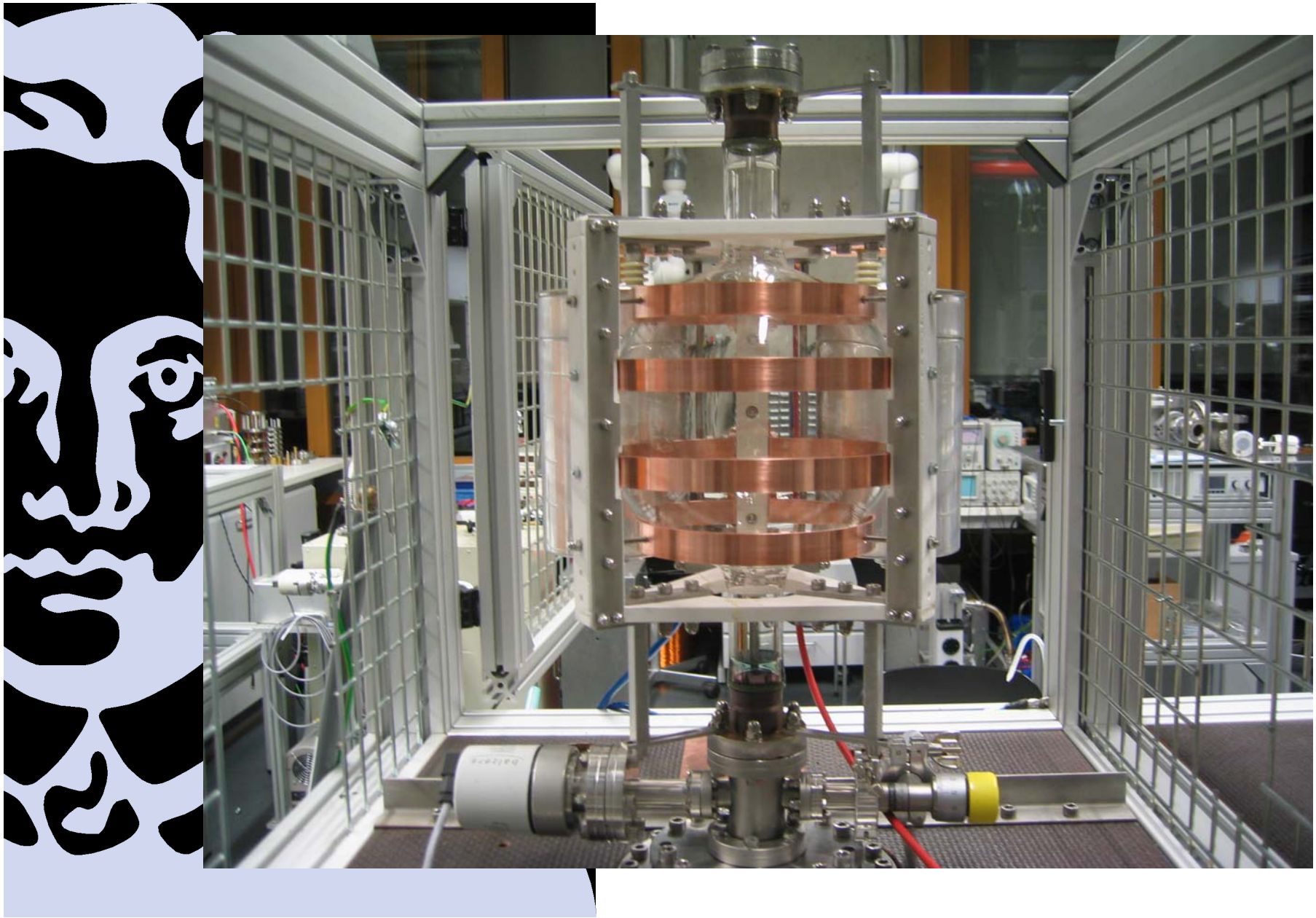
J. Jacoby , Ch.Teske[1], M. Tsagri[2], K. Zioutas[2,3]

1) für Angewandte Physik
olfgang Goethe-Universität, Frankfurt/Main

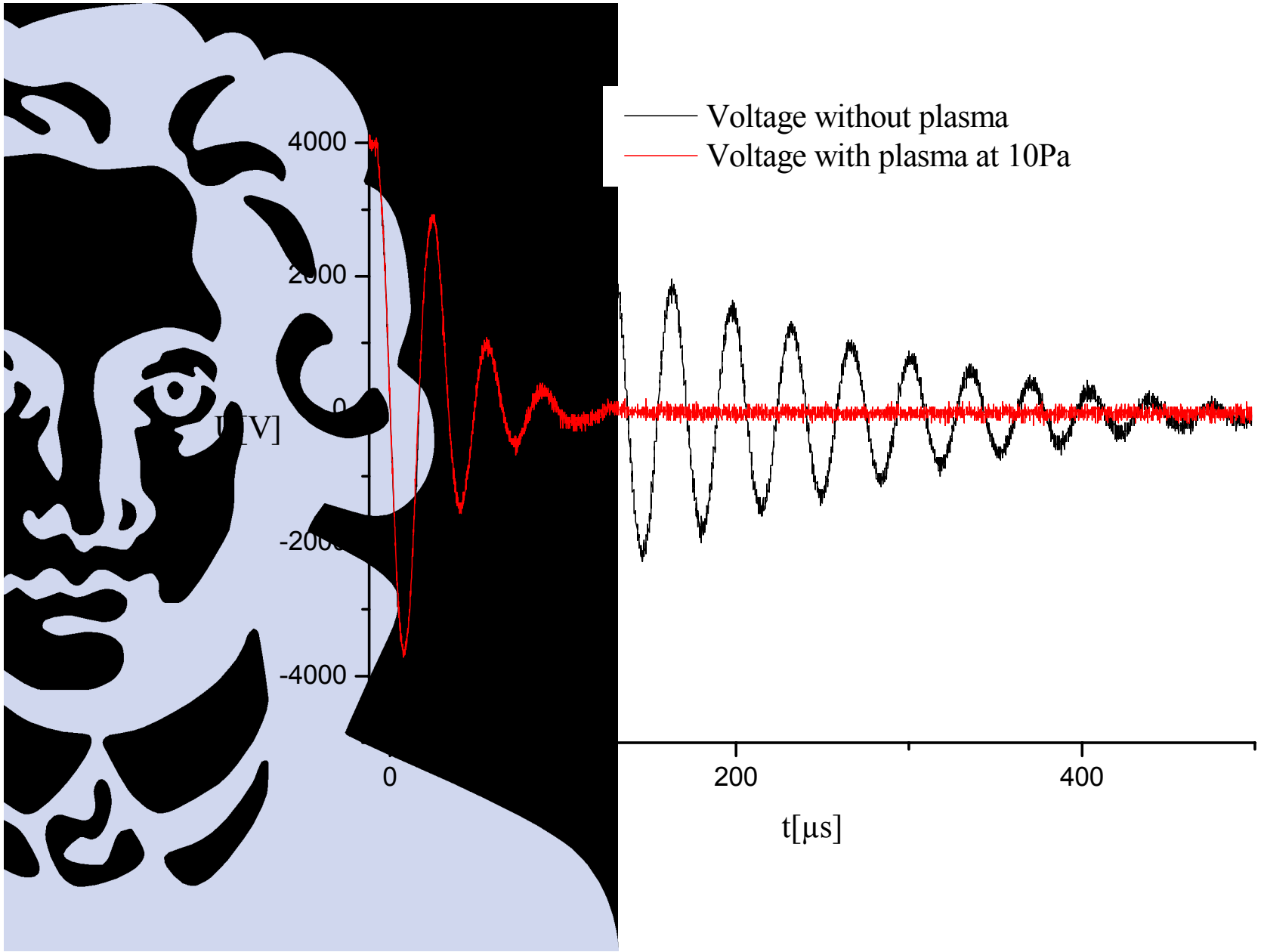
2) epartment, University of Patras

3)

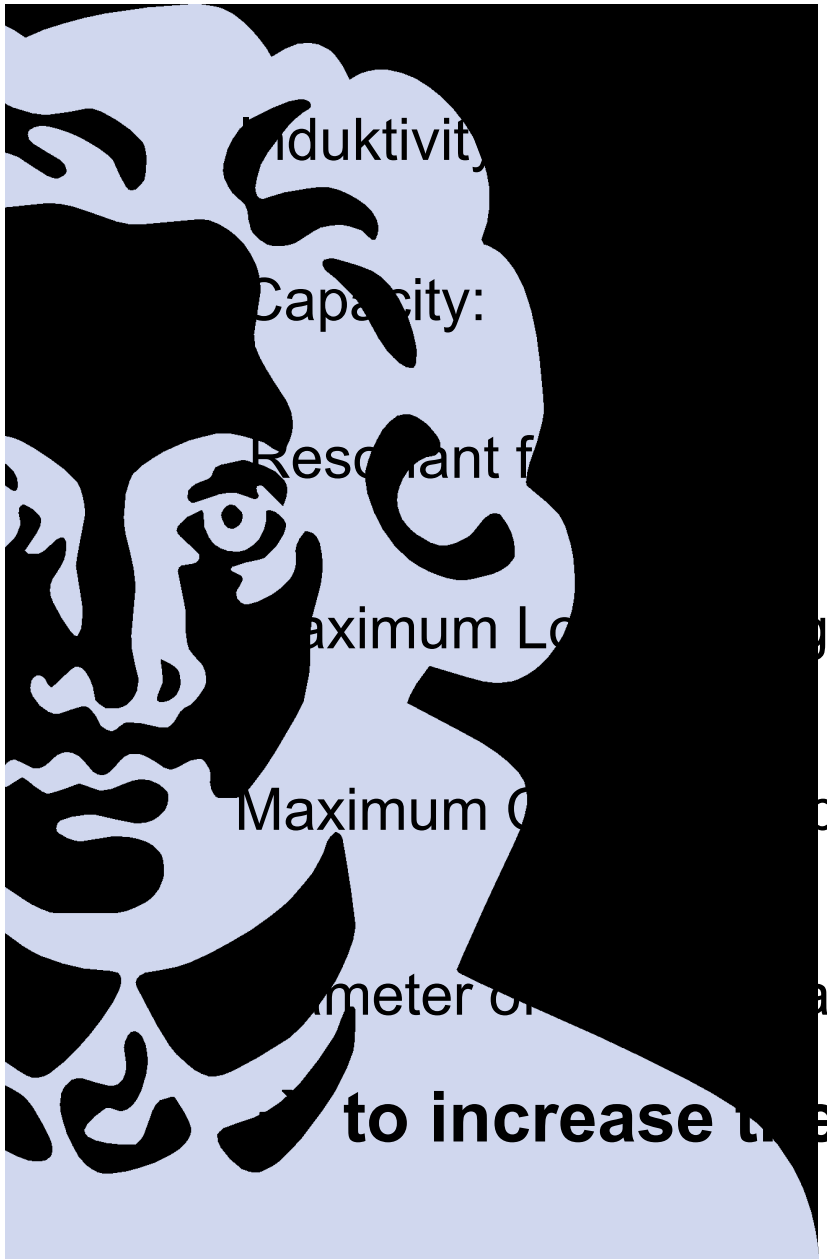
Front View of the LF ICP



Damping of the Circuit through Inductive Coupling



Technical Data



Induktivity: $L_0 = 2.1\ \mu H$

Capacity: $C_0 = 12\ \mu F$

Resonant f: $\nu = 30\ kHz$

Maximum Lo ge: $U_0 = 4100\ V$

Maximum C olitude: $I = 9.5\ kA$

meter of arge Vessel: **d = 20 cm**

to increase the T_e: **d > 20 cm**

Low frequency inductive coupled plasma

Present

Ar (98%), H (2%)

T_e ~2-3 eV

Future

Xe, VUV

T_e ~20 eV

B ≤ 1 Tesla

Possible Applications

r Electron Densities:

$$n_e > 10^{19}\, m^{-3}$$

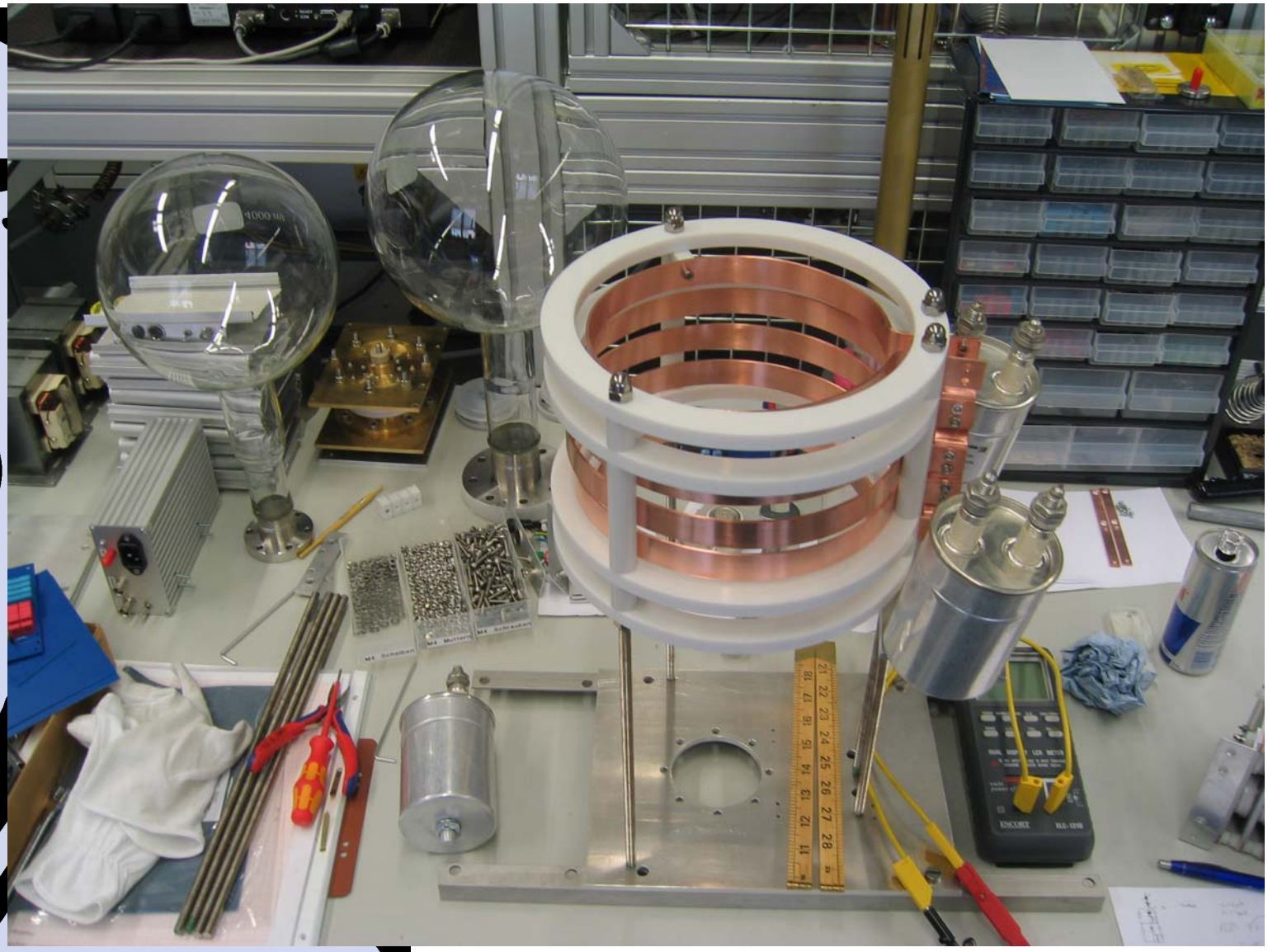
Plasmastripper

• Plasmatarget

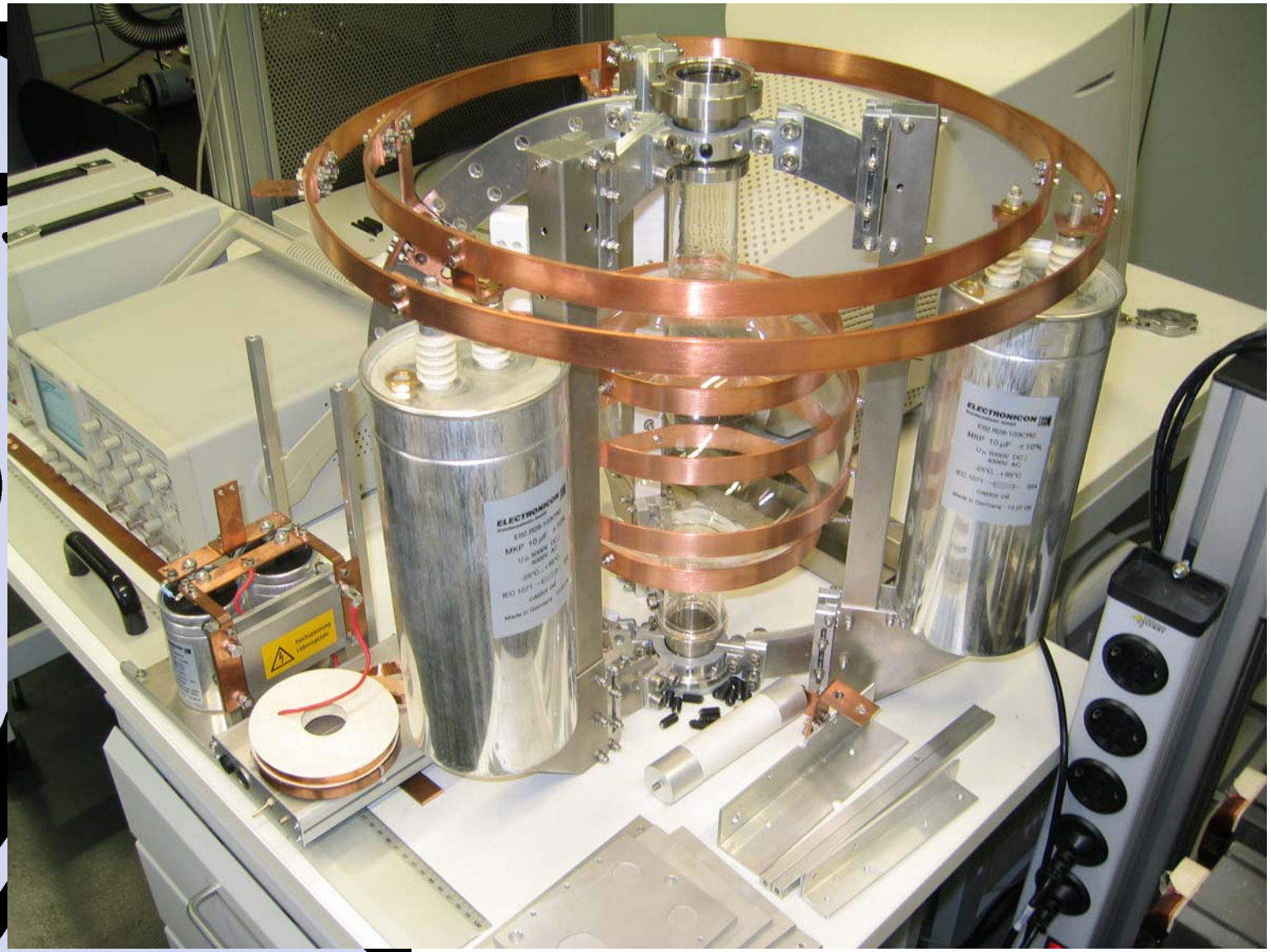
• Ion Source

• **UV Source**

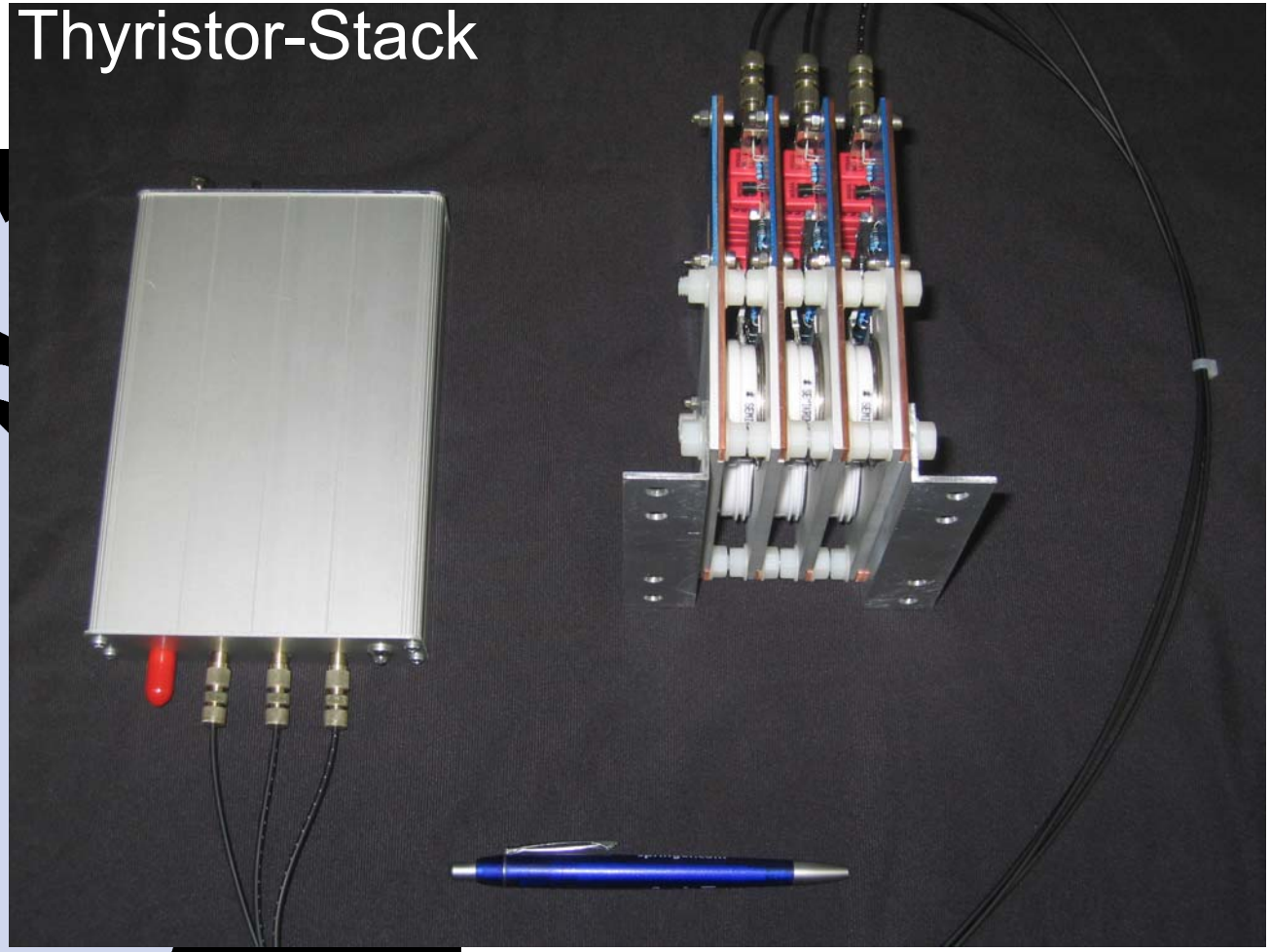
Weiterer Prototyp mit erhöhter Induktivität. Eine Ansteuerung mit Leistungshalbleitern wird hier getestet um höhere Pulswiederhohlraten zu ermöglichen. Die Induktivität ist hier mit L=5µH gegeben.



Prototyp zur Aufskalierung des Experiments auf bis zu **1kJ** Entladungsenergie

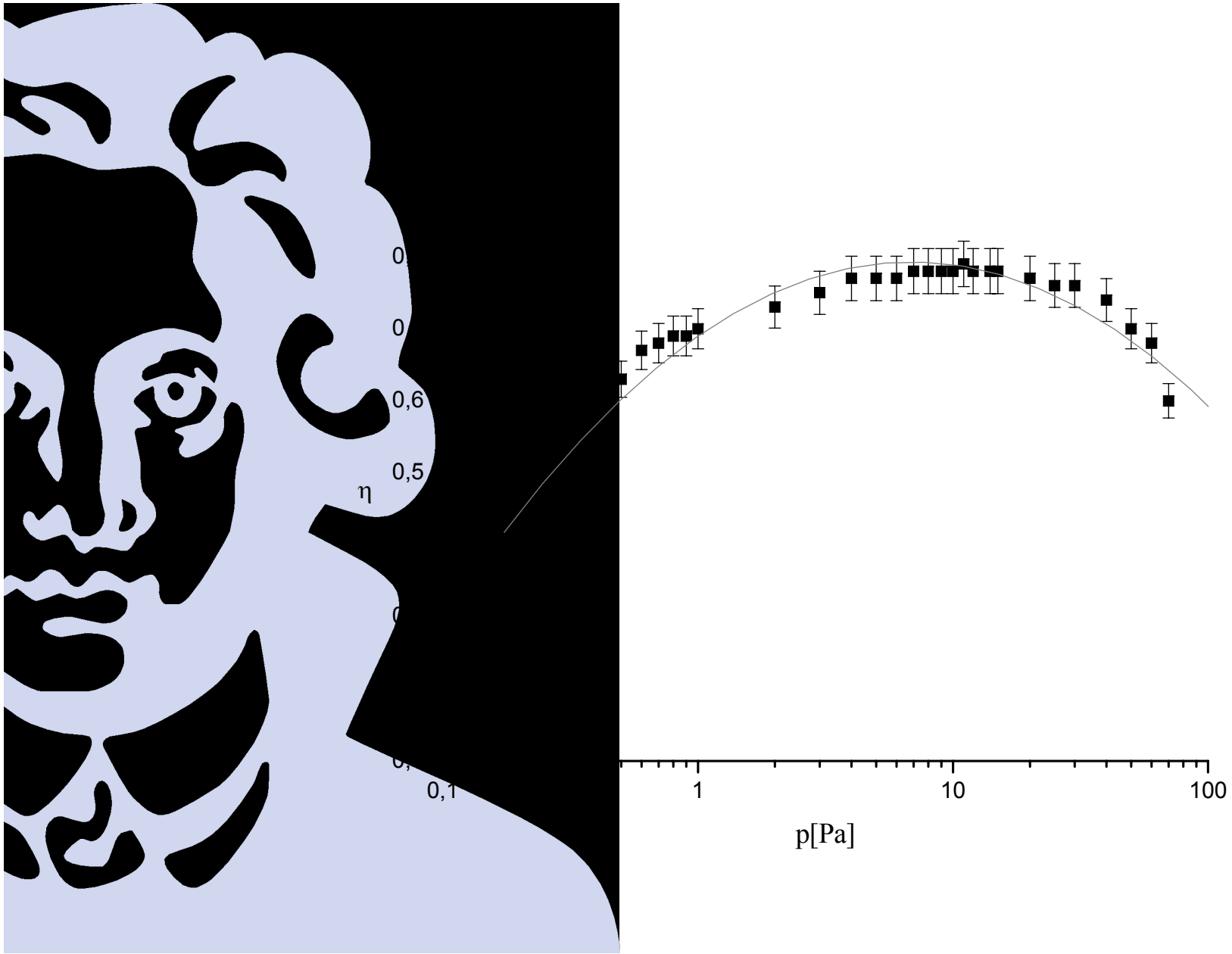


Thyristor-Stack zur Ansteuerung der Induktionsspulen.
→ self-made: Plasmaphysik U. Frankfurt / Main

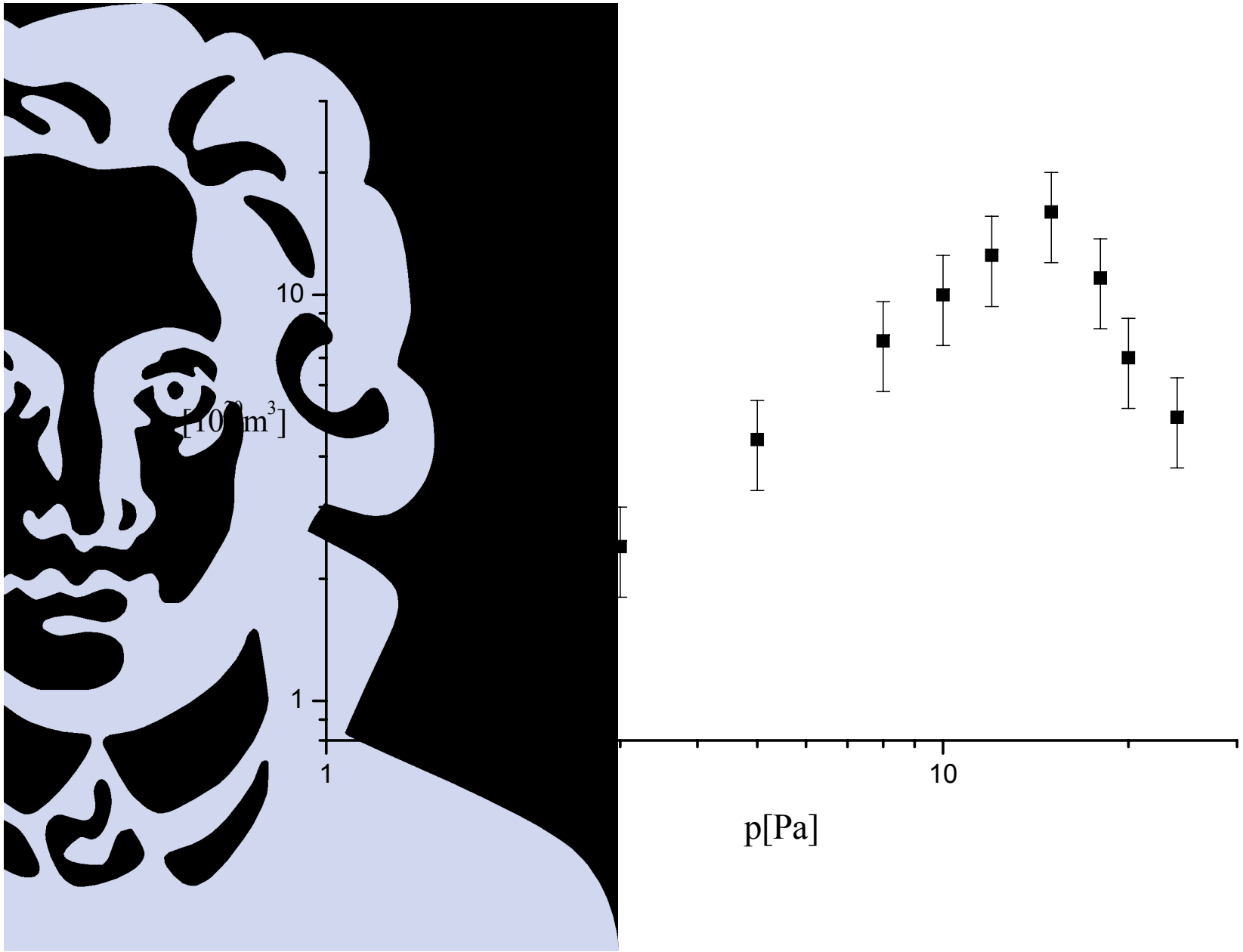


- höhere Pulsfrequenzen und → **~50Hz** ← **~10Hz**
- höhere Leistungsdichten
  → Emissionsspektren in den **UV-VUV**-Bereich

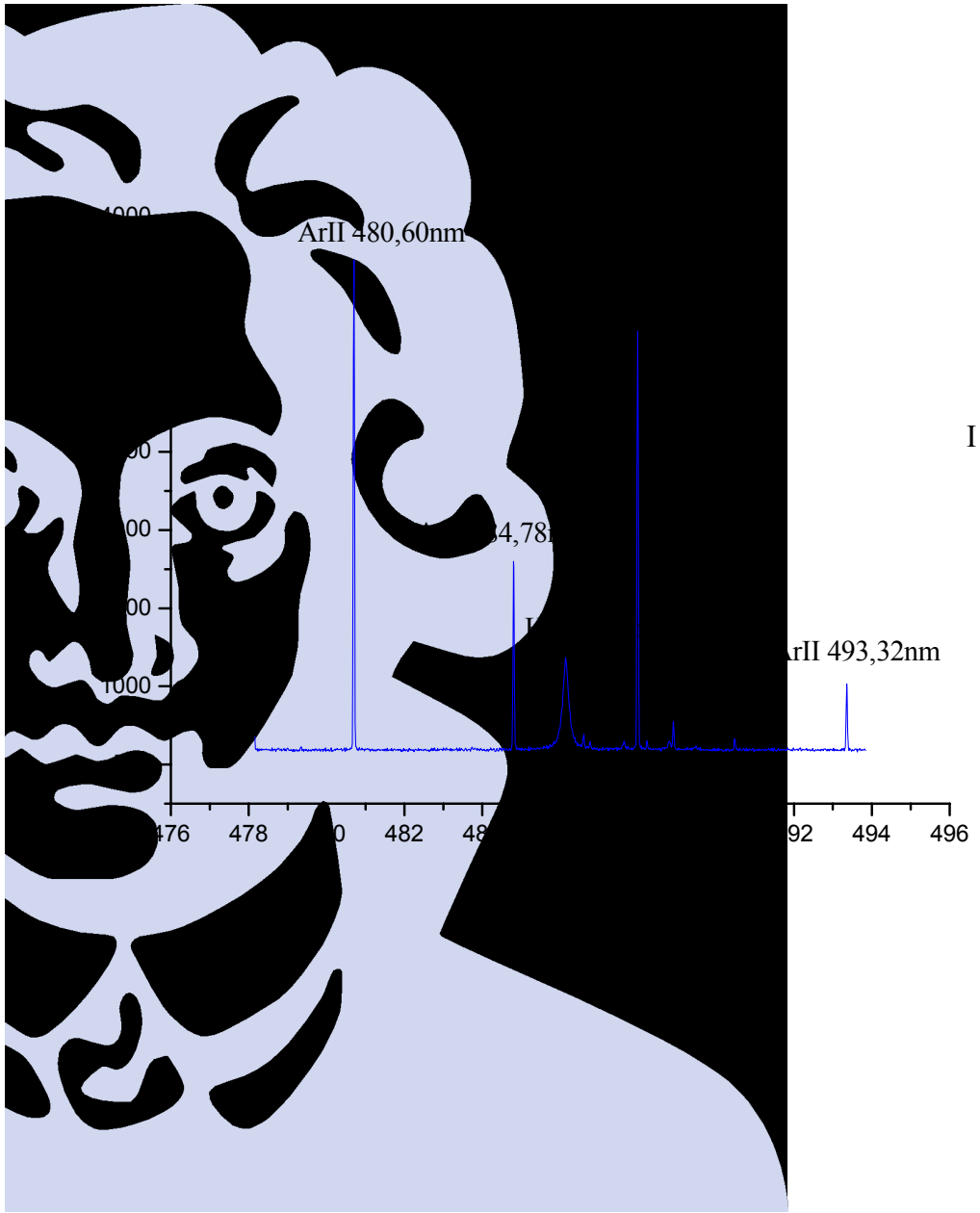
Energy Transfer Efficiency

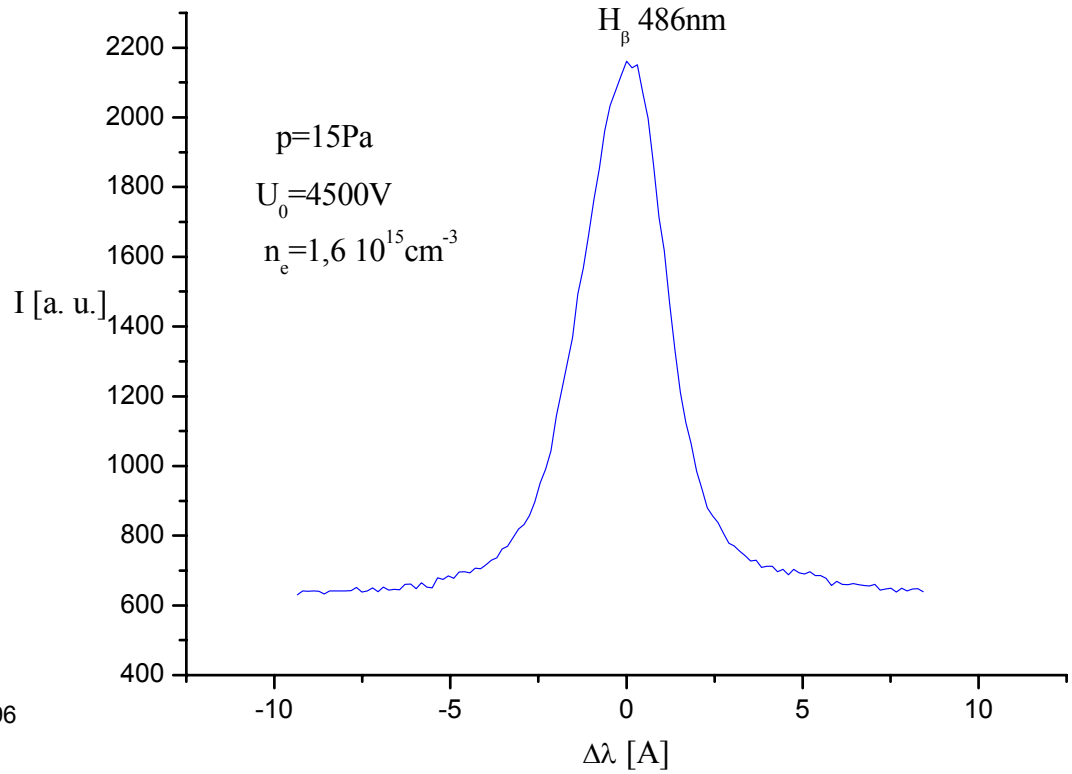


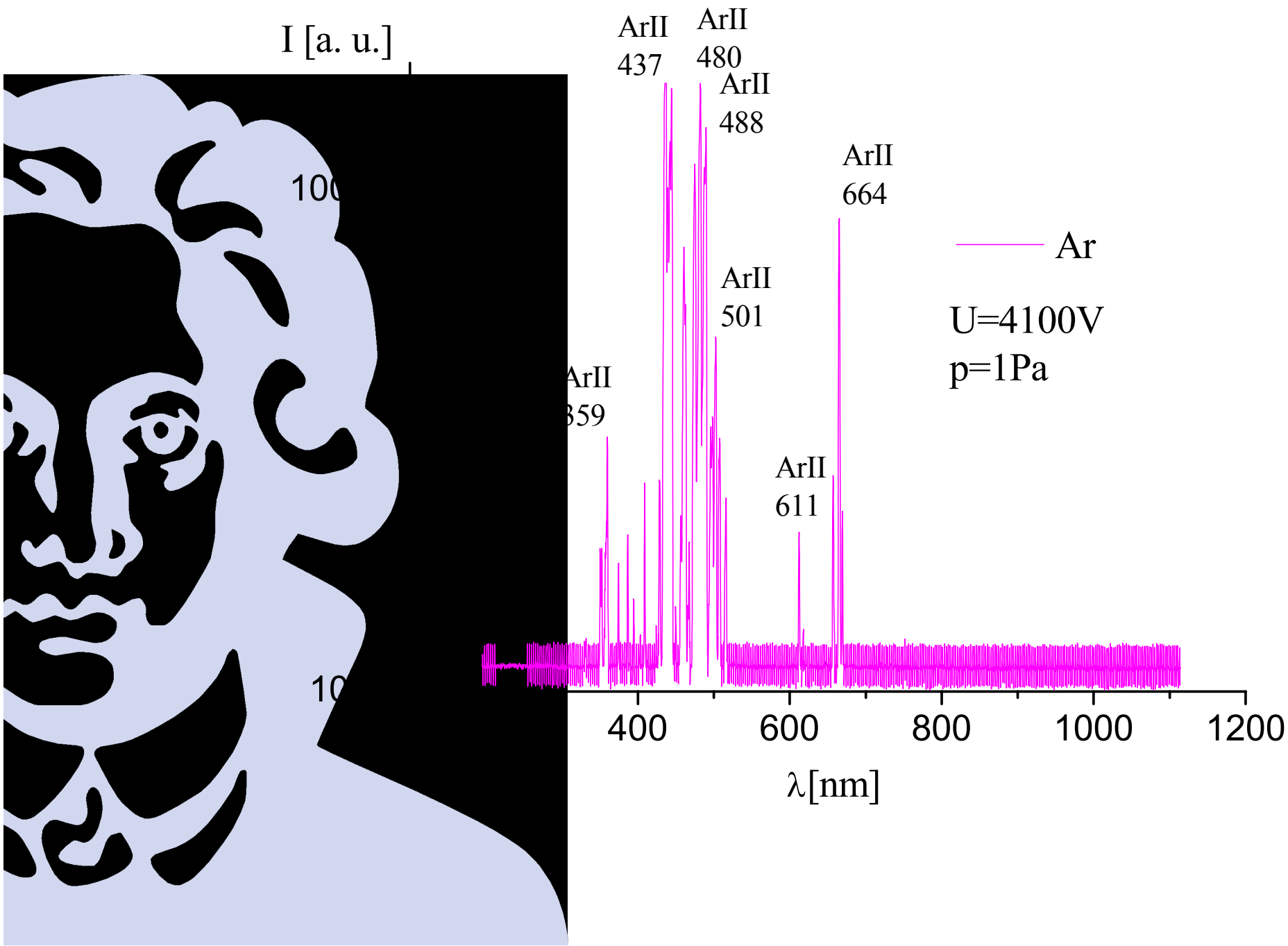
Mean Electron Density

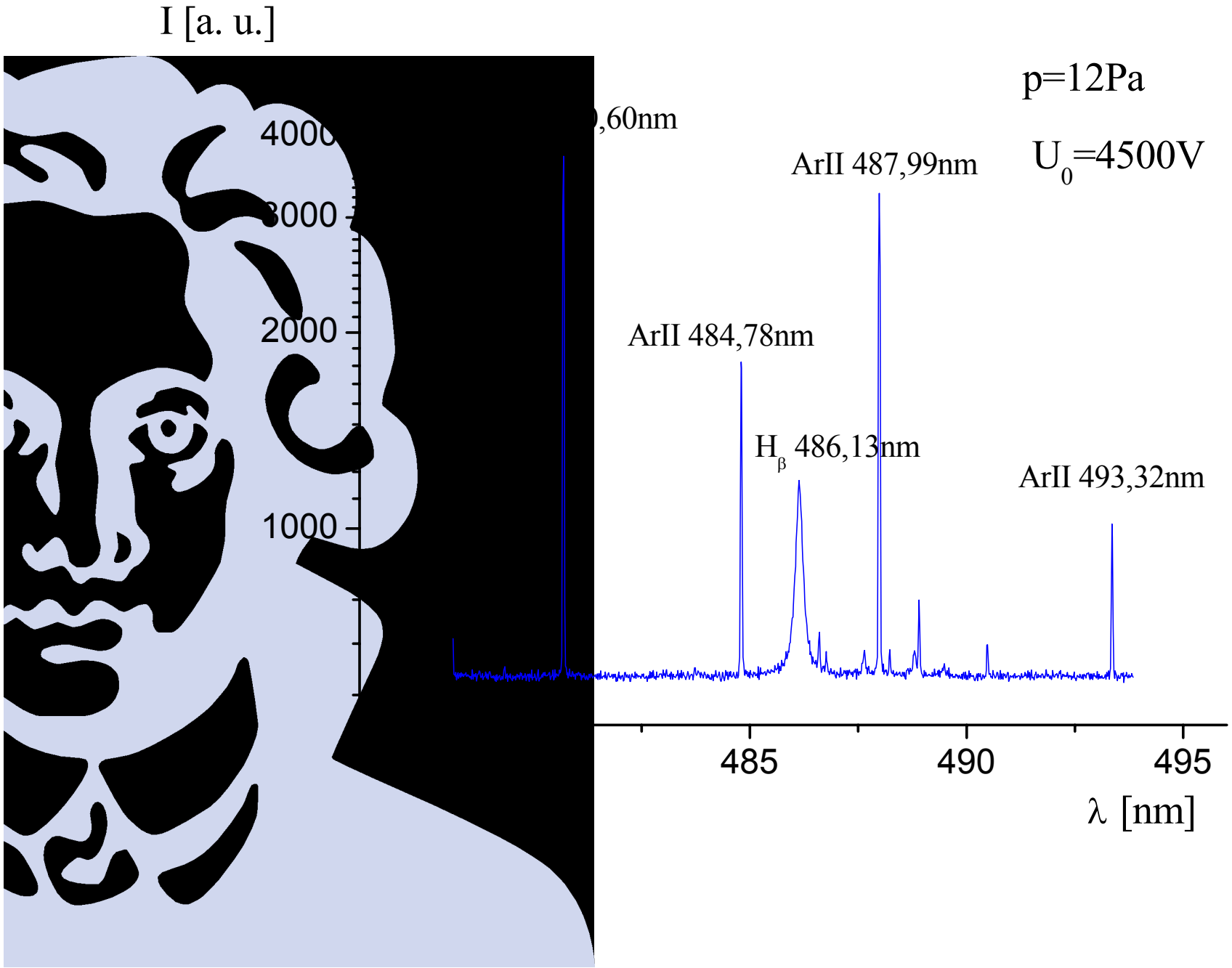


Spectroscopic Results

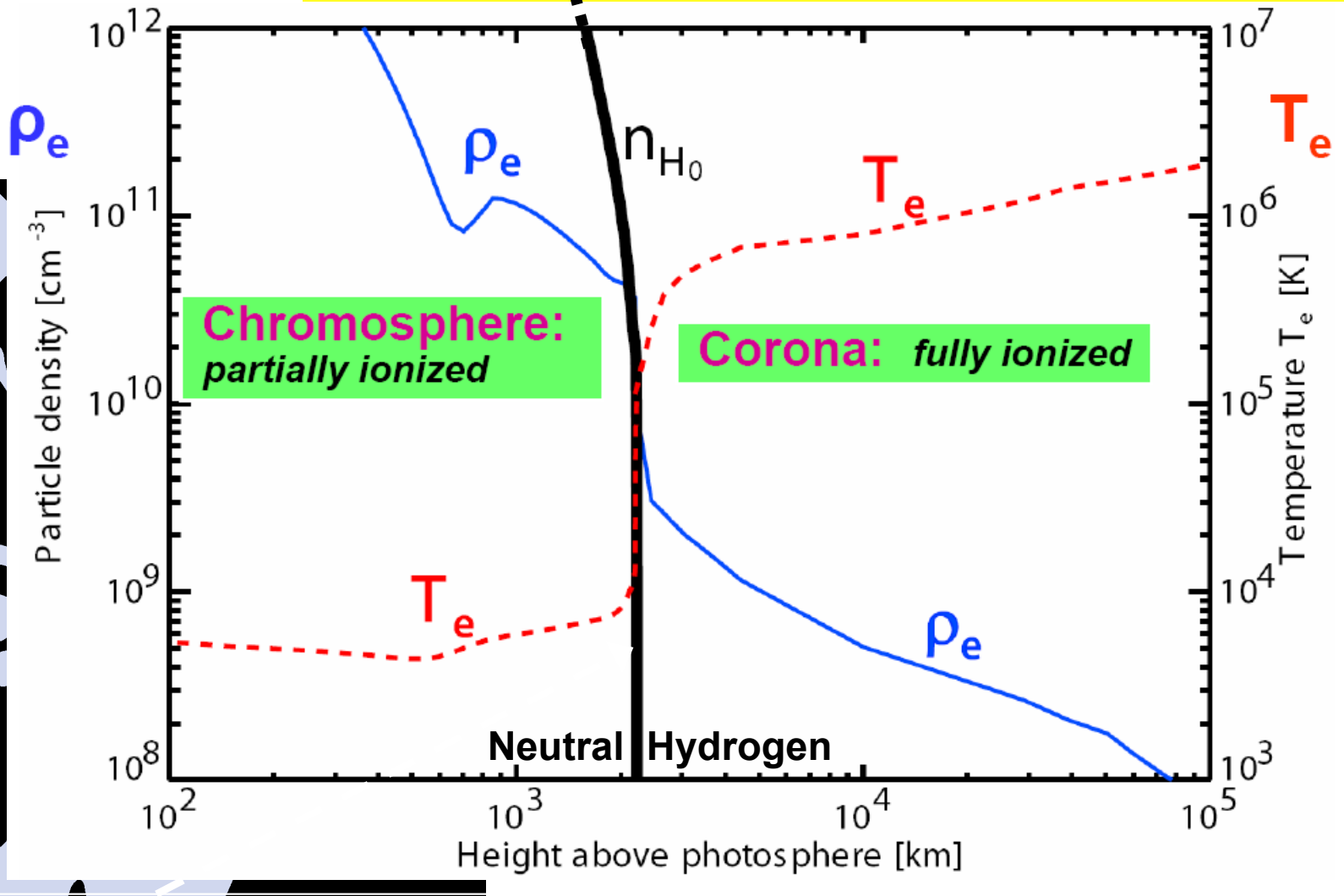





I [a. u.]
ArII
437
ArII
480
ArII
488
ArII
664
ArII
501
ArII
359
ArII
611
Ar
U=4100V
p=1Pa
400
600
800
1000
1200
λ[nm]


I [a. u.]
4000
3000
2000
1000
,60nm
p=12Pa
ArII 487,99nm
U0=4500V
ArII 484,78nm
Hβ 486,13nm
ArII 493,32nm
485
490
495
λ [nm]

Transition Region ~100 km thin!



Photosphere: ~0.01% **of the gas is ionized** (= plasma).

performance

100 J / 10^{-4} sec → 10^{9} erg/10^{-4}sec

15 m, e.g.,from CAST magnet(S.A.~3.5×10^{-7}), 2units &
plasma trigger rate ~10Hz → 50Hz

→ norm 1 AU → $\times10^{21}$ - $\times10^{22}$

~10^{3} erg/s from the Sun, T_e~2->20eV,
$_{plasma}$<meV, ~1T + pulsed.

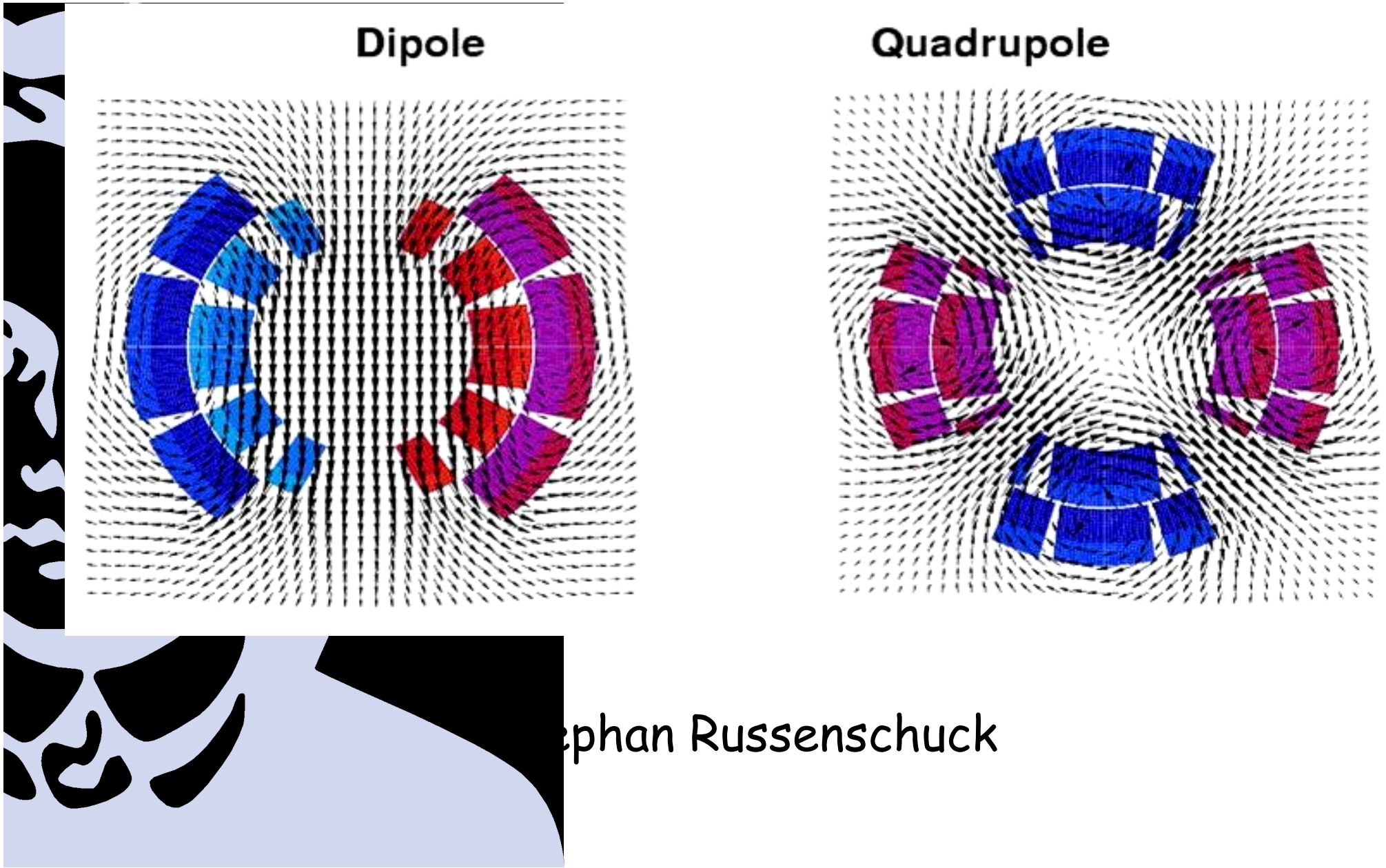
Further:

- qs a spher mirror: ~100 reflections? OR→
- **Fabry Perrot:** nced emission along LASER direction→
  fecti e S.A → enhancement up to $\times10^{5}$

→ 35-10 100μsec = **25-250x$L_{total-solar}$**

→ [0.1Tm] =[2kg Hydrogen/cm^2]^2

Coil Block Approximation



Stephan Russenschuck

Comparison with LASER experiments, through the wall

>>>> TBD