

## Ultra Selective Visualisation of Physicochemical Processes

When described broadly, my research is focused on developing new techniques for selective visualisation of physical and chemical processes in biological and other complex systems. Imagine that you can follow the course of a single virus for several hours and analyse the infection path or that you are able to monitor delivery of few molecules of a drug to a single cell. This breath taking perspective may become one day a reality. The challenge is to signal a specific process out of several others running simultaneously on the crowded background. More explicitly, I am focused on development of novel selective markers and new principles for low-noise detection schemes.

The **expected outcomes** include

- fabrication and characterization of photo stable, chemically inert, and minimally invasive selective labels based on colour centres in diamond nanocrystals
- design of optical system fully exploiting coherent, spectral, and temporal characteristics of the targeted optical signal
- improved understanding of theoretical foundation and fundamental limits of optical detection of nano particles.

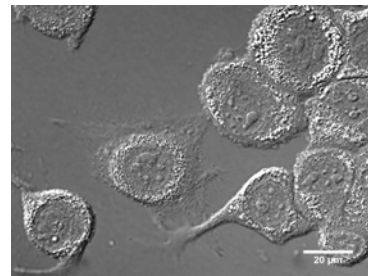
**To date**, substantial progress is achieved in chemical fictionalization of the diamond surface and in conceptual theoretical studies. Pilot images of the diamond based nano particles on real biological landscape are shown in the figures on the right.

The preliminary results are promising and encouraging but more insight into surface effects and more understanding of chemical and physical interactions affecting static and dynamic properties of nano particles are required.

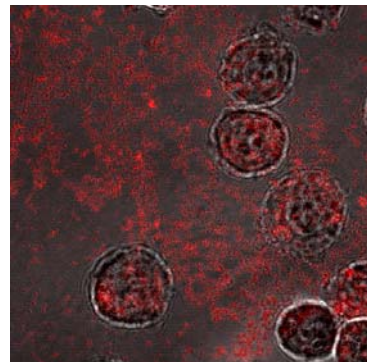
These studies have created a basis for broad international and cross-disciplinary collaborations.

**Contact details:**

Dr. Taras Plakhotnik  
School of Physical Sciences  
University of Queensland  
Email: [taras@physics.uq.edu.au](mailto:taras@physics.uq.edu.au)



Differential interference contrast (DIC) image of fixed 3T3 cells transfected with nanodiamond particles (visible as grained structures outside the cell nuclei).



Simultaneous confocal imaging of luminescent nanodiamonds (red dots) and macrophage cells.