The Sulfur Lamp

Lecture:
Inkohärente Lichtquellen
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The Sulfur Lamp

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History

- **1990**: Discovery
  - by M. Ury and C. Wood (Fusion Systems Corporation)
- **1994–1997**: 2 types of Sulfur Lamps (Solar 1000; Light Drive 1000) by Fusion Lighting
- **1998**: Production stop; Patents were licensed to LG
- **2006**: LG → start of production (PLS)
- **Today**: Research on Sulfur Lamps with electrodes
Functional Principle

**Construction:**
- Fused quartz bulb (30 mm) filled with argon (1 bar) and mg of sulfur powder
- Bulb on a spindel → rotation
- Magnetron: sends out microwaves (@ 2.45 GHz)
- Parabolic reflector
Functional Principle

- Microwave induction lamp (without electrodes)
- Microwaves excite the argon → 5 bar pressure
- Plasma of sulfur → many excited states (molecular emission)
  ⇒ Many lines in the spectra
Functional Principle

- How to use and distribute the light?
  → Light pipes
Properties

Typical Parameter:

- Power: 1.400 W
- Diameter of the bulb: ca. 30 mm
- Luminous flux: 135.000 Lumen
- Offset time: 25 s
- Lifetime (Illuminant): 60.000 h
- Lifetime (Magnetron): 20.000 h
- Luminous efficiency: 95 lm/W
Properties

- Color temperature: ~6.000 K
- Nearly solar spectra
- Low emission in UV and IR
- Dimmable
- Relatively long lifetime
- Does not harm the environment
- Reduce the required amount of energy
Properties

- Maximum at 536 nm (eye sensitive curve) $\rightarrow$ greenish (adjustment due to use of other materials or color filter)
- High voltages are required
- Short lifetime of the magnetron
- Magnetron consumes the most energy
- Need of rotation and cooling
Comparison to other Light Sources

- Compared parameter: $\text{Im}/\text{W}$
  - Sulfur lamp: 80 – 1353
  - Sodium low pressure: 100 – 200
  - White LED: 20 – 150
  - Energy saving lamp: 35 – 75
  - Mercury high pressure: 30 – 60
  - Halogen lamp: 14 – 25
  - Incandescent lamp: 5 – 16
Comparison to other Light Sources

Incandescent lamp

White LED

Sulfur lamp

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Application

- Light therapy
- Horticultural Research
- Light pipes → Architectural highlights
- TV studios
Application

- Sundsvall–Härnösand Airport, Sweden
- U.S. Air and Space Museum, Washington D.C.
- Headquarter of DONG Energy, Denmark
Research

- Cheap, efficient microwave source with long lifetime
- Low wattage sulfur lamps
- How to get rid of rotating an cooling
- Sulfur lamps with electrodes (since 2006)
  - German Patent (2011)

![Diagram of sulfur lamp with labeled parts 1 to 5]
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Thank you for your Attention