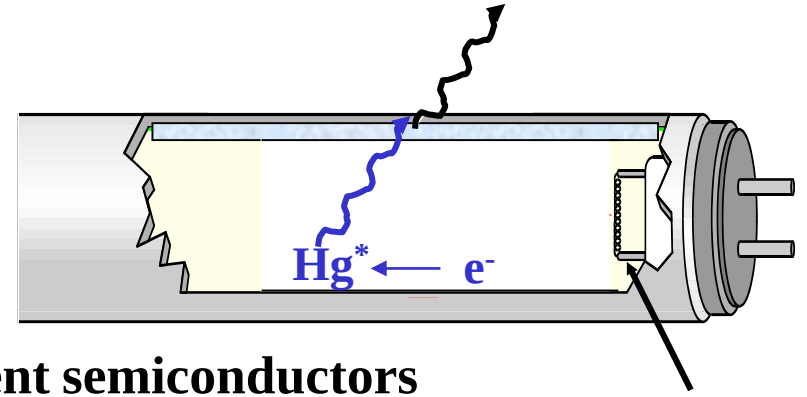
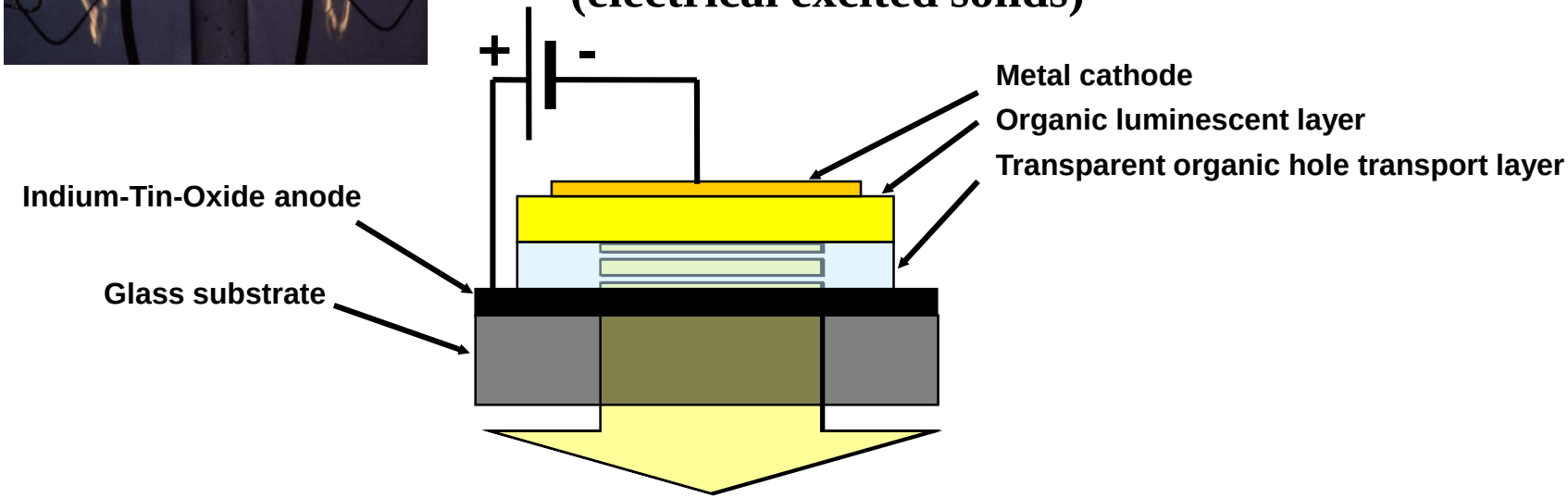
3. Physical Concepts of Light Generation

Black body radiator
Incandescent solid state compounds or metals

Gas discharges
(excited gas atoms/molecules)



Electroluminescent semiconductors
(electrical excited solids)



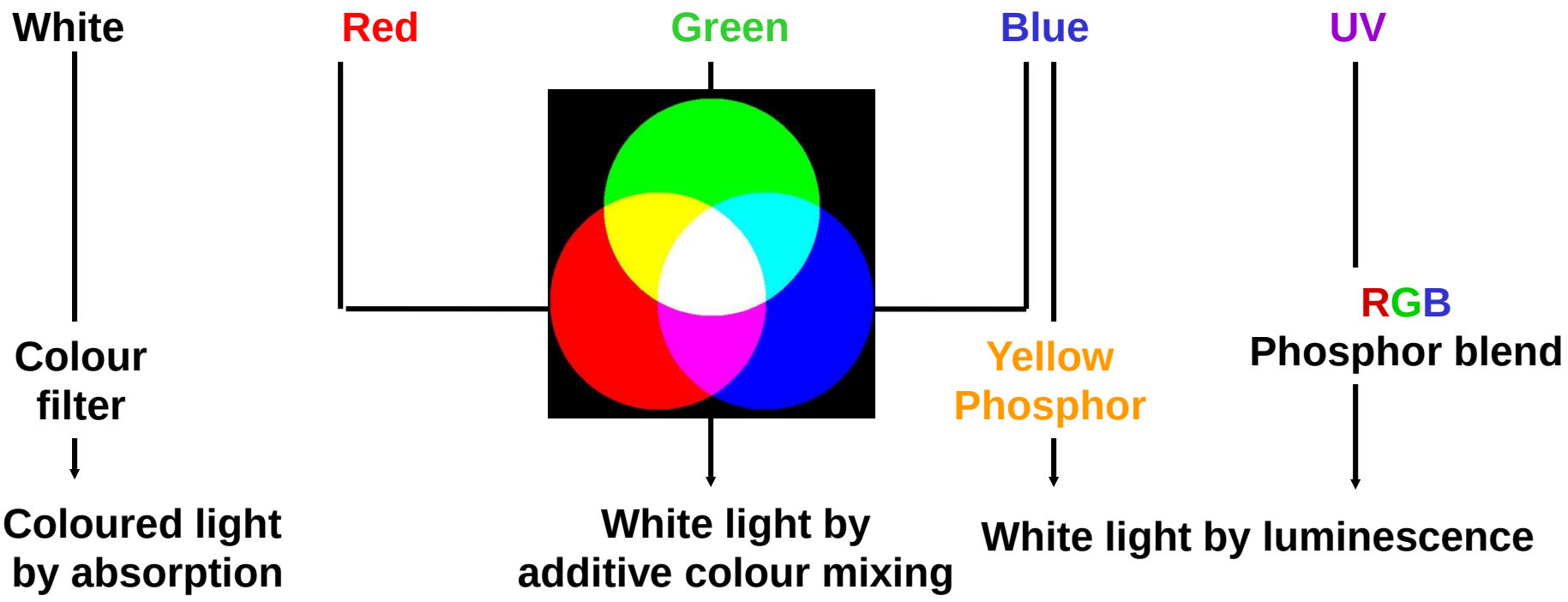
3. Physical Concepts of Light Generation

Generation of white and colour light

Black body radiators ⇒ visible white light + IR

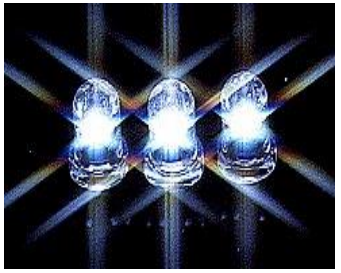
Gas discharges ⇒ UV + visible coloured light

Electroluminescent semiconductors ⇒ visible coloured light



3. Physical Concepts of Light Generation

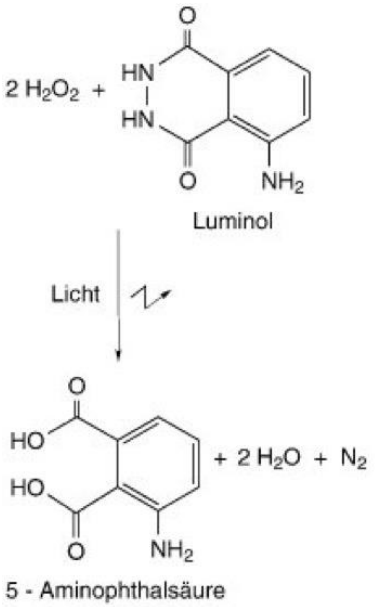
Classification of light sources

Incandescent and halogen lamps	*Gas discharge lamps/displays*	*Inorganic + organic light emitting diodes*	*Exotics*
 	 	 	**Laser** **Laser diodes** **Cluster lamps (Dicharge and incandescence)** **Chemical light sources**
thermal →	**non-thermal**	**non-thermal**	**non-thermal**

3. Physical Concepts of Light Generation

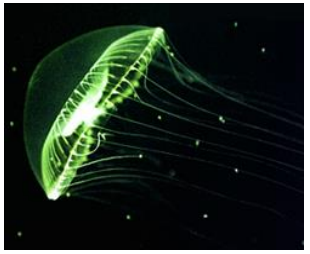
Chemical light sources: Bio- and chemiluminescence

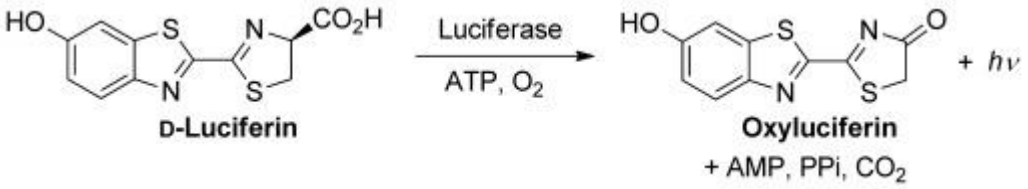
Chemiluminescence
Generation of light by a chemical reaction, e.g. cleavage of luminol

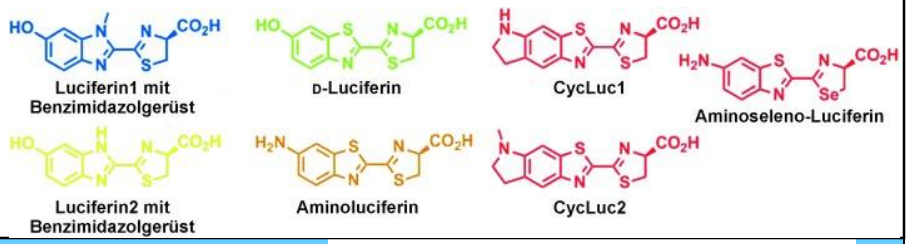


Bioluminescence
Chemiluminescence in living organisms such as

- **insects like fireflies**
- **deep sea organisms like the Anglerfish**
- **jellyfish like Aequorea victoria**
- **microorganisms**







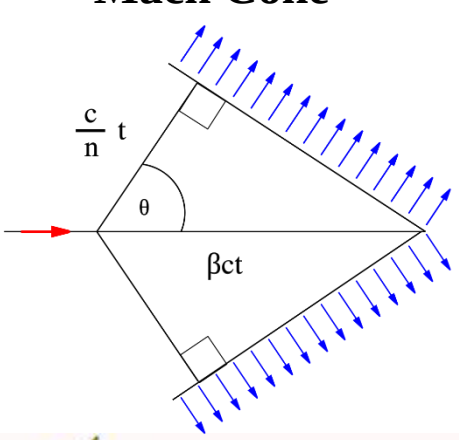
Ref.: W. Guo et al., Angew. Chem. 124 (2012) 8554

3. Physical Concepts of Light Generation

Other Processes

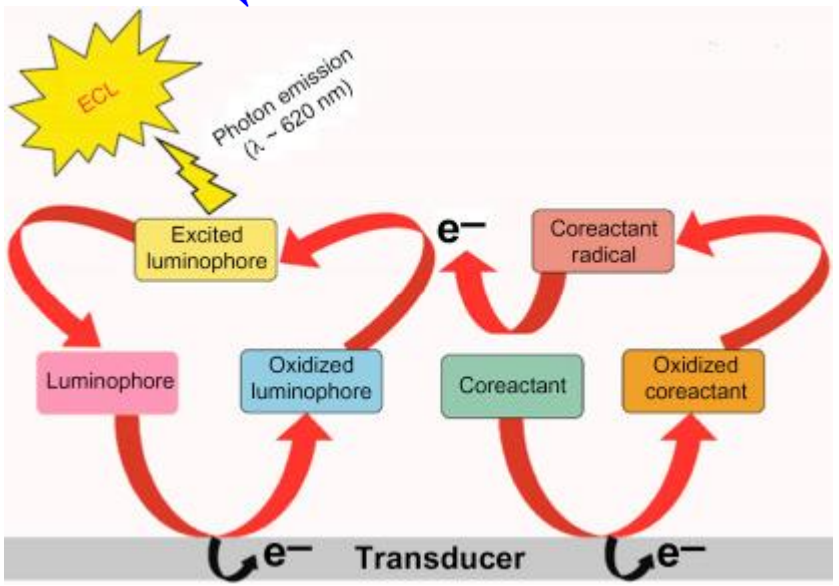
- **Cherenkov radiation**
- **(after Soviet Scientist Pavel Cherenkov)**
  with t = time and
  ß = speed of particle v_p/speed of light c_{medium}

Mach Cone



- **Electrochemoluminescence (ECL)**
  with $Ru^{2+/3+}$ complexes such as $[Ru(bpy)_3]^{2+}$

Lit.: Anal. Bioanal. Chem. 407 (2015) 3911–392



Main applications: Analytics and diagnostics