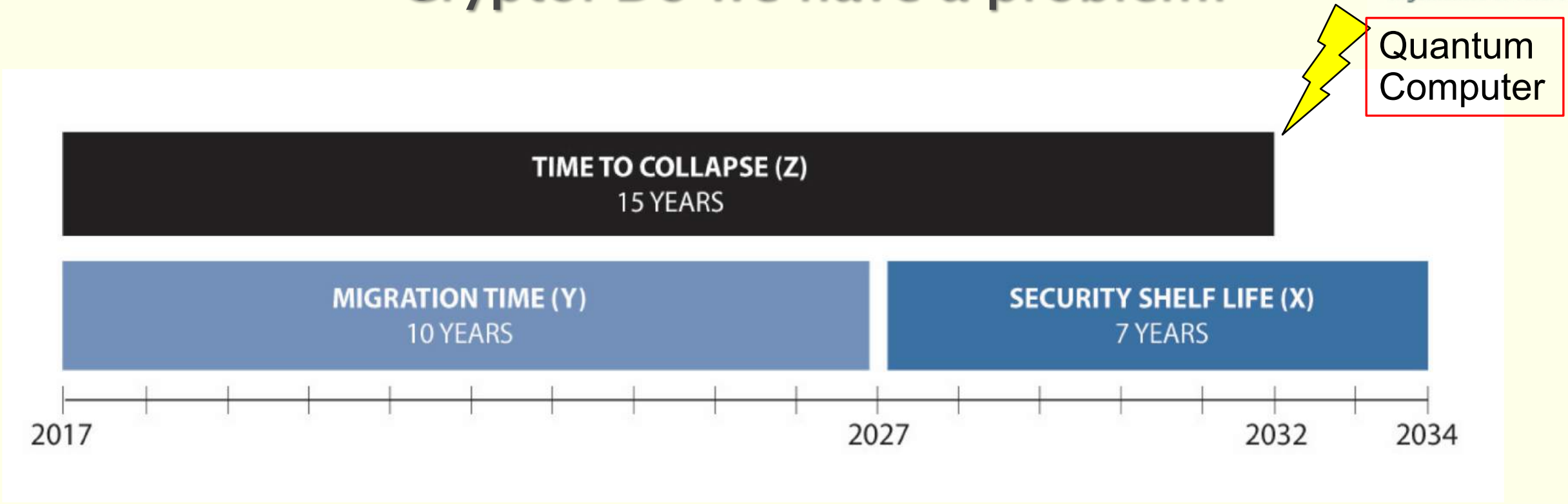
Madrid SDN Quantum Network

SecPho Workshop: Quantum Technologies in Spain. The Future is Now

Madrid, 8 Mayo 2019

Presenter: Vicente Martin
U. Politécnica de Madrid
Vicente@fi.upm.es
gcc.fi.upm.es

Quantum Computing and Quantum Crypto: Do we have a problem?



From : Quantum Computing: Progress & Prospects 2018. A Consensus Report. National Academy of Sciences, Engineering and Medicine (adapted from M. Mosca, 2015)

… write your own answer:

- **Q:** Time to a quantum computer: ?
- **I:** Time to fully change the security infrastructure: Estimate (NIST) 20yrs.
- **S:** Shelf life: 1-50 yrs. (what is your application?)

If I+S > Q… you have problems.

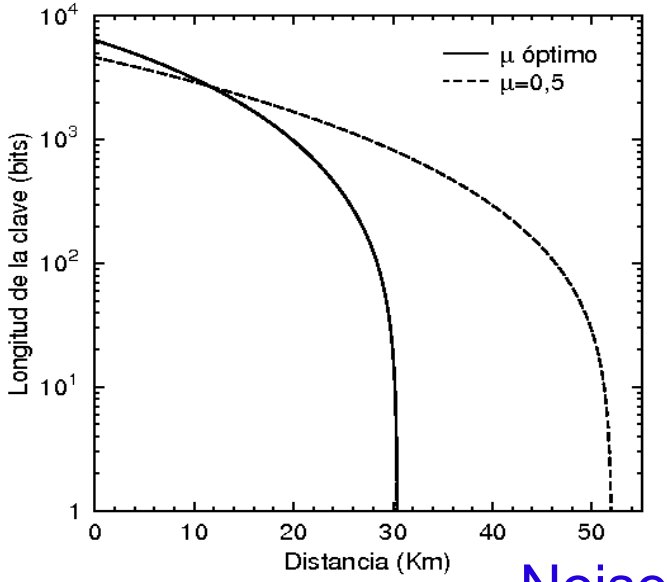
Solutions:

- **Postquantum crypto**: Business as usual.
  - "new" **algorithms** believed to be secure against Quantum Computers.

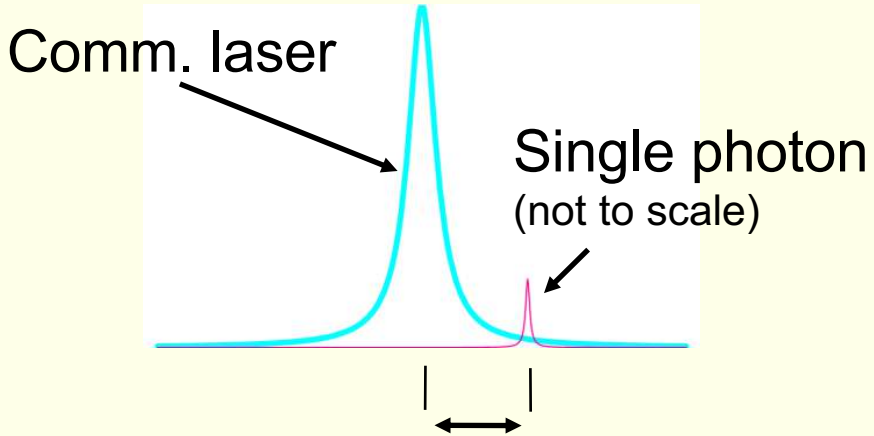
- **Quantum Cryptography**:
  - **Physical** layer security -> Networks
    - You need hardware
    - … and it is not easy
  - Not a complete substitute!

Quantum communications and networks, why is it difficult?

Limited reach, point to point.

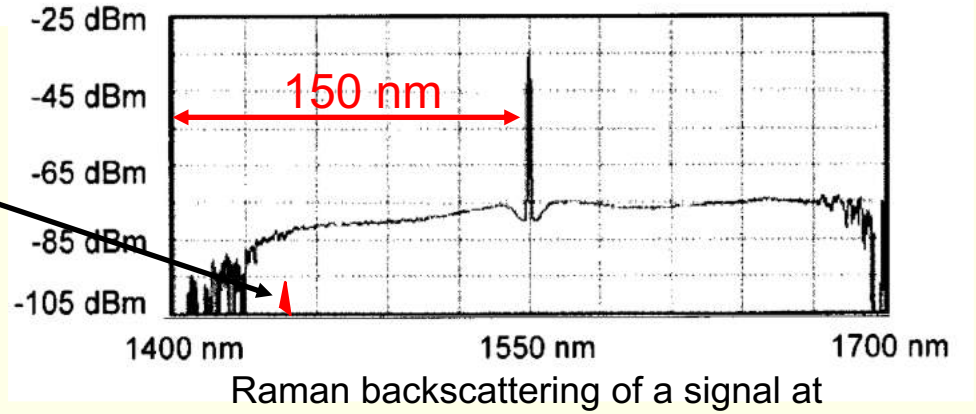


extremely weak signals.



Noise in the fibre: Raman

Single Photon
(approx. scale)



Raman backscattering of a signal at 1549 nm [DOI: 10.1063/1.1842862]

- Difficult to detect.
- Absorpions
- Masked by the noise

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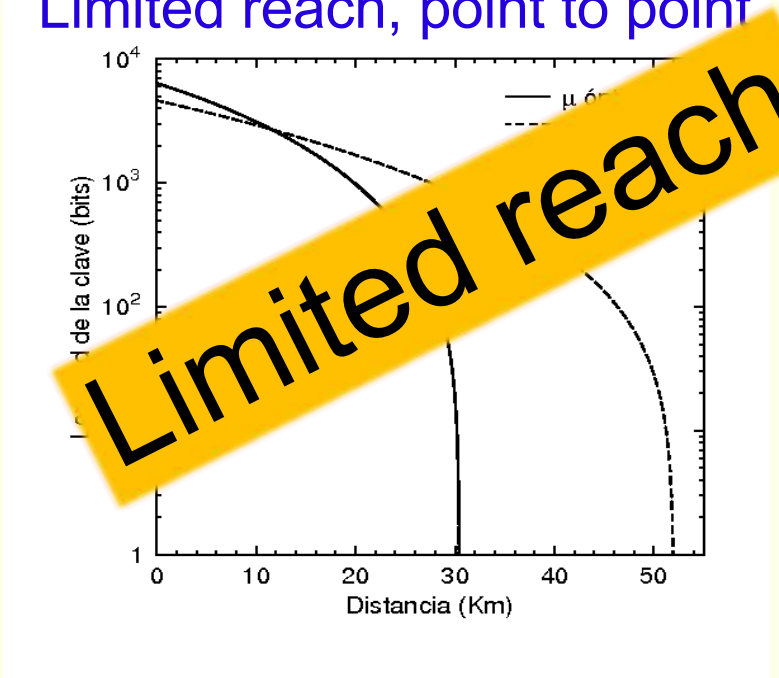

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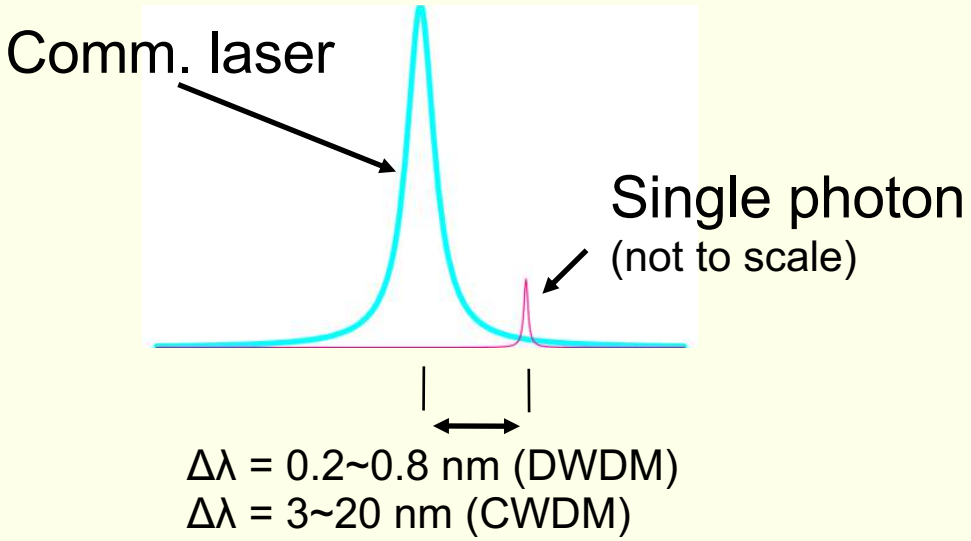

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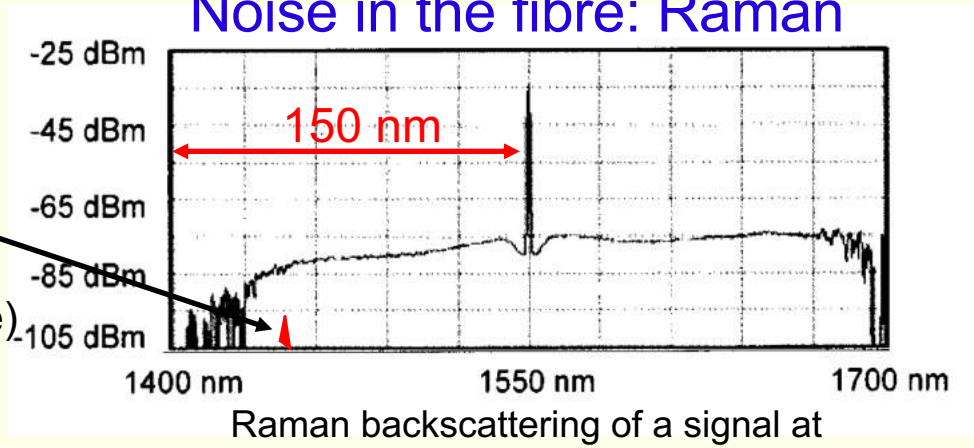

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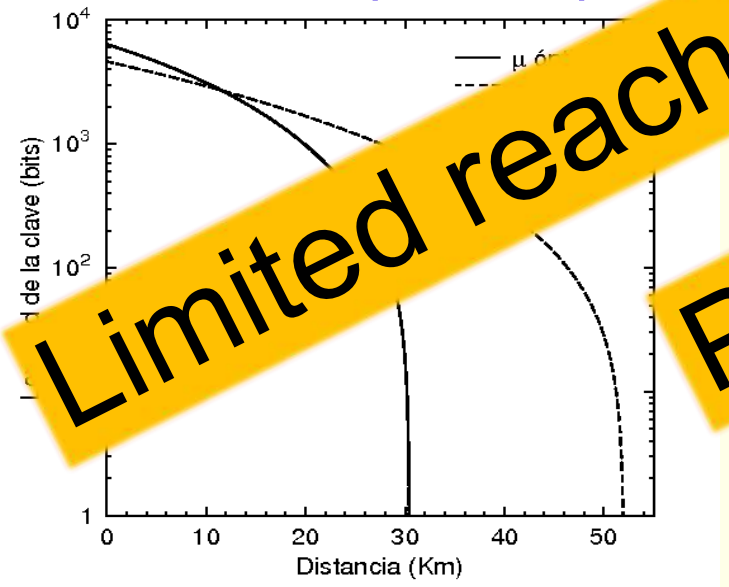
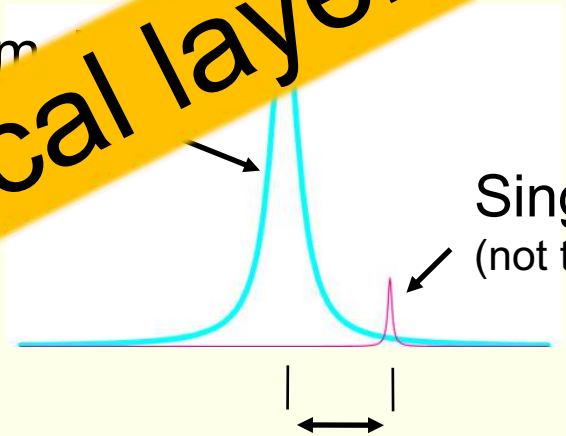


Limited reach

Physical layer

extremely … nals.

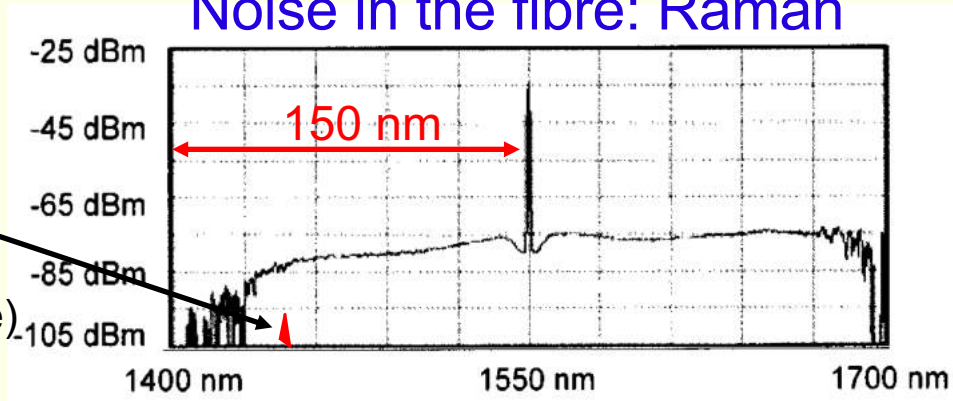
Comm…



Single photon
(not to scale)

$\Delta\lambda$ = 0.2~0.8 nm (DWDM)
$\Delta\lambda$ = 3~20 nm (CWDM)

Noise in the fibre: Raman



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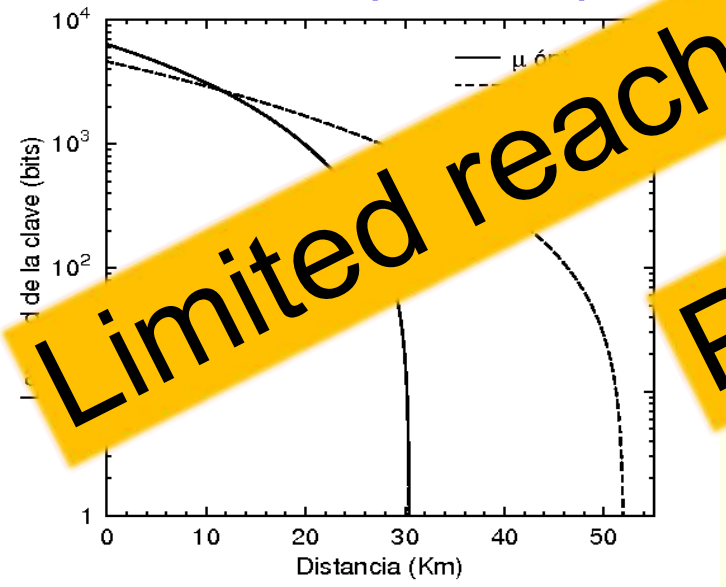
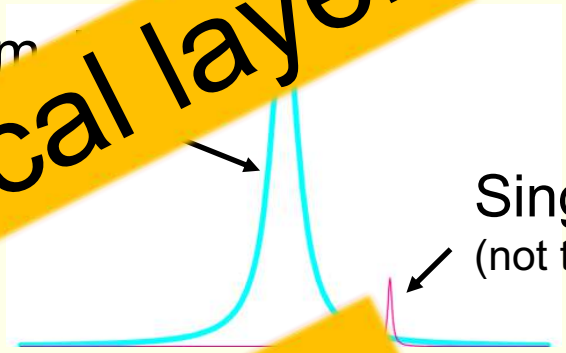


extremely ... nals.

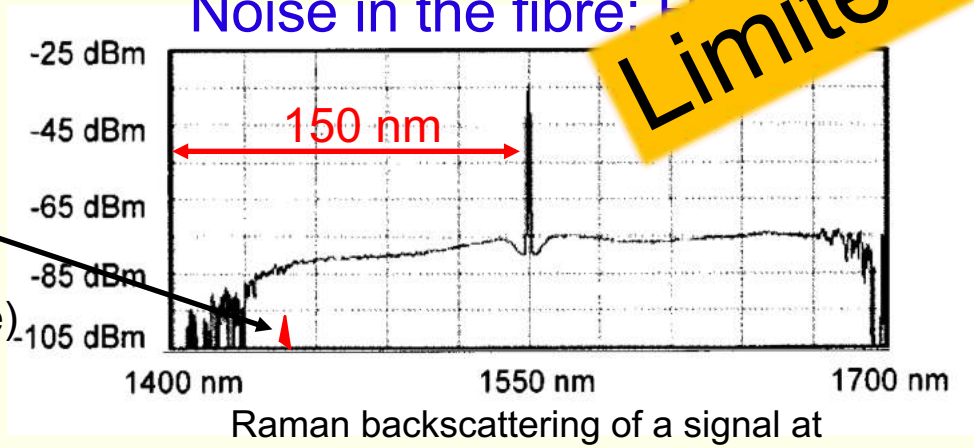
Comm...



Single photon
(not to scale)

...nm (DWDM)
...0 nm (CWDM)

Noise in the fibre: R...



Single Photon
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Limited reach

Physical layer

Limited crypto

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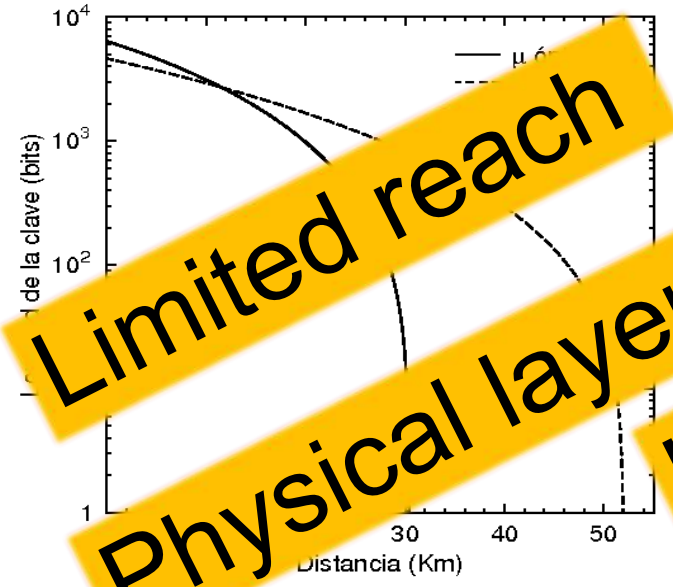

extremely weak signals.

Comm. laser

ton

M)

DM)

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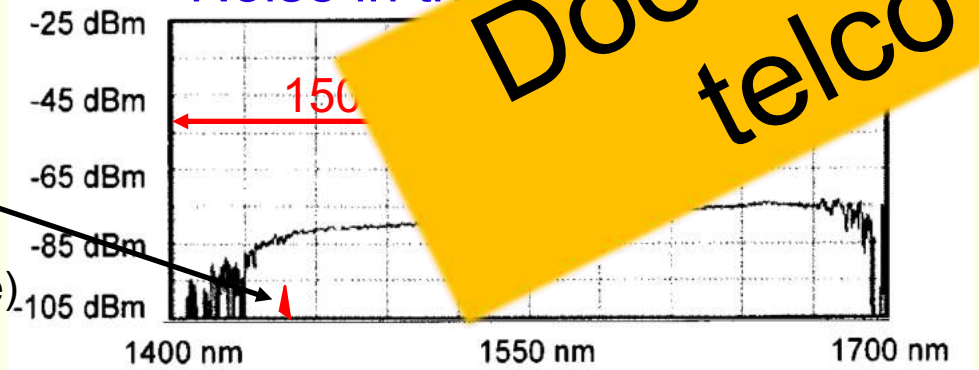
Limited reach

Physical layer

Limited crypto

Does not play well in telco networks

Noise in the



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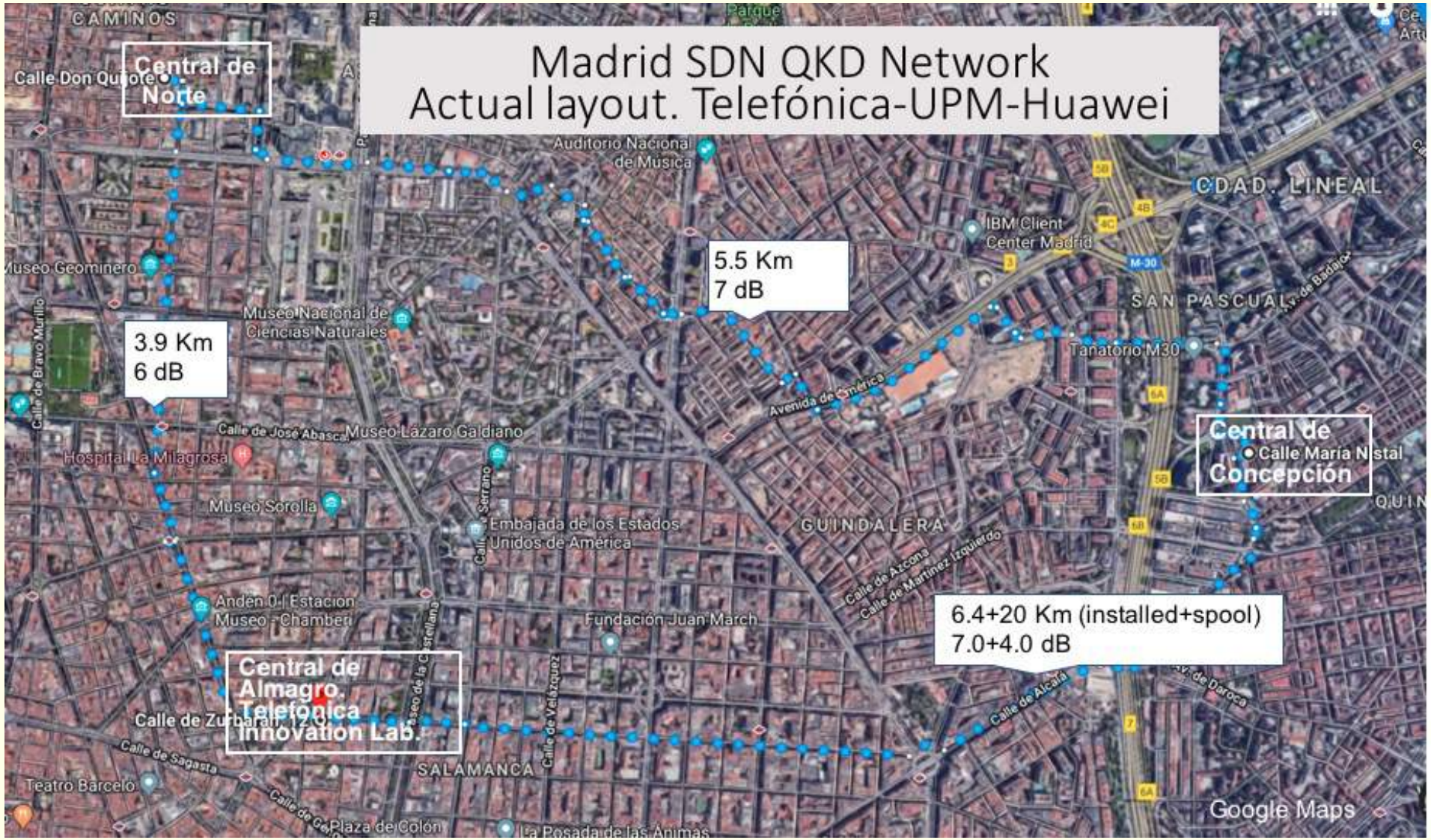
Single Photon (approx. scale)

R. Doisneau

Does not play well in telco networks?



It does…

First Quantum SDN Network in the world.

Installed in Telefónica Spain **production facilities**.

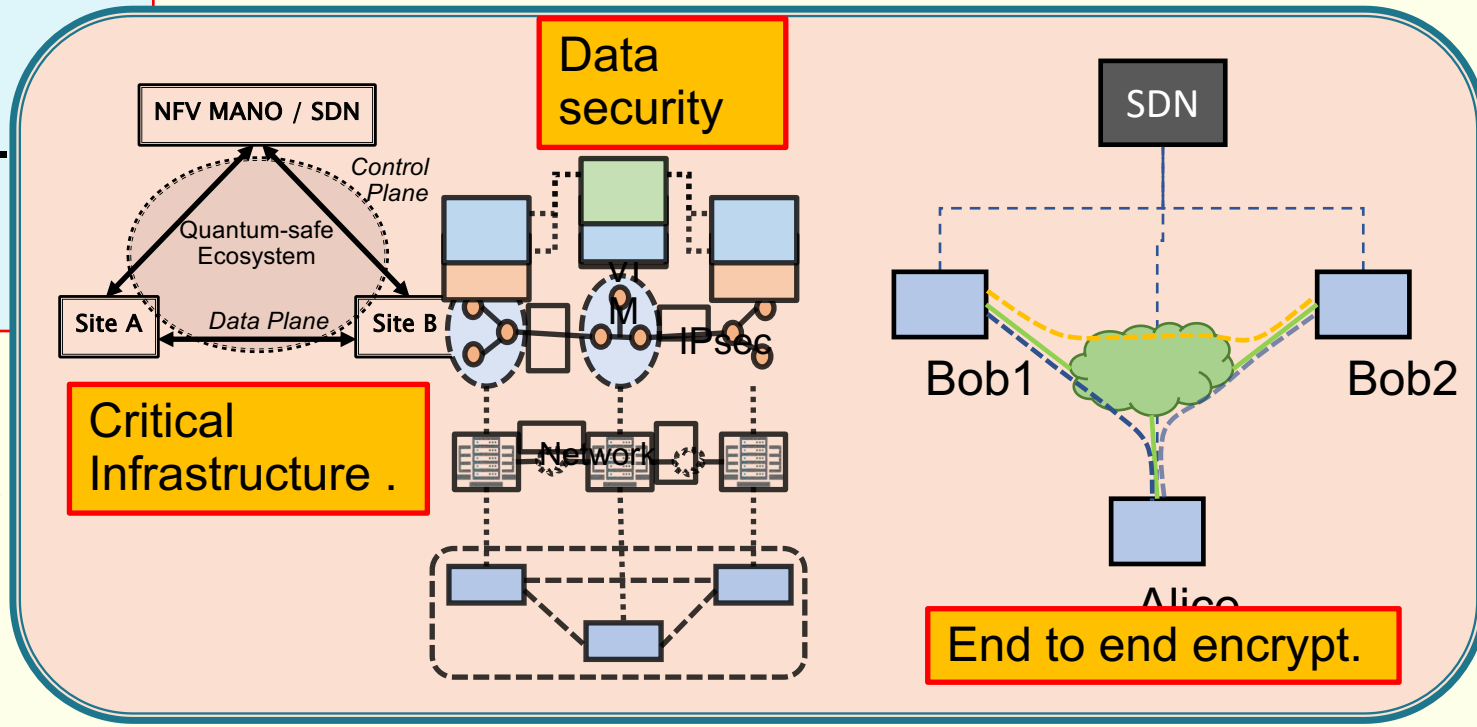
Madrid Quantum Network: First SDN-QKD network in the world

Use the correct technology

- **SDN** – Software Defined Networking
  - Network Flexibility
- **CV-QKD** technology:
  - Better tolerance to noise: quantum/classical copropagation.
  - Prospective industrialization path

EU H2020
Grant 820466

Real world use cases:



Future

- Evolution of the Madrid Quantum Network.
  - RedIMadrid.
  - EU H2020 Project in negotiation phase.
  - Beyond QKD

EU H2020
Grant 820466

EU H2020
Grant 820466

Madrid Quantum Network

Comunidad de Madrid
S2018/TCS-4342

CvQuCo - MINECO/FEDER TEC2015-70406-R

A. Aguado[1], P. Salas[1],
A.L. Sanz[1], J.P. Brito[1],
D. R. Lopez[2], V. Lopez[2],
A. Pastor[2], J. Folgueira[2],
F. de la Iglesia[2] , H.H. Brunner[3],
S. Bettelli[3], F. Fung[3],
D. Hillerkuss[3], L. C. Comandar[3],
D. Wang[3], A. Poppe[3] ,
M. Peev[3] and V. Martin[1],

[1]Center for Computational Simulation and ETSI Informáticos, Universidad Politécnica de Madrid 28660 Madrid, Spain
[2]Telefónica Investigacion y Desarrollo, Ronda de la Comunicacion s/n 28050 Madrid. Spain
[3]Huawei Technologies Duesseldorf GmbH, Riesstrasse 25, 80992 München. Germany

Thanks!...
Questions/comments?

Vicente Martin
U. Politécnica de Madrid
Vicente@fi.upm.es
gcc.fi.upm.es