



A few words about

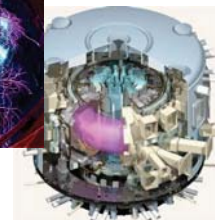
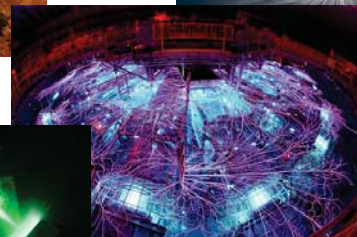
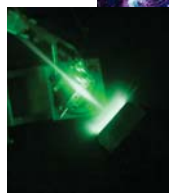
## Plasma Spectroscopy

...and the School

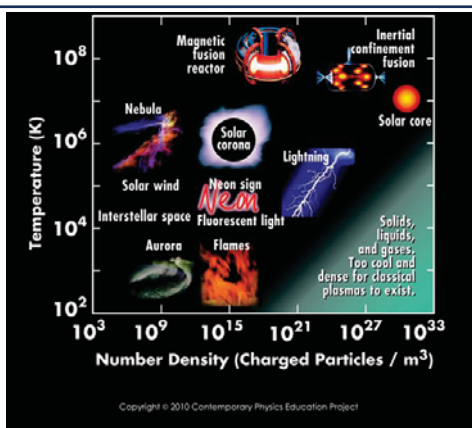
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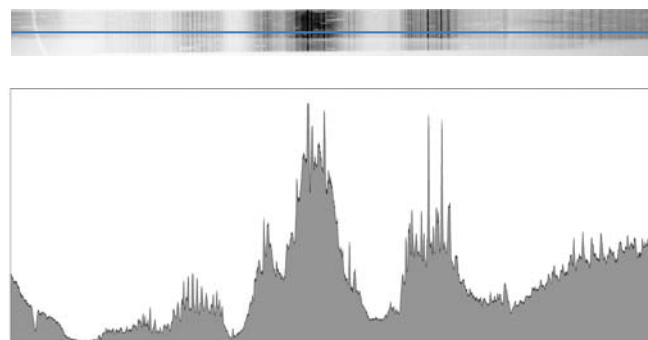
ICTP-IAEA Advanced School on Modern Methods in Plasma Spectroscopy  
Mar 16-20, 2015



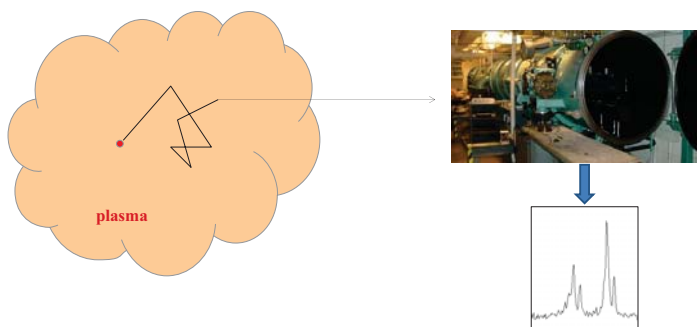
## Typical plasmas



## Miracle of creation



## Why are we doing this?..



Plasma spectroscopy tries to understand what the number of photons (or energy) registered at a specific energy/wavelength can tell us about plasma properties (density, temperature, motion, fields...)



## Purpose of the School

- **Introduce modern concepts in plasma spectroscopy to advanced students and young scientists**
  - Lecturers: *IAEA* (Austria), *Ruhr-University Bochum* (Germany), *Forschungszentrum Jülich* (Germany), *Technion* (Israel), *Institute of Spectroscopy RAS* (Russia), *Malmö University* (Sweden), *LANL* (USA), *LLNL* (USA), *NIST* (USA)
  - Students: ~40 (out of >170 applicants)



## A Few Textbooks/Reviews on Plasma Spectroscopy

- H.R. Griem
  - Plasma Spectroscopy (1964)
  - Principles of Plasma Spectroscopy (1997)
- W. Lochte-Holtgreven (ed.)
  - Plasma Diagnostics (1968)
- T. Fujimoto
  - Plasma Spectroscopy (2004)
- H.-J. Kunze
  - Introduction to Plasma Spectroscopy (2009)
- D. Salzmänn
  - Atomic Physics in Hot Plasmas (1998)
- R.D. Cowan
  - Theory of Atomic Structure and Spectra (1981)
- J. Cooper, Rep. Prog. Phys. **29**, 35 (1966)
- U. Fantz, Plasma Sources Sci. Techn. **15**, S137 (2006)



## Units

- Energy
  - $1 \text{ Ry} = 0.5 \text{ a.u.} = 13.61 \text{ eV}$   
(ionization energy of H)
  - Ionization energy of H-like U: **8464 Ry = 115 keV**
  - $1 \text{ eV} = 8065.5442 \text{ cm}^{-1}$
  - $1 \text{ cm}^{-1} =$
- Temperature
  - $1 \text{ eV} = 11604 \text{ K}$
  - Solar photosphere: 0.5 eV
  - Solar corona: ~100 eV
  - ITER: 20,000 eV
- Velocity
  - $1 \text{ a.u.} = 2.2 \cdot 10^8 \text{ cm/s} = c/137$
- Length
  - $a_0 = 5.29 \cdot 10^{-9} \text{ cm} = 0.0529 \text{ nm}$  (radius of H atom)
- Wavelength
  - $1 \text{ \AA} = 0.1 \text{ nm}$
  - Visible: 380-780 nm
  - X-ray: 0.1-1 nm
- Area (cross section)
  - $\pi a_0^2 = 8.8 \cdot 10^{-17} \text{ cm}^2$  (area of H atom)

<http://physics.nist.gov/cuu/Units/>



## What's expected

- **Ask questions!!!**
- Talk with students and lecturers
- Some things may look familiar and/or simple: do not feel frustrated
- Total solar eclipse: **Friday March 20**
  - Max: **10:38:39**
  - Eclipse magnitude ~0.67
  - **NEVER LOOK DIRECTLY AT THE SUN!**
- **Enjoy**