To: Editor, Physical Review Letters.

Dear Editor,

We would like to submit our manuscript entitled “Super absorption of light by nanoparticles” for publication in the *Physical Review Letters*.

In this paper we propose the concept of super-absorption by multi-layer nanoparticles. We show that by carefully designing nanoparticle shells it becomes possible to significantly overcome the limit of a single material particle. This is achieved when several resonances of the particle become degenerate, i.e. occur at the same frequency.

We further analyze the efficiency of absorption, as an absorption cross-section normalized to the physical cross-section of the nanoparticle, and find that the most efficient absorption can be achieved for a deeply sub-wavelength particle, whose absorption cross-section is 5 times larger than its physical cross-section.

In order to find efficient absorption regimes, we utilize stochastic optimization algorithms. The universal nature of this algorithm can allow designing efficient absorbers for any desired frequency or frequency range.

We believe that the presented idea and numerical simulations contain a practical concept with far reaching applications in many areas of physics, and we hope that it will be of interest to Physical Review Letters readers.

Sincerely yours,

On behalf of the authors,

Konstantin Ladutenko