

Colloidal Quantum Dots for Short-Wave Infrared Photon Sensing

Presenter:

Renita Mwangachuchu

Interested in Renewable Energy

Associate's in Engineering from Howard Community College



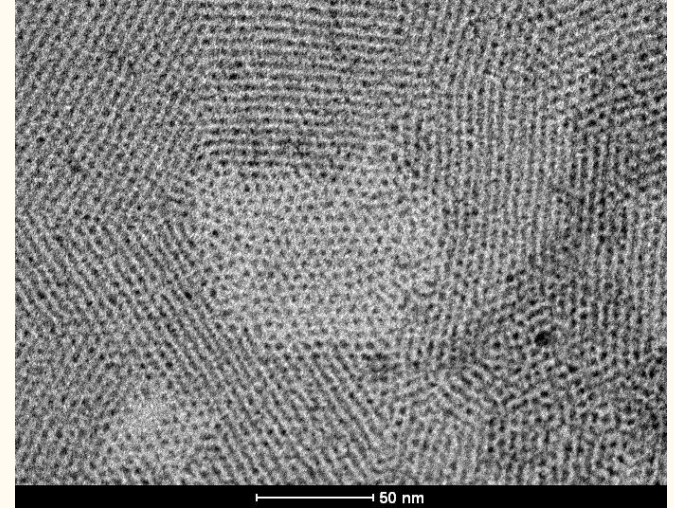
What are Colloidal Quantum Dot Particles?

Emerging Technology

Nano sized semiconductor particles

Solution-processed

Quantum and electrical properties size-tunable

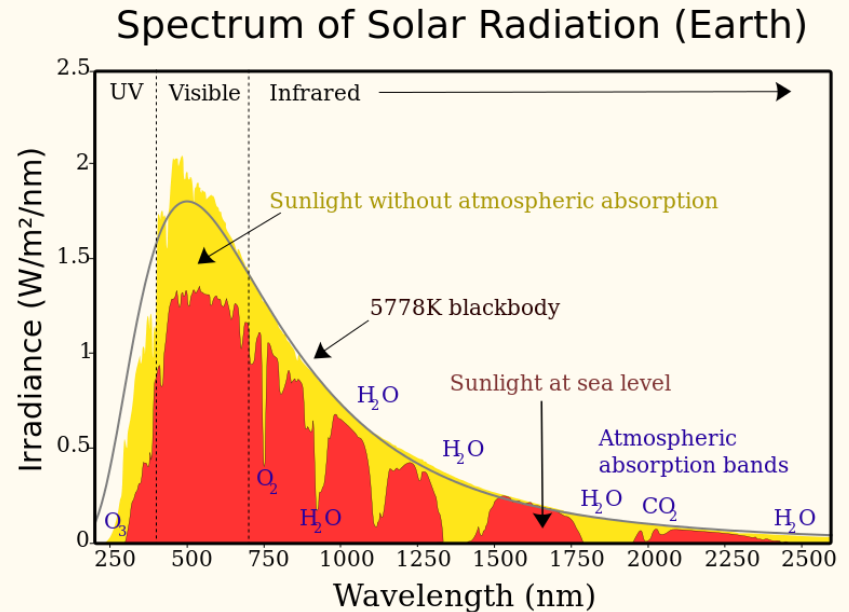


Why Infrared?

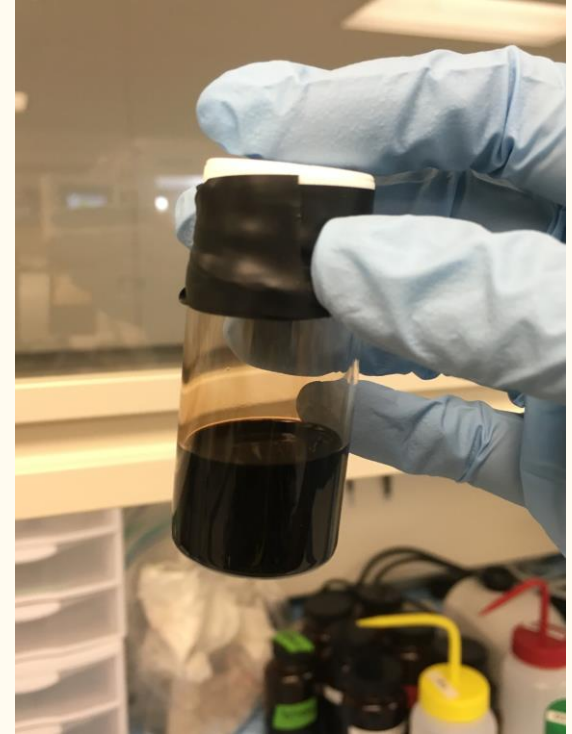
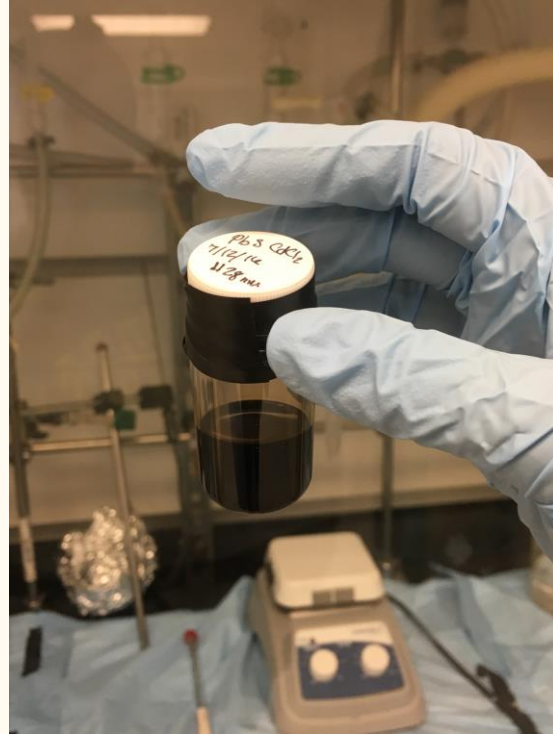
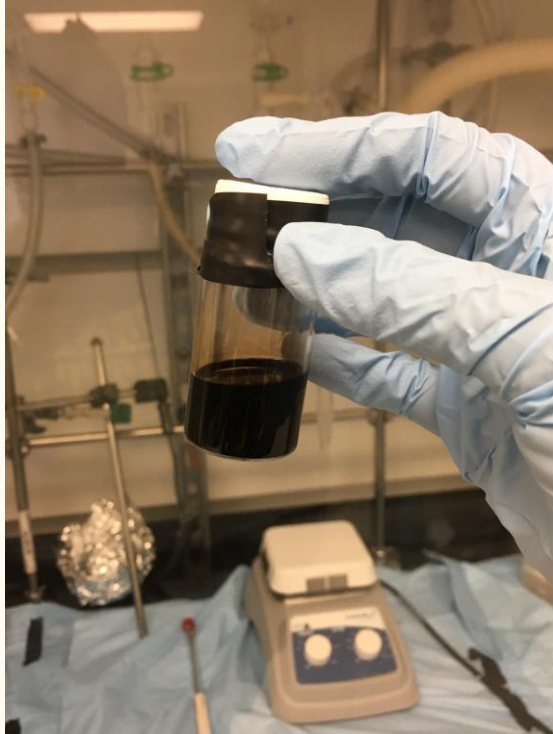
Silicon: 400-1100nm

Gallium Arsenide: 800-2000nm

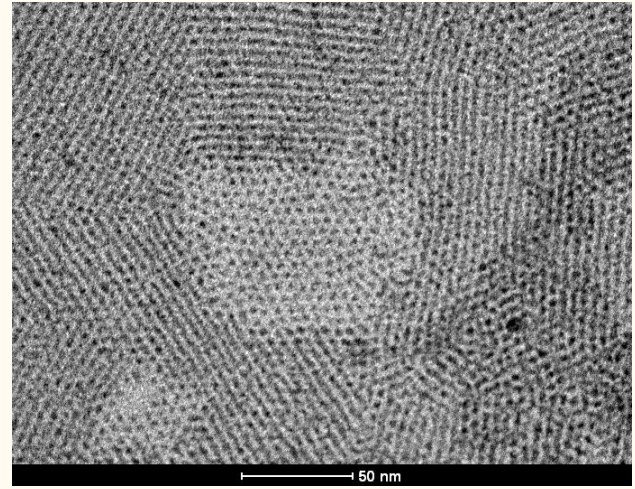
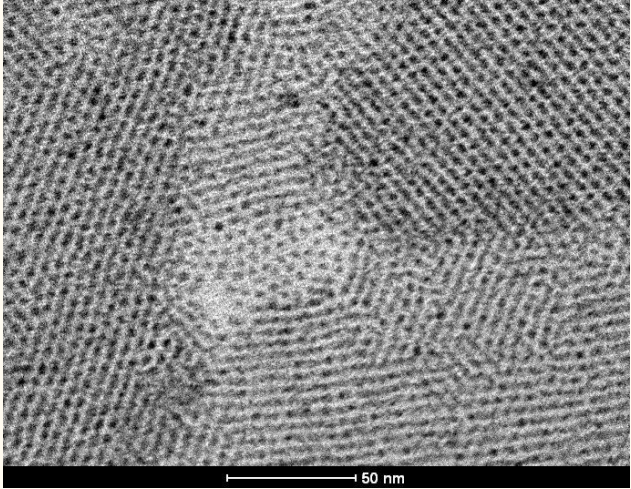
Wikipedia, "Image Solar Spectrum" 2008



Solution-Processed Colloidal Quantum Dots



More Details on Colloidal Quantum Dots

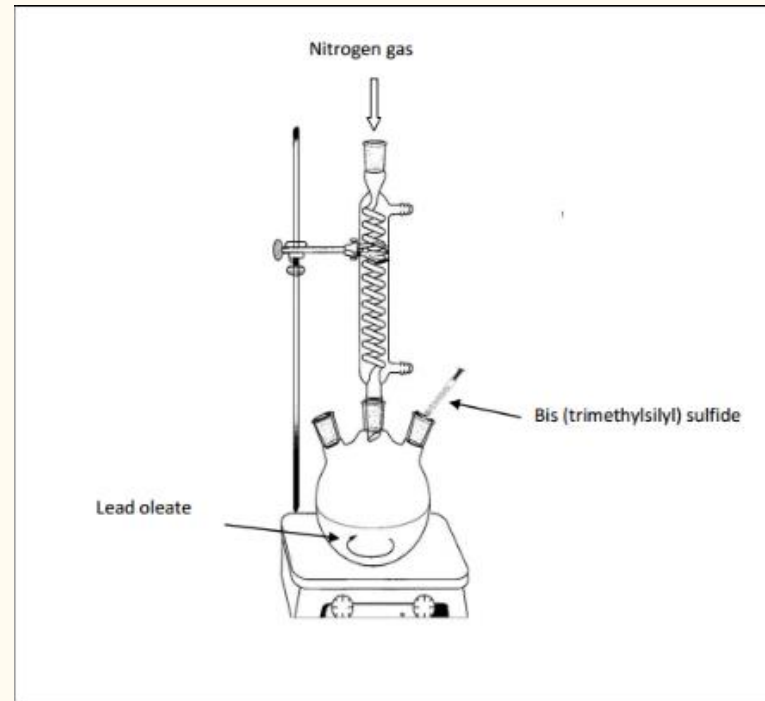


Goals

To synthesize 1 eV nanoparticles

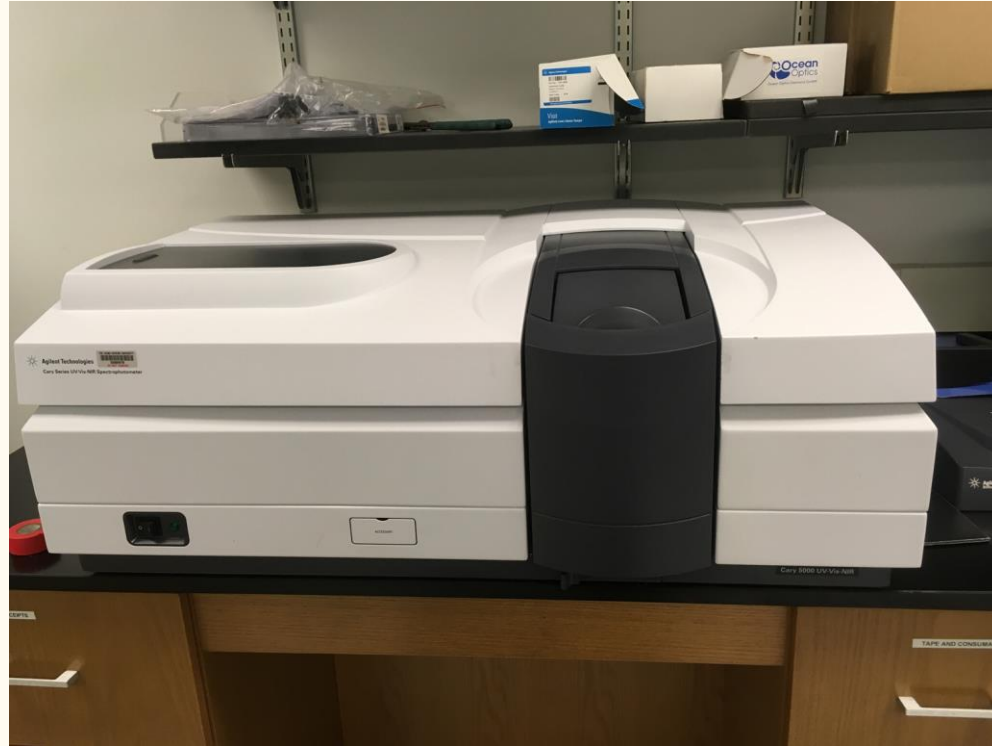
- Peak at 1240nm
- Peak to Valley Ratio at least 2.0

Methods



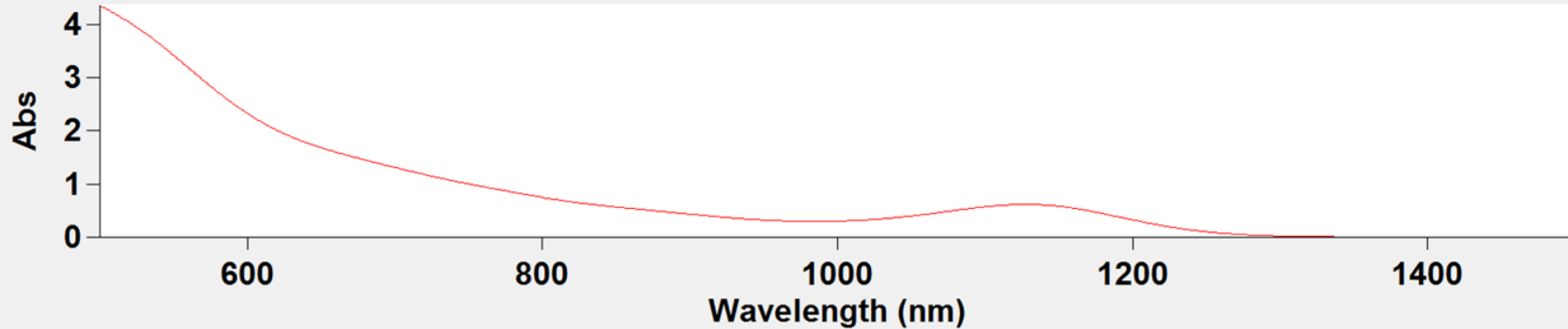
Mousa, A. (2011) "Experimental Setup for Synthesis"

Results

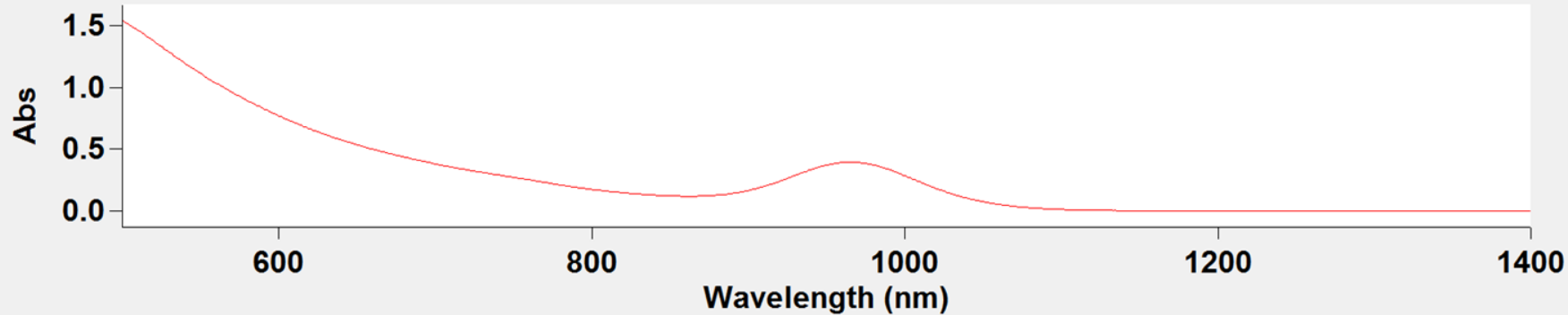


Results

1288 nm CQDs with peak to valley ratio of 1.5

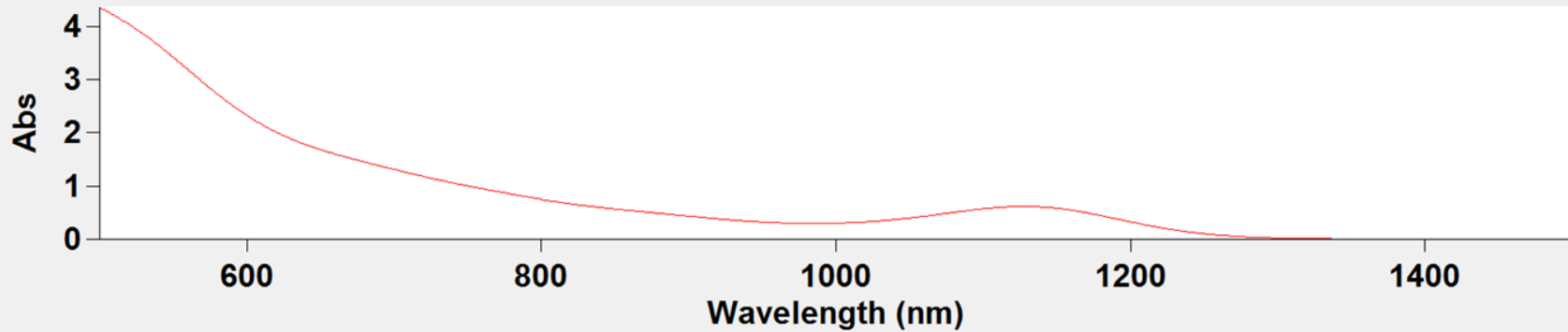


964 nm CQDs with peak to valley ratio of 3.36



Results

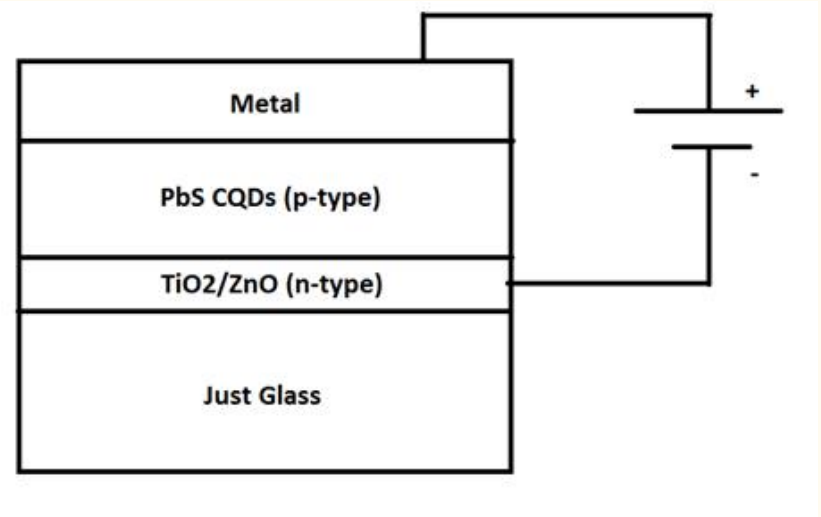
1128 nm CQDs with peak to valley ratio of 2.07



Photodetectors and Optoelectronics



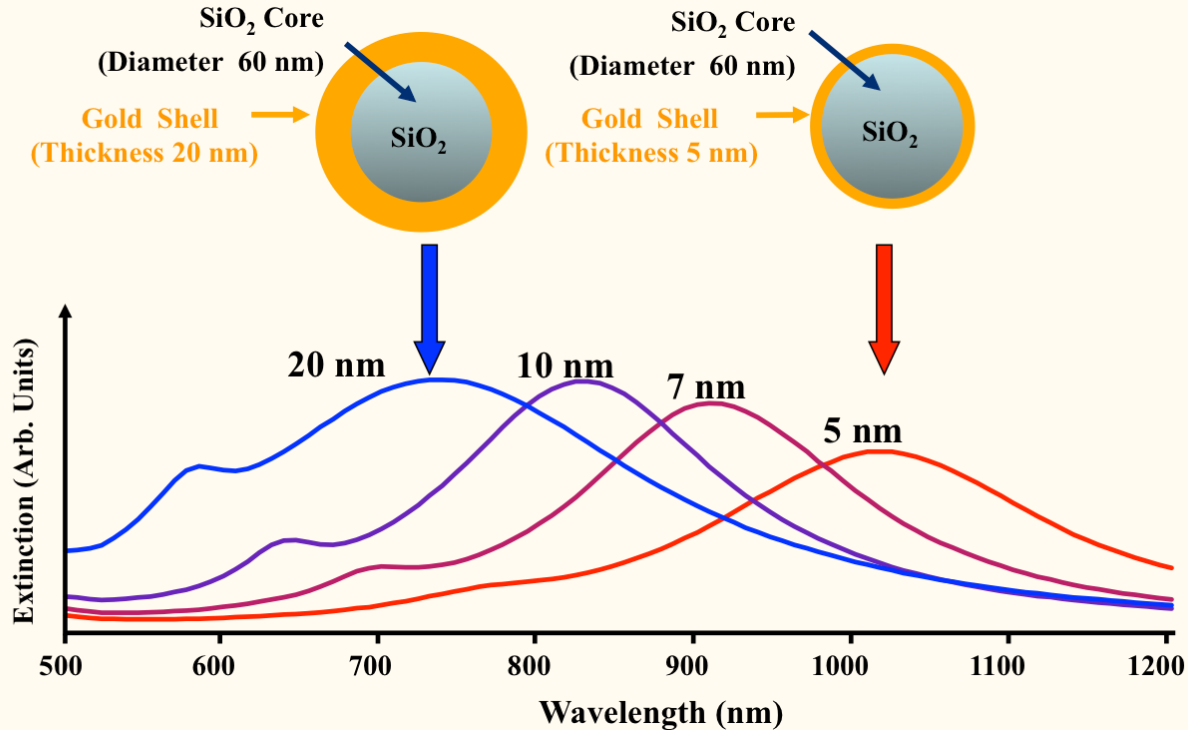
Brzozowski, L. (2011) "Spin Cast Quantum Dot Solar Cell"



Plasmonics



Silica-Gold Core-Shell Nanoparticles



Discussion

Photodetectors can be used in:

Imaging devices such as MRI scanners, X-rays, satellite imaging equipment

Energy harvesting devices such as solar cells and solar panels

Other electronic devices that make use of photodetectors such as fibre-optic cables, spectrophotometers,

Thank You!



Acknowledgements

Dr. Susanna Thon

Yan Cheng

Botong Qui

Ebuka Arinze

Yida, Gary, Garrett

References

<http://lup.lub.lu.se/luur/download?func=downloadFile&recordId=2862856&fileId=2862857>

http://www.ele.uri.edu/Courses/ele432/spring08/photo_detectors.pdf

Bo Sang Kim and T. Randall Lee (2015). The Development of Smart, Multi-Responsive Core@Shell Composite Nanoparticles, Nanoparticles Technology, Dr. Mahmood Aliofkhazraei (Ed.), InTech, DOI: 10.5772/61262. Available from: <http://www.intechopen.com/books/nanoparticles-technology/the-development-of-smart-multi-responsive-core-shell-composite-nanoparticles>

https://en.wikipedia.org/wiki/Quantum_dot_solar_cell#Quantum_dots

<https://en.wikipedia.org/wiki/Sun>