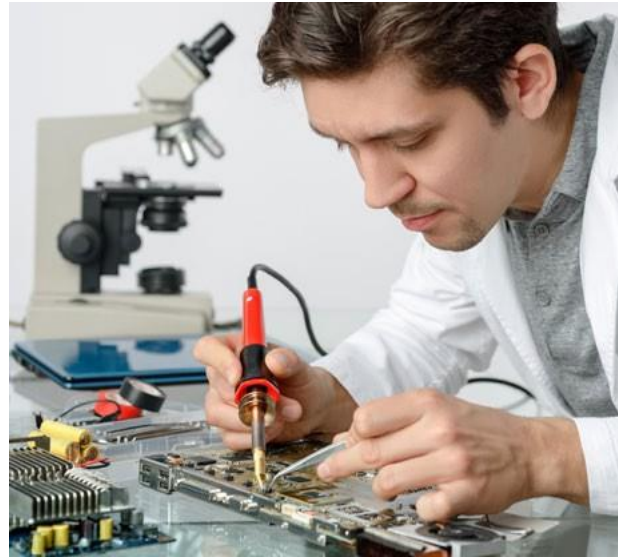# IQDEMY
Quantum Tech

INNOVATIVE ANTI-COUNTERFEITING SYSTEM

Using quantum dots for security market

Monitoring & Authentication of products by a secure combination of quantum dots printing technologies

Structural subdivisions of the IQDEMY holding:

IQDEMY chemicals

Formulation development for printing
(inks, varnishes, primers);

Ink and varnish production;

Production of quantum dot (nano-particles) ;

Quality control and testing.

DPS Digital Printing Systems Innovations
www.dps-innovations.com

UV LED curing unit production;

Control electronic systems;
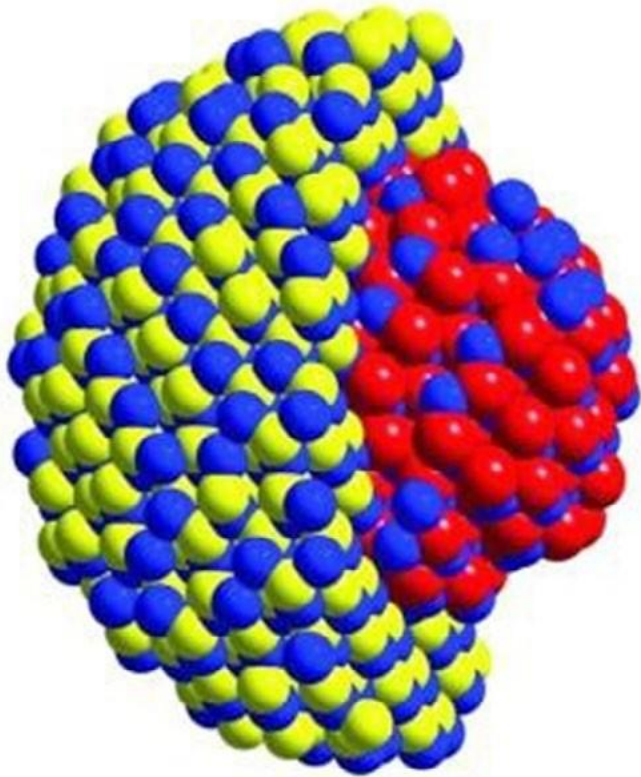
Software.

IQDEMY digital printing systems

Manufacturing of digital printing systems;

Customized industrial solutions and
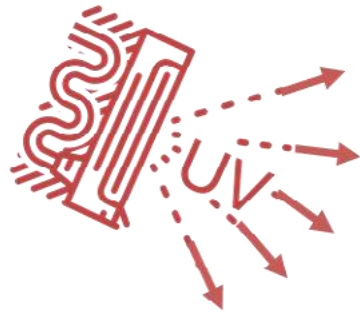integration into production lines;
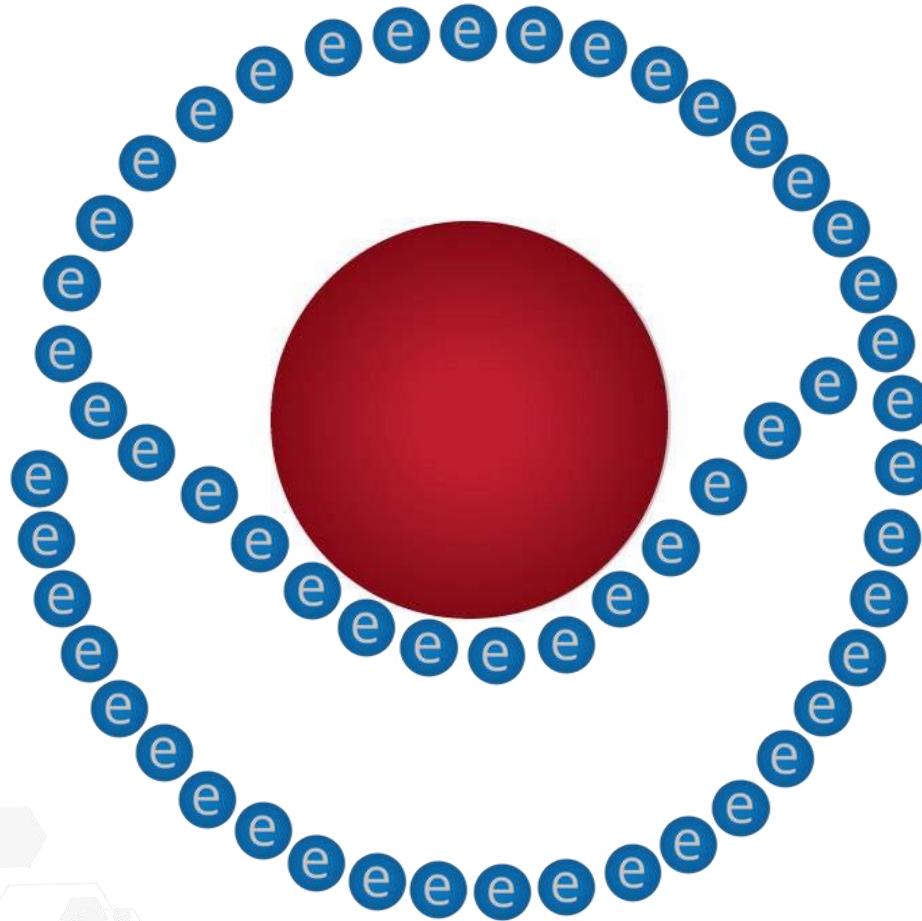
What are Quantum Dots ?

Quantum Dots (QD) are metal- based nano-particles possessing semi- conductive properties, absorbing light in UV spectrum and emitting it in a visible range. It is composed of such non- organic elements as Indium, or Graphene, or Perovskite etc., which range between 2-10 nm in size.
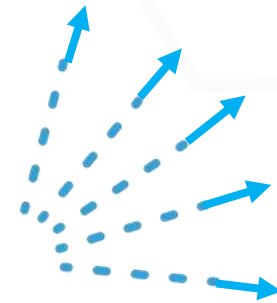
UV - Light (till 400nm)

100% Light

Light emission
(in visible range and color**)**

92-98% Light
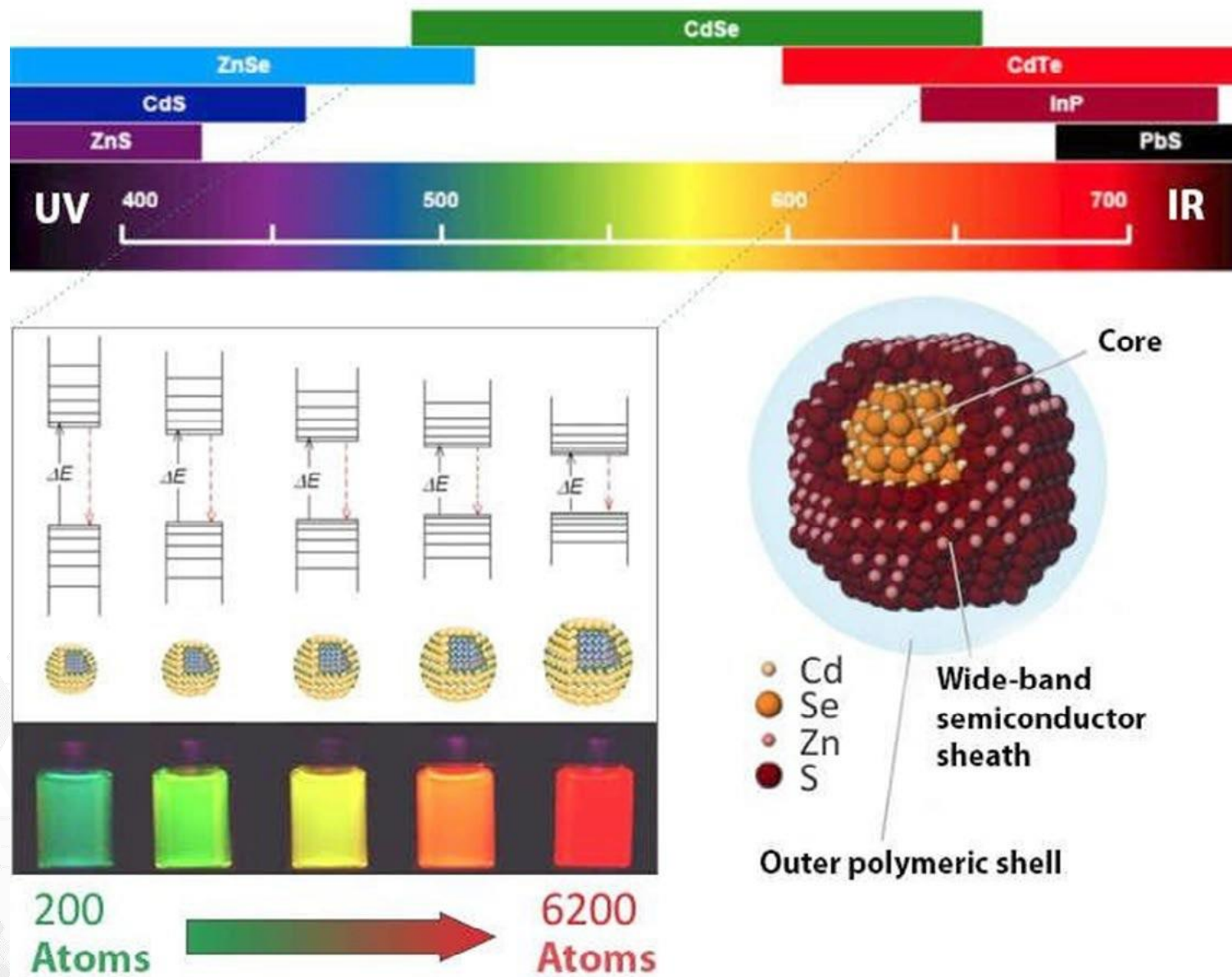
According to the chemical structure there are different types of QDs with various parameters to pay attention to

quantum yield (f max), & **the length of the wave (λ – red line by X axis)** & **full width at half maximum (FWHM)**
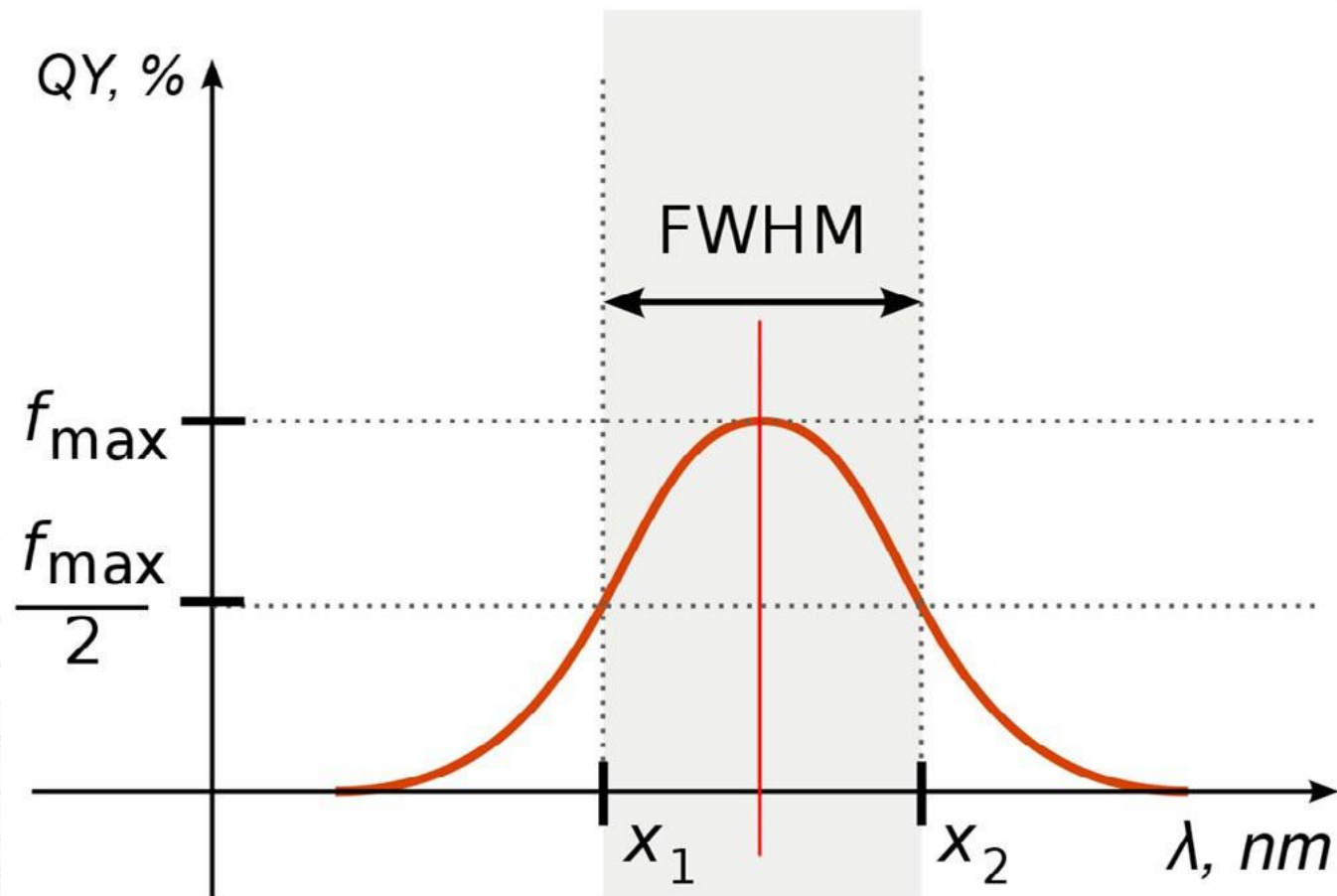
Depending on these parameters and synthesis conditions QDs can be adjusted and modulated in a wide range to get **million combinations.**

Quantum yield   The length of the wave   Full width at half maximum

Q(1)   L(1)   W(1)
Q(2)   L(2)   W(2)
.   .   .
.   .   .
.   .   .
.   .   .
Q(n)   L(m)   W(x)
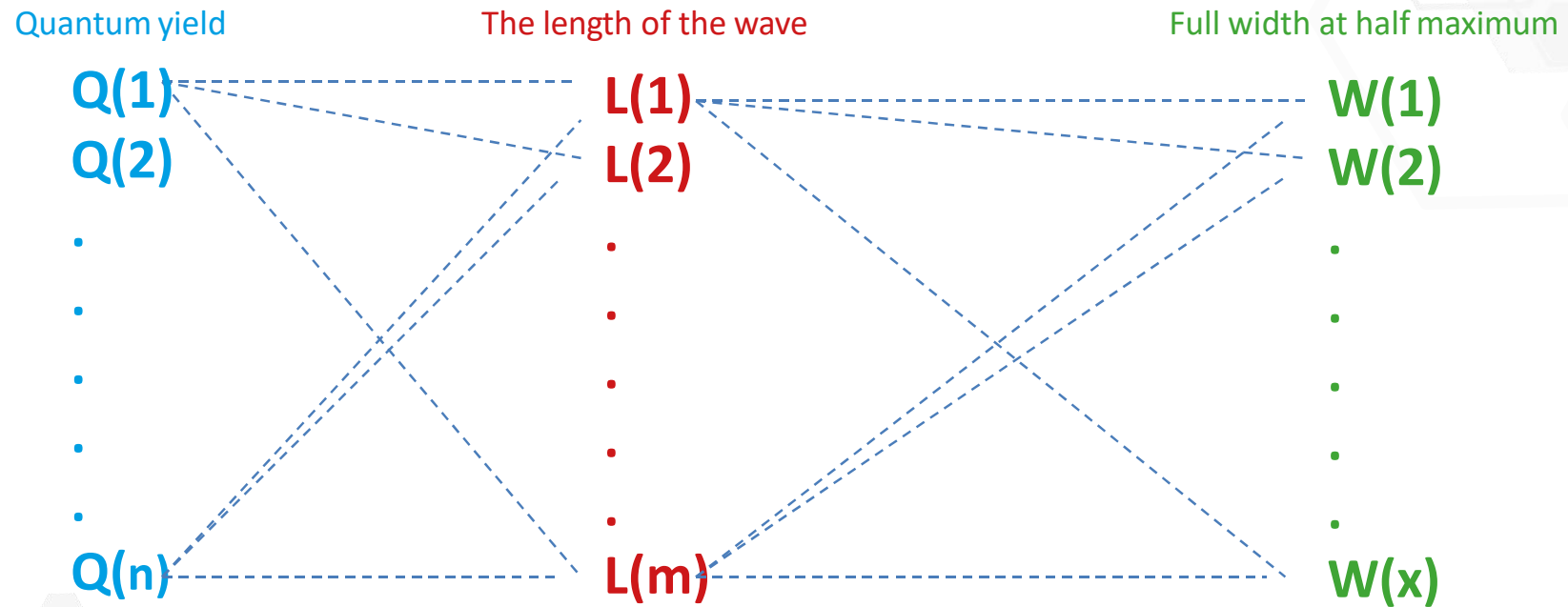
VARIATIONS OF QD = (n+m+x)!= million combinations

Regular security inks (luminophore = n!) have particular spectral characteristics, that impossible to change.

WHY NOT "NON ORGANIC LUMINOPHORE"?

Non organic luminophores do not have transparent colors, the size of pigment particles is huge (because the luminescence intensity depends on the size of the particles: the bigger particles the brighter luminescence).

→ it is impossible to produce inkjet inks using luminophores, **but traditional inks for offset, flexography, silk screen, etc.**

Size   Brigtness
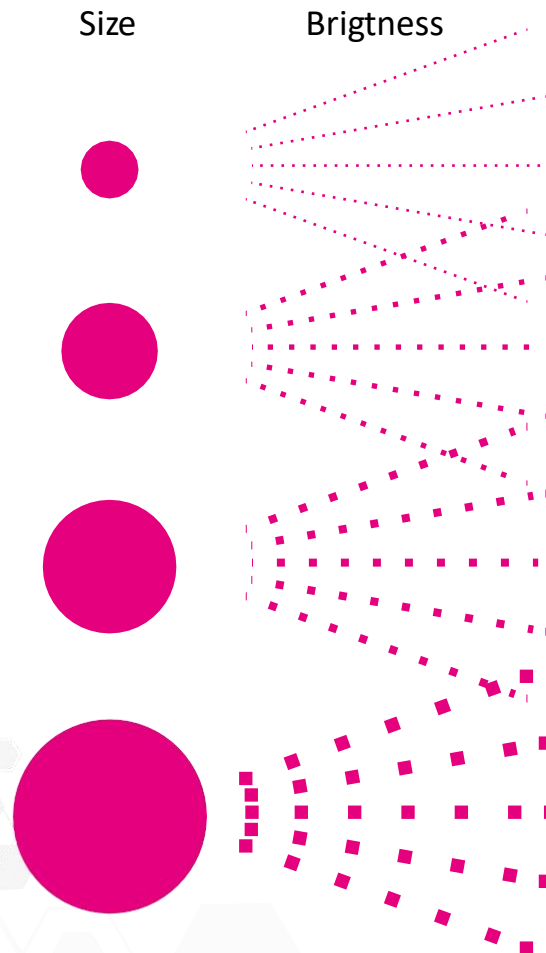
ORGANIC LUMINOPHORES OR QUANTUM DOTS?
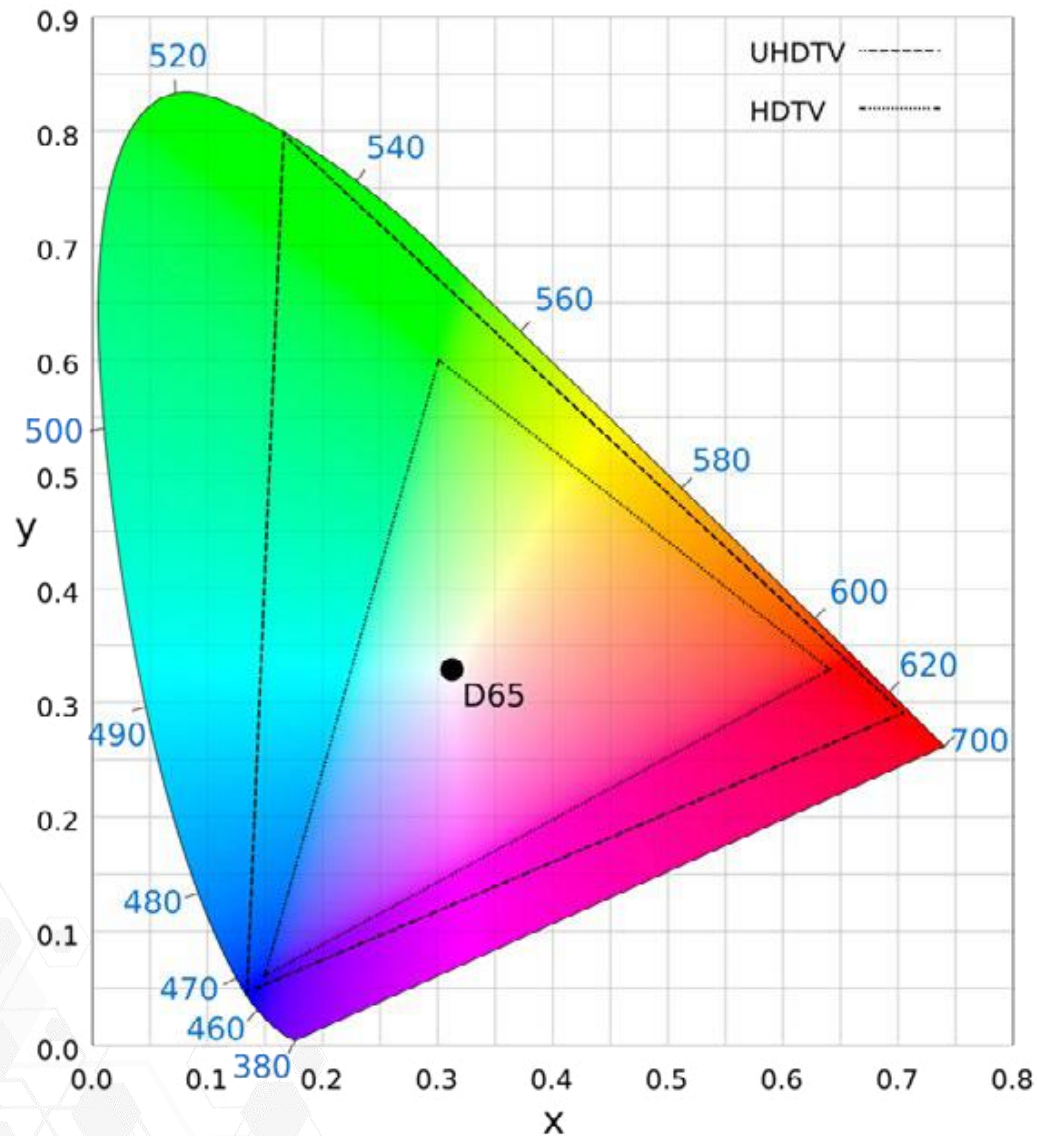
Organic luminophores:

- Easy to be dispersed, not resistant and quickly degrade florescence features;

- All parameters are not stable in a period of time;

- The colors of luminophores are not possible to be on a perimeter of the color plane, only inside;

- Each lumonipore has its own point inside the plane and it is not possible to move.

Quantum Dots:

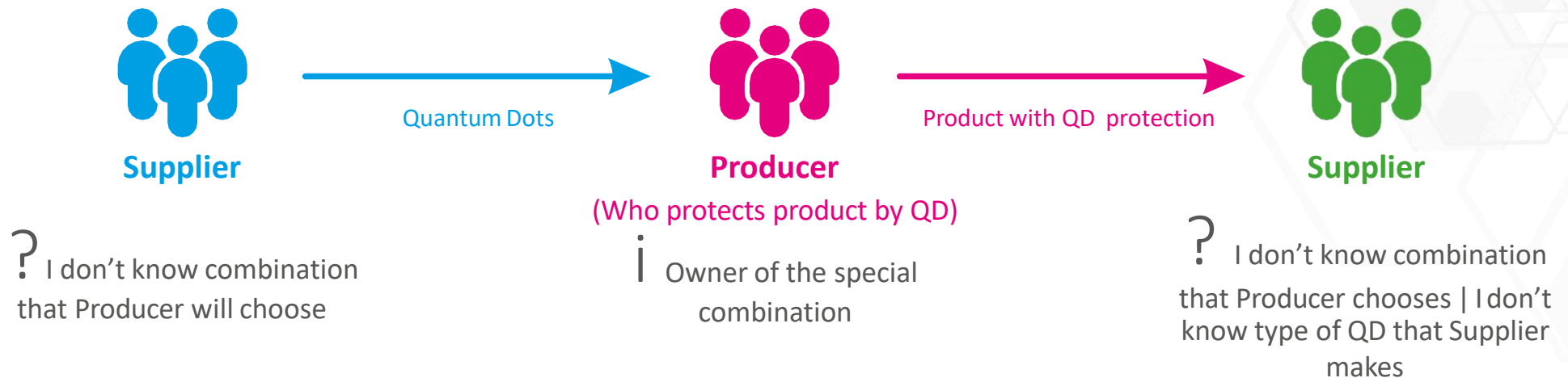- QDs have monochromatic radiation;

- Radiation peaks are close to physic model and are almost symmetric;

- The colors of QDs could be located only by perimeter of color plane of visible spectrum;

- It is possible to get any color of QDs in any point of the spectrum accurate to 1 nm.

However we can get **innumerable combinations** of different color combinations using raster imagine processors (RIP) of QD

QUANTUM DOTS ARE UNIQUE!

Supplier → Quantum Dots → **Producer**
(Who protects product by QD) → Product with QD protection → **Supplier**

? I don't know combination that Producer will choose

i Owner of the special combination

? I don't know combination that Producer chooses | I don't know type of QD that Supplier makes

- **In addition to the visible region of the spectrum we can also produce QDs that emit in the IR region (NIR – near infra-red и MIR – middle infra-red: 700-2000 nm).**

- **We can produce anti-Stokes type QD and Up-conversion QD (UC QD) (absorb in NIR and emit in visible spectrum)**

All these together allow to creat security systems to avoid counterfeiting

You can detect all types of QDs using the modern scanner in 1-2 ppm concentrations
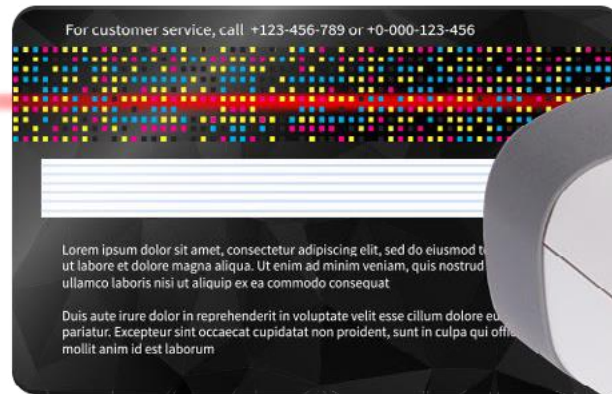
Using a few types of QDs allow to create QR-code systems

Using a few types of QDs allows to create QR-code systems instead of magnetic stripes.

This type of color code consists of 5 types of QDs that allows to code 2500 symbols instead of magnetic stripe

5 colors+ background color! 2500 symbols
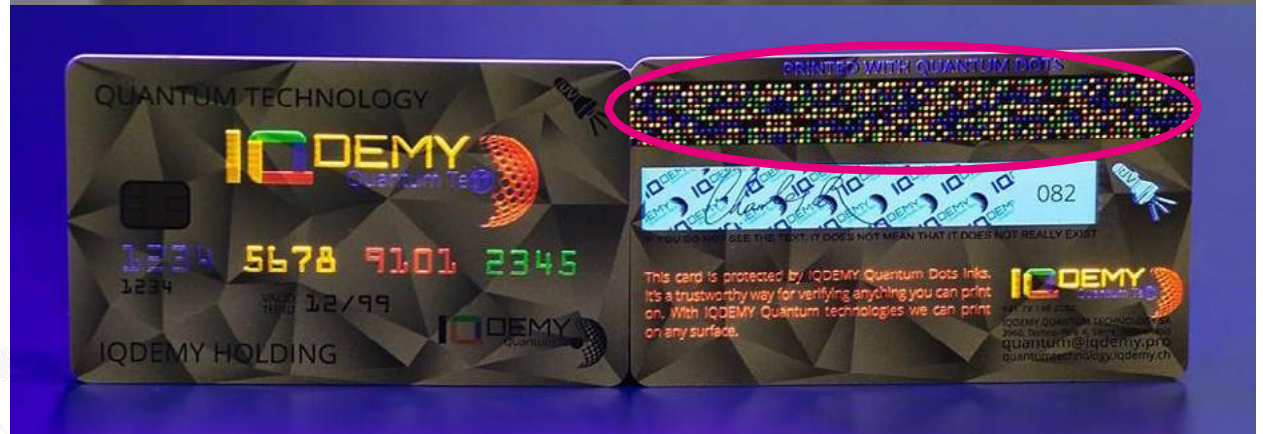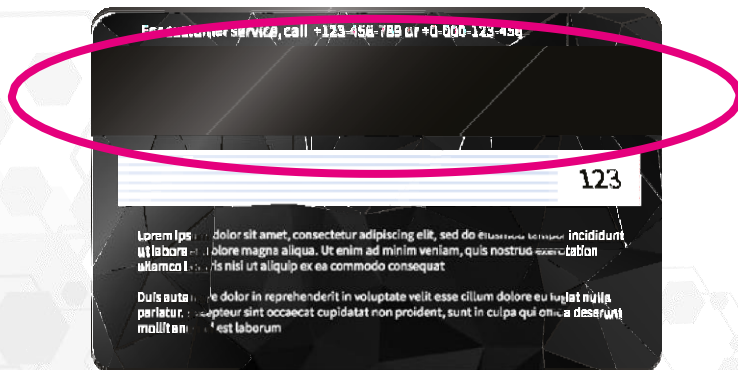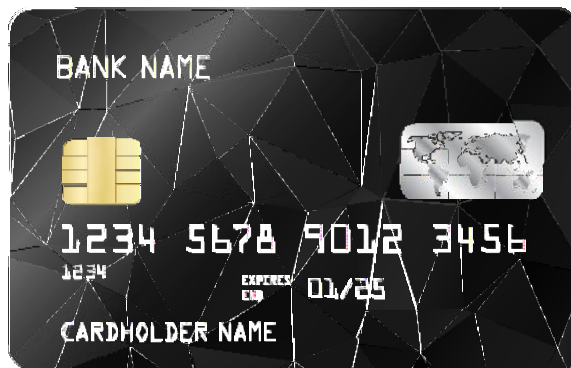
OPPORTUNITY TO INTEGRATE IN ANY PRODUCTION LINE
Printing on a wide range of substrates: from paper and cartons to glass and ceramics

SUBSTRATES
Paper, metal, plastics, wood, glass, foil, carton

QUANTUM QR & READING: ADVANTAGES QUATUM DOTS CODING

✓ **PRINTED SECURITY CODE WITH QUANTUM DOTS IS NOT POSSIBLE TO REALIZE WITH USUAL PRINTING, BECAUSE OF INHOMOGENEOUS BACKGROUND, CODE WILL BE UNREADABLE.**

Usual two-dimensional codes are the one-color matrix, each pixel is 1 information bit. QR-code is well known and widely used two-dimensional code. Such element can be coded by 2953 bites. This is approximately one page of printed text.

We develop QR-code expanded version with several colors. It allows to increase code capacity several times. By mixing shades, we have a unique color code, which, when using only 4 colors, produces 4.3 billion variants.

✓ **IT IS EXTREMELY DIFFICULT TO FORGE CODE AND MINIMUM CHANCES TO DECODE**

- Various parameters of quantum dot synthesis leads to difficulties in counterfeiting.

✓ **PRINTED SECURITY MARK WITH QUANTUM DOTS ISN'T VISIBLE UNDER NORMAL CONDITIONS**

- Quantum dots can be transparent (like lacquer, water-based)

✓ **RESILIENS AND UNIVERSALITY OF PRINTING**

- Quantum dots are included in special substance – water based solution or UV varnish, it allows to print on any material.

- Withstand temperatures up to 200-400 (in some cases 600°C), without changing structure and features (appropriate for lamination).

- Dose not change color over time up to 10 years (intensity may change, not color).

- Highly resistant to external chemical impact.

✓ **LOW-COST MARK**

Contrary to what one would imagine about high cost quantum dots and quantum dots based solutions, if we use transparent UV lacquer printing with quantum dots, mark cost (1*1 cm) is about only 0,1 euro cent!

DATA STORAGE: HOW DOES IT WORK?

#1 A special security label with three-factor identification using ink with quantum dots and containing a protected unique code which only the manufacturer is knowing.

#2 In addition, this mark contains a visual unique QR-code, created automatically in the blockchain system, which is not possible to de-code even from the manufacturer and its employees.

#3 The system for generating unique codes for each product will be controlled by the company and cannot be modified or corrected.

For customer service, call +123-456-789 or +0-000-123-456

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod t ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud ullamco laboris nisi ut aliquip ex ea commodo consequat

Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui offic mollit anim id est laborum

QUANTUM QR & READING:
ADVANTAGES QUATUM DOTS CODING