THE ELECTRO MAGNETIC SPECTRUM

Wavelength (metres)

Radio: $10^3$
Microwave: $10^{-2}$
Infrared: $10^{-5}$
Visible: $10^{-6}$
Ultraviolet: $10^{-8}$
X-Ray: $10^{-10}$
Gamma Ray: $10^{-12}$

Frequency (Hz)

$10^4$ $10^8$ $10^{12}$ $10^{15}$ $10^{16}$ $10^{18}$ $10^{20}$
Artist Rendition of Solar Wind
Created by: K. Endo

Photo Courtesy of Prof. Yohsuke Kamide
National Geophysical Data Center
Visual

Biological

Emotional

Well Being
Our research about ambient lighting, light and health

Direct or direct/indirect light?

Does ambient light affect learning?

Does pupils feel and perform better in indirect LED?

Vertical light – does levels and colour temperature matter?

Vertical light – LED or T5?

The third receptor!
Cortisol Adrenal cortex

Pineal gland

Visual cortex

Hypophysis - regulates daily and seasonal circadian rhythms

Optic nerve 1-2 receptor rods and cones

Biologic nerve 3 receptor

Retina

Adrenal cortex Cortisol (spinal cord)

Visual Photopic lane

Biological lane
Fluorescent T5-tubes 3000K

Fluorescent T5-tubes 4000K

\[ L_{av\ 1} = 20 \text{ cd/m}^2 \]
\[ L_{av\ 2} = 100 \text{ cd/m}^2 \]
\[ L_{av\ 3} = 350 \text{ cd/m}^2 \]

\( E_h = 500 \text{ lx} \)

\( \pm 30^\circ \)

36 subjects

Methodology of the test

Test room 1

Test room 2
The Pickhurst study
Math

Progress

Grade

Dark season  Whole school year


C1 Control room

E1 Experimental room
Reading Grades

Progress

Grade

Dark season

Whole school year

Ground floor

Ground floor

2008 Sept – 2009 Jan

2008 Sept – 2009 May

C1 Control room

E1 Experimental room

C1 E1 C1 E1
What is a solid angel?

Ø: 14mm

D: 40cm

0,5 Sr

50cm
View from my office
Luminance view from my office
View at my desk
My environment

< 0.1 Sr

< 0.5 Sr

Vertical reference line

Horizontal reference line
Luminance view at my desk

< 0,5 Sr

< 0,1 Sr
Evening view at my desk
Luminance evening view at my desk

< 0.5 Sr

< 0.1 Sr
Legende

1  200 lx und 3 000 K
2  Beleuchtungsniveau entsprechend Erfordernis der Sehaufgabe auszuführen
3  250 lx und 8 000 K
Biologisch wirksame Beleuchtung – Planungsempfehlungen

Biologically effective illumination – Design guidelines

Effets biologiques de l'éclairage – Conseils de conception
A few inspirational books..

Available as a free download in iBook store