Universidade do Minho
Escola de Ciências

LIGHT AND ART

How light inspires art and how some forms of art are made of light

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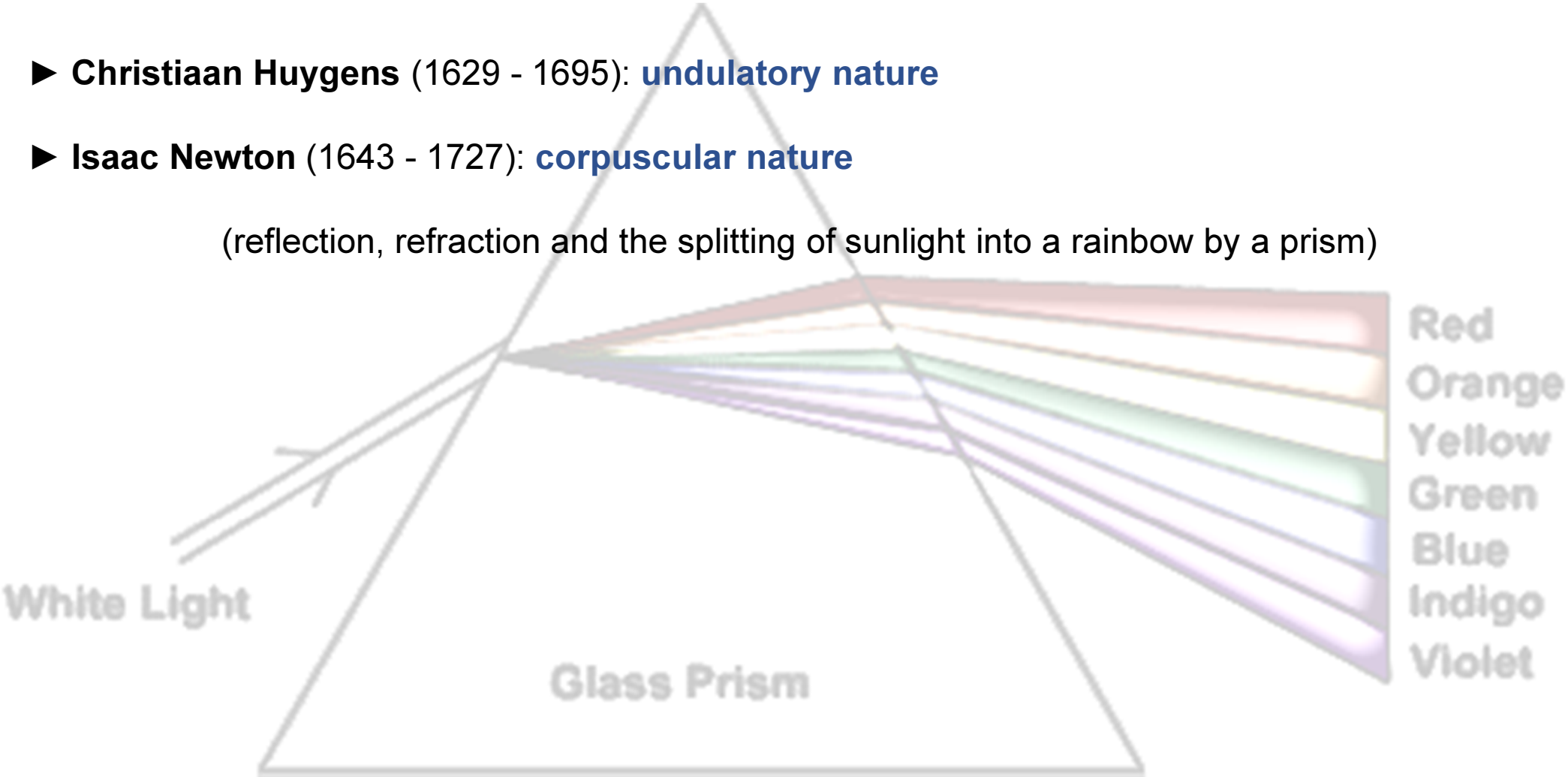
Echo and Narcissus (1903), John William Waterhouse

Light: some milestones

- **Christiaan Huygens** (1629 - 1695): **undulatory nature**
- **Isaac Newton** (1643 - 1727): **corpuscular nature**

(reflection, refraction and the splitting of sunlight into a rainbow by a prism)



Light: some milestones

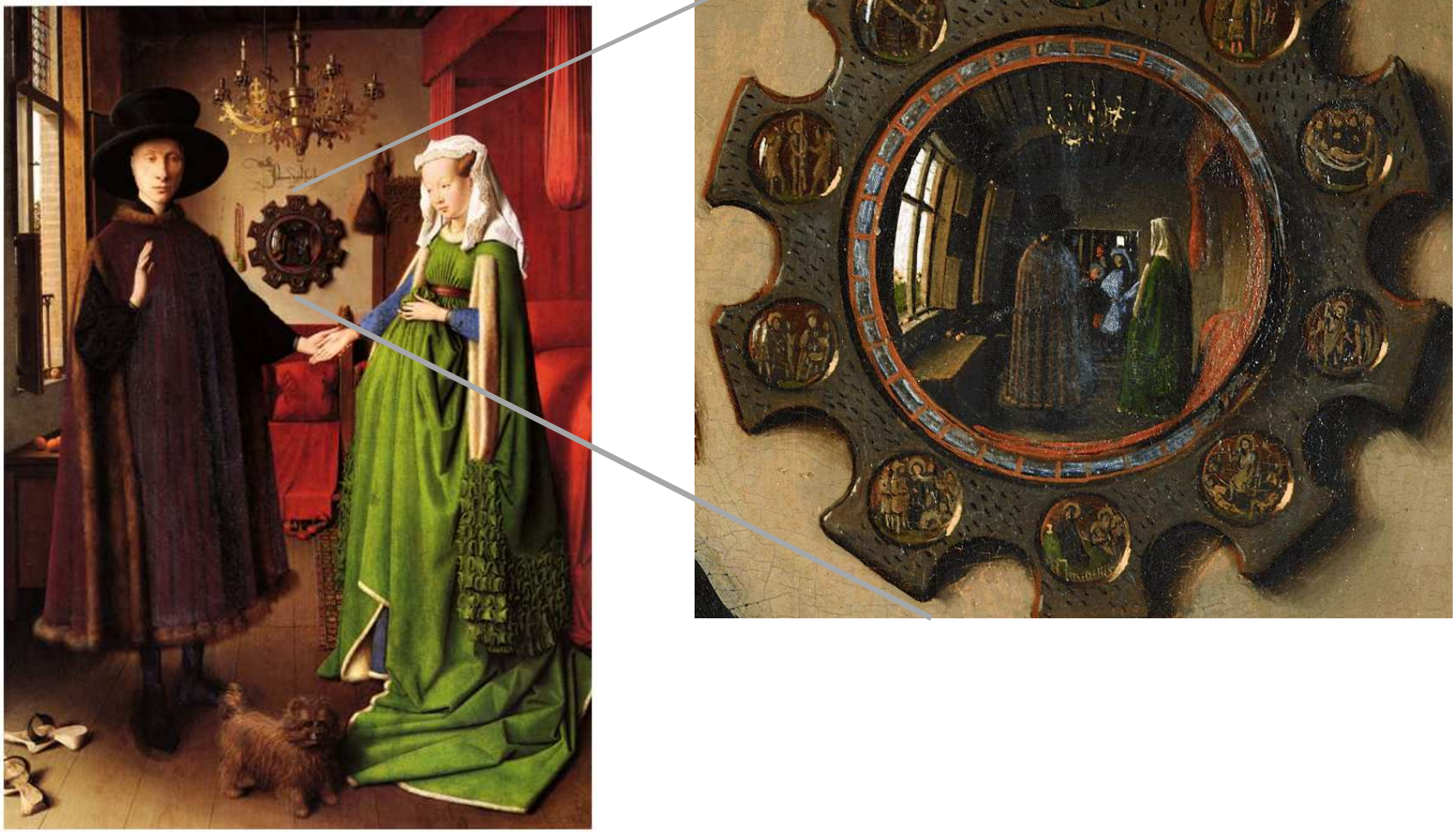
► **Thomas Young** and **Augustin-Jean Fresnel** (early 19th century): double-slit experiments **interference patterns**

► **James Clerk Maxwell** (1865): light as the **propagation of electromagnetic waves**

► **Heinrich Hertz** (1887): Maxwell's equations experimentally verified; **wave theory widely accepted**

► **Max Planck** (1900): blackbody radiation ***(E = hν)*** **quantum theory**

► **Albert Einstein** (1905): **photon**



The Arnolfini Portrait (1434), Jan van Eyck

A Bar at the Folies-Bergère (1882), Édouard Manet

Impression - sunrise, 1872, Claude Monet

Study of Water (1976), David Hockney

A Large Diver (1978), David Hockney

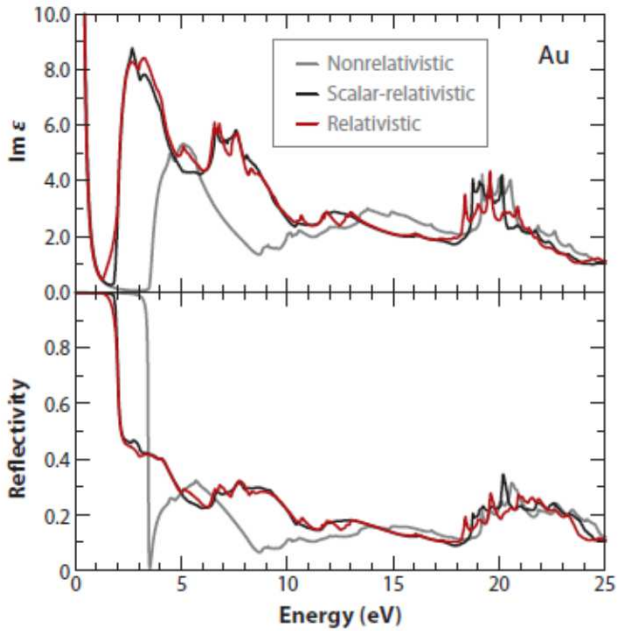
Gold used in the representation of the divine

The Aberdeen Bestiary (1542)

Gold absorbs ***blue*** photons due to the electronic transitions $5d^{10}\ 6s^1 \leftrightarrow 5d^9\ 6s^2$

(Silver: $4d^{10}\ 5s^1 \leftrightarrow 4d^9\ 5s^2$ UV photons)

Relativistic effects in the gold atom



Annu. Rev. Phys. Chem. 2012. 63:45–64

Gold used in the representation of the divine

Monreale Cathedral (Sicily), 12th century

I am the light of the world,

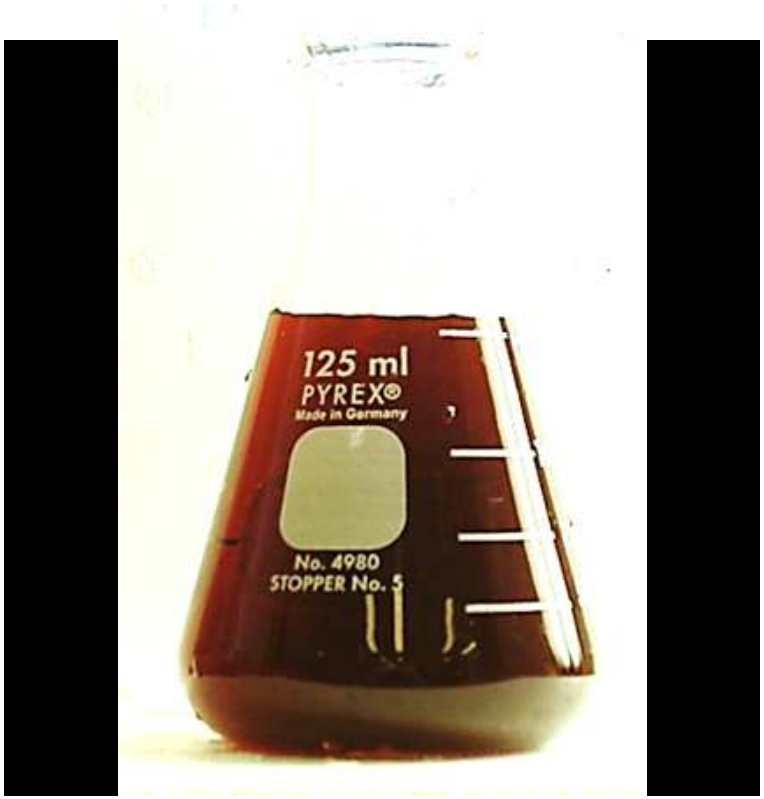
he who follows me

shall not walk in darkness,

but shall have the light of life.

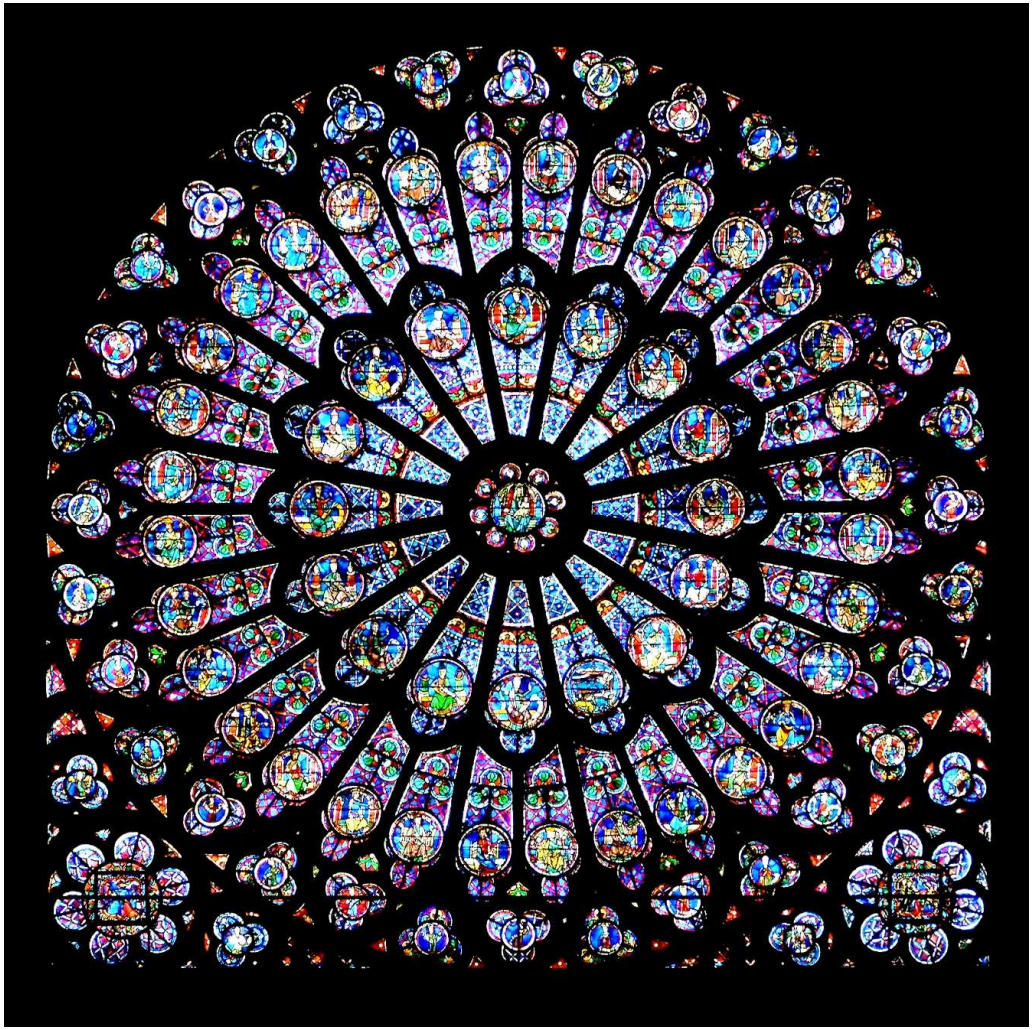
John 8:12

Did the Romans invent nanotechnology? 1,600-year-old jade green goblet glows red because of silver and gold particles in the glass



Lycurgus Cup

Colloidal systems can give rise to light scattering phenomena that result in color effects.



Gothic stained glass rose window of Notre-Dame de Paris.
Some colors were achieved using gold nanoparticles.

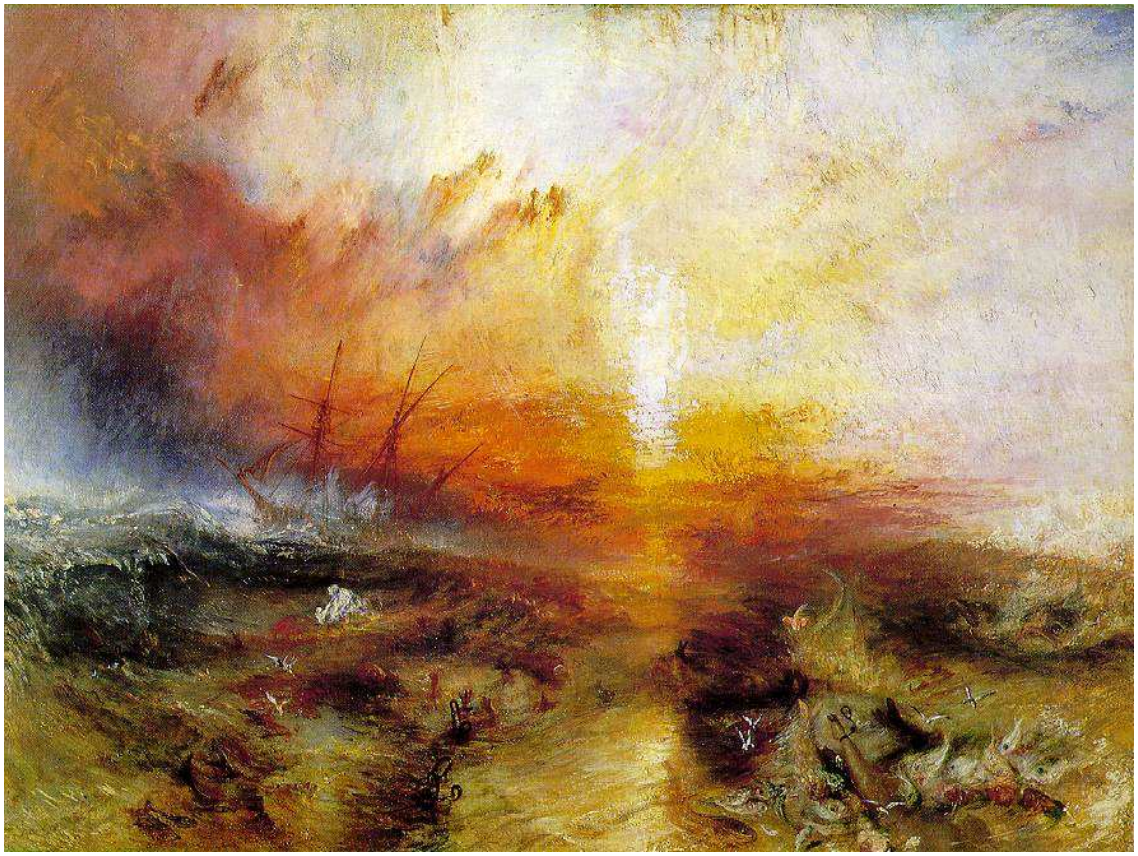
Masters of Light

Conversion on the way to Damascus (1601), Caravaggio

Masters of Light

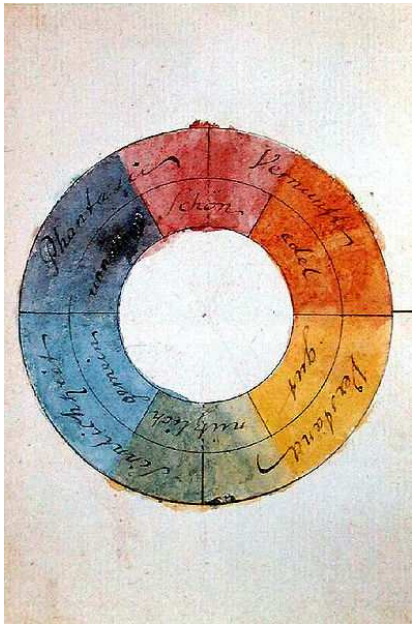
A Philosopher giving a lecture on the orrery in which a lamp is put in place of the Sun (1766), Joseph Wright of Derby

Masters of Light



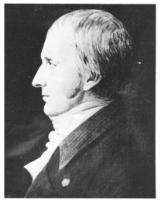
The Slave Ship (1840), William Turner

Theory of Colours (*Zur Farbenlehre*, 1810)
Goethe‘s views on the nature of colors and how these are perceived by humans



Goethe's color wheel with associated symbolic qualities

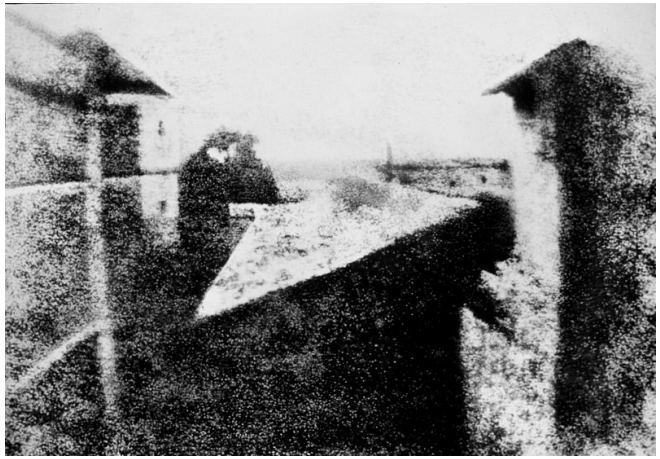
Photography



Thomas Wedgwood (1771-1805) light-sensitive chemicals (silver nitrate) to capture silhouette images on durable media such as paper.

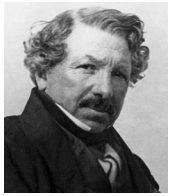
Nicéphore Niépce (1765-1833): earliest surviving photograph of a real-world scene; made use of a *camera obscura* and plates covered with bitumen of Judea, a resinous material that gets hard when exposed to light (polymerization).

Leaf (*circa* 1800),Thomas Wedgwood



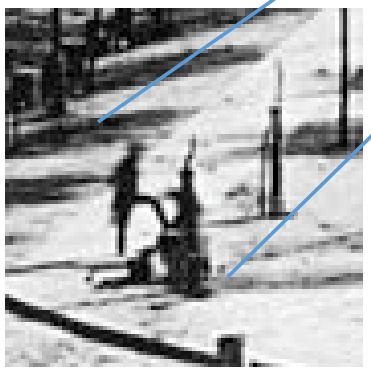
View from the Window at Le Gras (1826 or 1827), Nicéphore Niépce

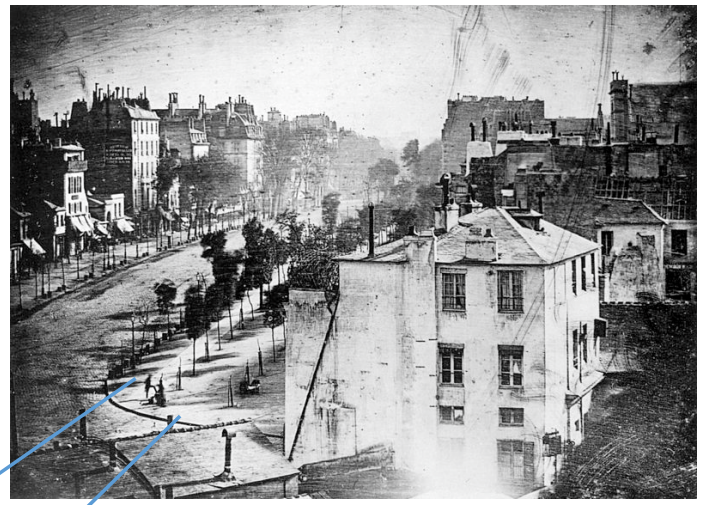
Photography



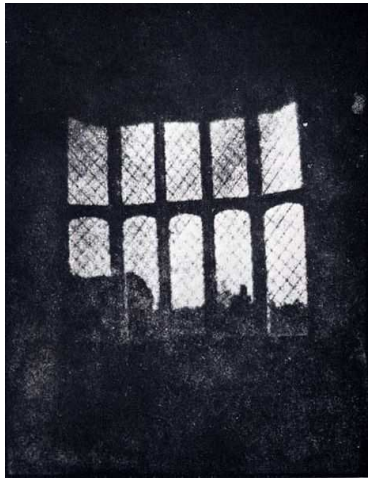
Louis Daguerre (1787-1815): plates covered with silver iodide, affording a negative (unique!)

William Henry Talbot: silver chloride; the excess was eliminated in a bath of NaCl: a negative that could be reproduced





Boulevard du Temple, Paris (1838), L. Daguerre



Latticed window at Lacock Abbey (1835), W.H. Talbot
(a positive from what may be the oldest existing negative)

Color Photography

James Clerk Maxwell: the *three-color method*

Colored ribbon (1861) - The first color photograph made by the method suggested by James Clerk Maxwell in 1855 (photographer: Thomas Sutton)

Color Photography

Gabriel Lippmann (Nobel Prize in Physics 1908)

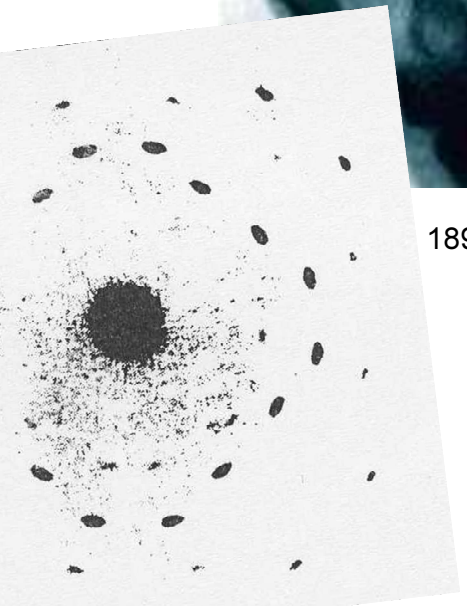
"for his method of reproducing colours photographically based on the phenomenon of interference"

Colour photograph made by Lippmann in the 1890s

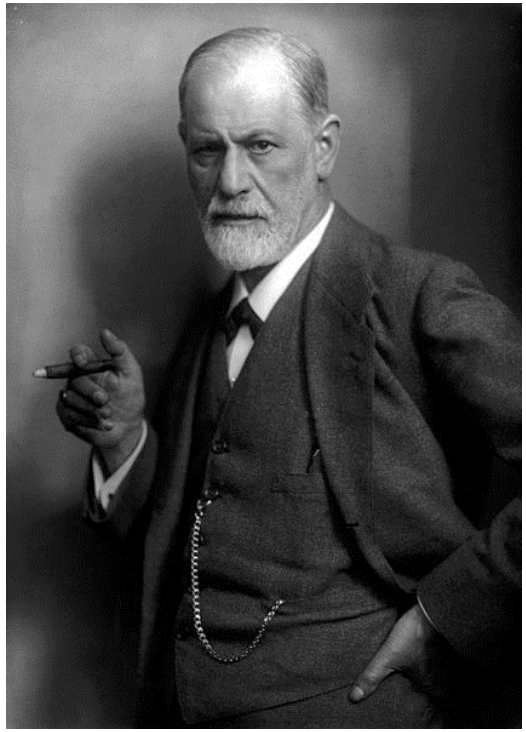
In the same day Wilhelm Röntgen submitted the paper "On a new kind of ray: A preliminary communication" to the *Würzburg's Physical-Medical Society Journal*

Workers Leaving the Lumière Factory in Lyon
The first public screening of films was held on 28-12-1895

CINÉMATOGRAPHE LUMIÈRE



1895



The Interpretation of Dreams (1899)

1898

Haunted rays

X-rays

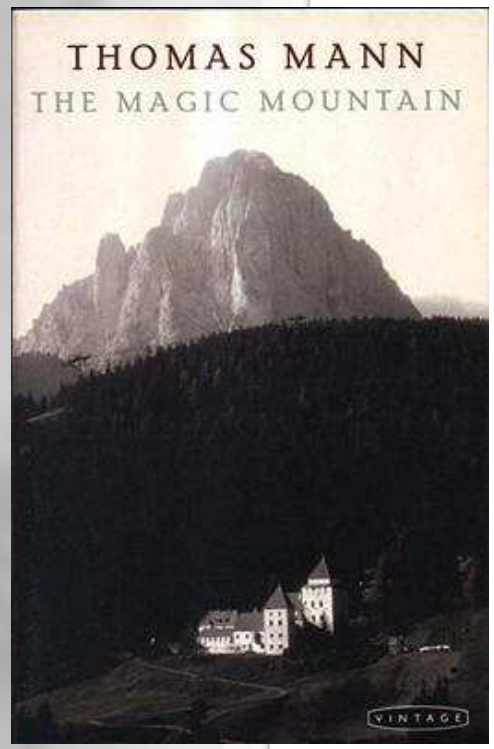
The inside and outside became ambiguous concepts; the opaque became transparent

Radioactivity

The seemingly unlimited amounts of energy suggested that space was full of alpha, beta, gamma and X-rays flying everywhere and unveiling everything

Connection to supernatural

The occult; the *ether* - the medium through which heat, light, electricity, and magnetism could move (Heinrich Hertz, James Clerk Maxwell,… and even after the 1910s); **revival of mesmerism**



Thomas Mann's ***The Magic Mountain*** (1924): "a radiological cabinet described in mystical ways, when the protagonist, Hans Castorp, receives from a screening an uncanny premonition of death"

Do the roots of cubism lie only within art?

Art historians: the roots of cubism can be found in Paul Cézanne and primitive art, but…

…**developments in science and technology contributed to the very definition of *avant-garde***

Airplanes, wireless telegraphy, automobiles,… altered everyone's **conception of space and time**

Mathematics: **"exotic" new geometries that could be represented in more than three dimensions**

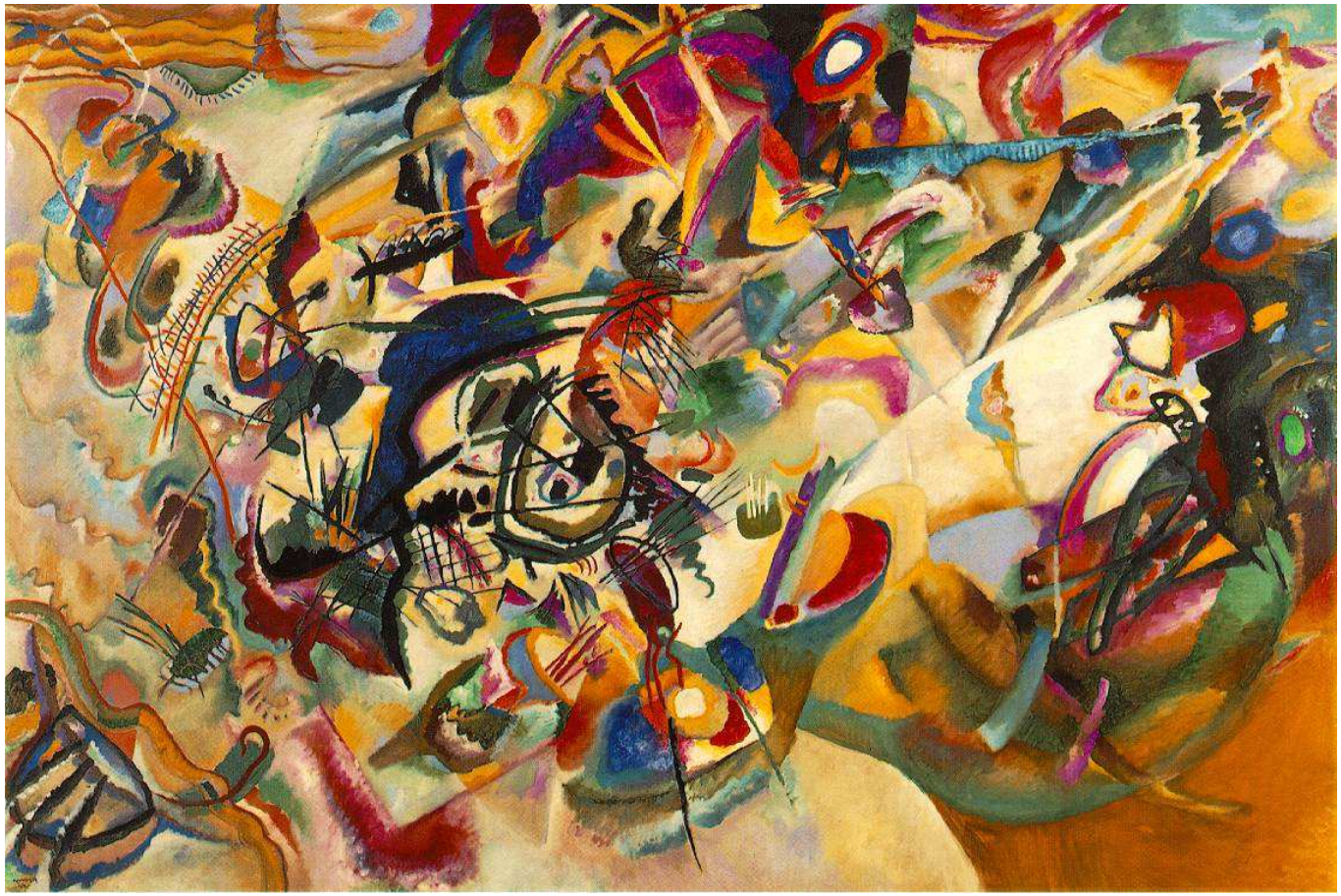
Einstein's 1905 **Theory of Relativity**

A.I. MILLER, *Einstein, Picasso - Space, Time, and the Beauty That Causes Havoc*

The things that Picasso could see were the things which had their own reality, reality not of things seen but of things that exist.

Gertrude Stein

Les Demoiselles d'Avignon (1907), Pablo Picasso

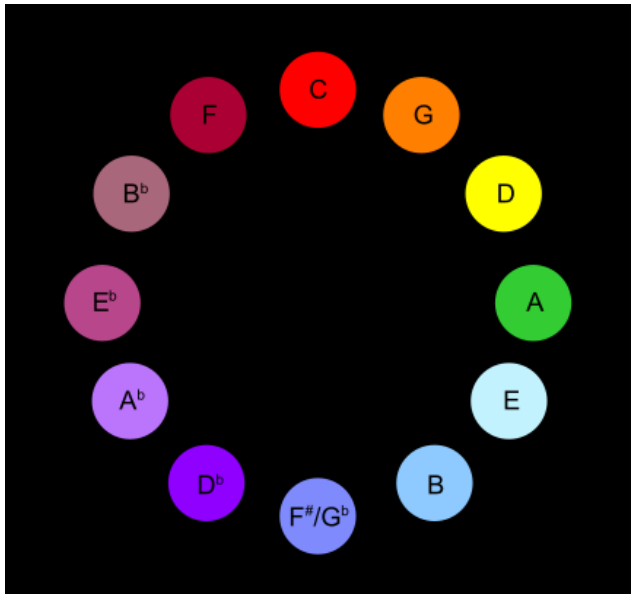


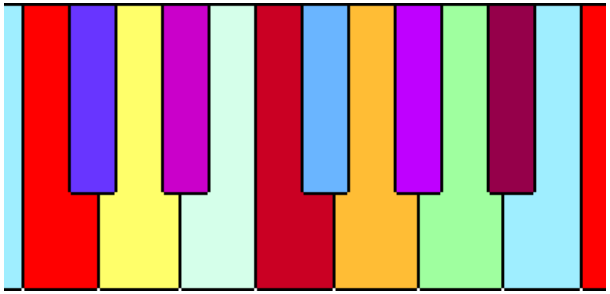
Composition VII (1913), Wassily Kandinsky

Loïe Fuller on stage (1902), Frederick Glasier

Loïe Fuller (1892), Toulouse Lautrec

Alexander Scriabin (1871-1915) – *The composer of light*





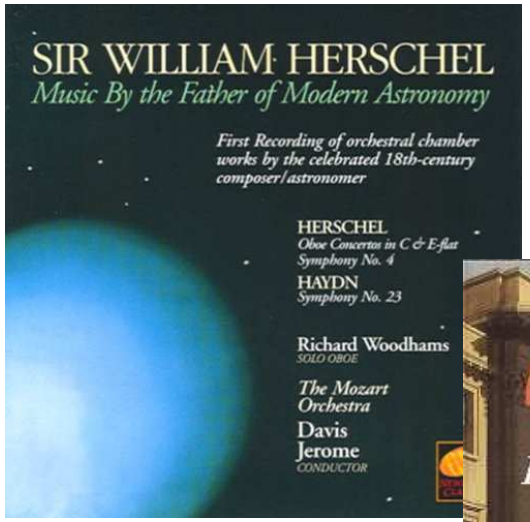
Tone-to-color mapping of Scriabin's *Clavier à lumières* for *Prometheus: Poem of Fire* (1910)

Scriabin's color associations were influenced by Newton's *Opticks* (1704)

Other synesthete composers: Rimsky-Korsakov; György Ligeti, Olivier Messiaen,…

William Herschel (1738 -1822)

Discovered the infrared radiation in sunlight



Herschel's complete musical works:

18 symphonies for small orchestra (1760–1762)
6 symphonies for large orchestra (1762–1764)
12 concertos for oboe, violin and viola (1759–1764)
2 concertos for organ
6 sonatas for violin, cello and harpsichord (published 1769)
12 solos for violin and basso continuo (1763)
24 capriccios and 1 sonata for solo violin
1 andante for two basset horns, two oboes, two horns and two bassoons

Vaudemont

So deep in your heart there is no desire

To see Light the glory of the Universe?

Iolanta

What does mean "to see"?

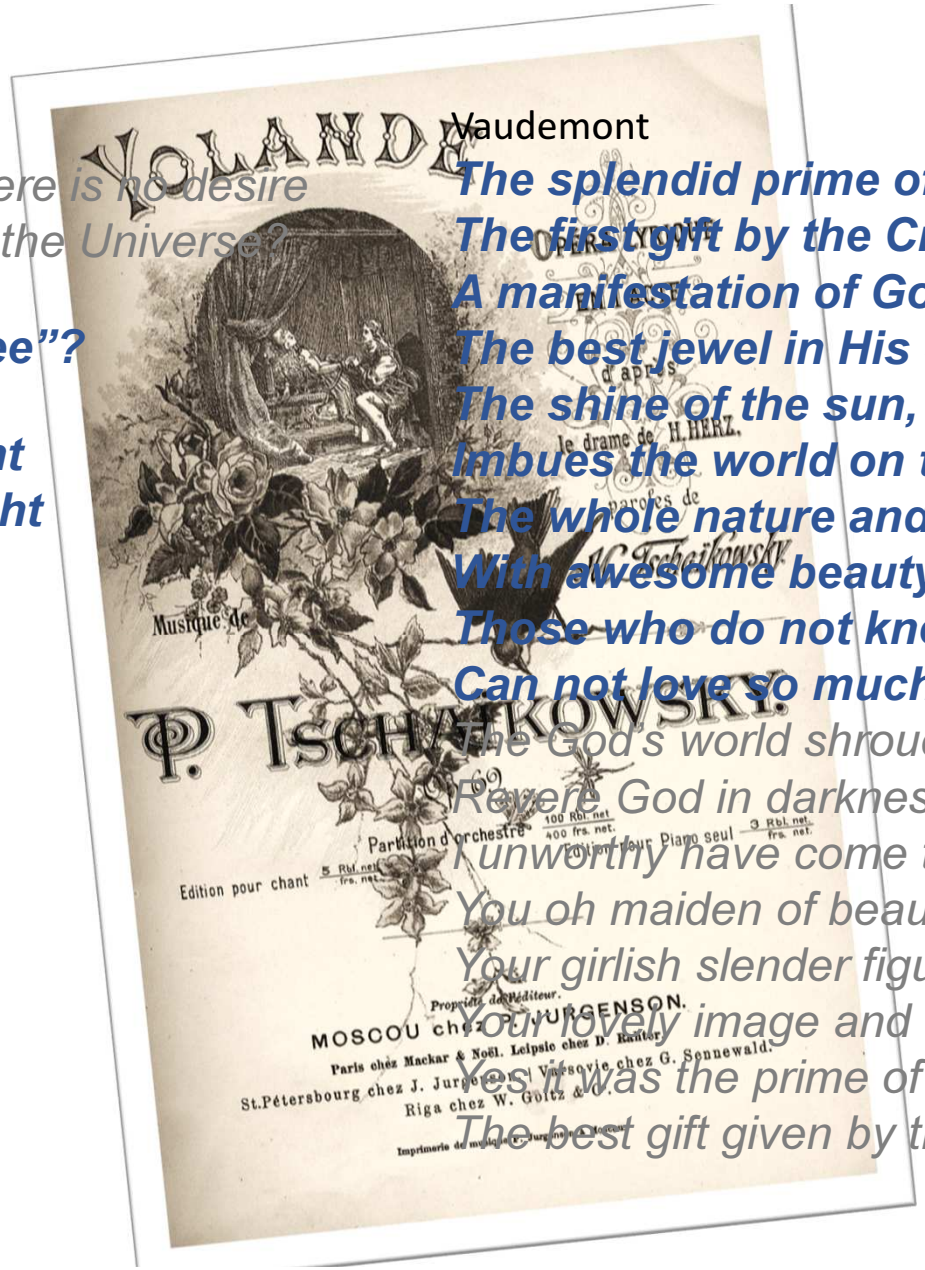
Vaudemont

To embrace God's Light

To embrace shining light

Iolanta

Knight, what is Light?



Vaudemont

The splendid prime of creation,

The first gift by the Creator to the world,

A manifestation of God's glory

The best jewel in His crown.

The shine of the sun, sky, stars

Imbues the world on the Earth,

The whole nature and creatures

With awesome beauty.

Those who do not know a blessing of Light

Can not love so much.

The God's world shrouded in darkness

Revere God in darkness as in light.

I unworthy have come to know

You oh maiden of beauty

Your girlish slender figure,

Your lovely image and features

Yes it was the prime of the creation,

The best gift given by the Creator to the World.

Acknowledgements

ORGANIZATION OF

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