

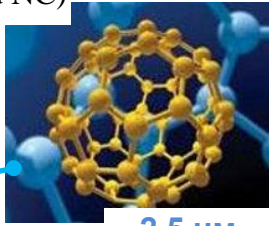
Research (What is it about?)	Tunnel nanooscillator
UNN authors	<i>Gorshkov O., Filatov D., Antonov D., Antonov I., Shenina M., Pavlov D.</i>
We find (The result)	The prototype of nanooscillator on resonant quantum size effect has been experimentally demonstrated
Abstract	<p>Metal nanoclusters embedded into the ultrathin dielectric films attracted much attention due to their unusual electronic, optical, etc., properties differing from those of the bulk metals essentially and, hence, to the prospects of their applications in novel nanoelectronic, single electronic, non-volatile memory, etc., devices.</p> <p>We have developed a new opportunity to use these systems. We have studied experimentally a prototype nanoelectronic device based on the resonant electron tunneling via the quantum confirmed energy states in a single ultrafine metal nanoparticle in an ultrathin dielectric film. We have shown that under certain conditions the nanoparticle exhibits negative differential resistance so it can be the basis for an <i>oscillator</i>. The main distinction of this oscillator from all existing ones (except atoms) is its unique nanometer size.</p> <p>The essential problem is the connection of the nanoparticle with the oscillation loop. We solve this problem by using a <i>probe</i> of a conductive atomic force microscope (AFM). The device includes small (2.5 nm in diameter) <i>Au nanoclusters</i> embedded into a tunnel-transparent (6.5 nm thick) <i>yttria-stabilized zirconia</i> (YSZ) film on the Si substrate. For these nanoclusters, we realize the oscillator which is close to harmonic one with the frequency 24.3 kHz.</p>

Representative articles 2017-2018, quartiles	1. <i>Gorshkov O.N., Filatov D.O., Antonov D.A., Antonov I.N., Shenina M.E., Pavlov D.A.</i> An oscillator based on a single Au nanocluster. <i>J. Appl. Phys.</i> 121 : 014308 (2017).	Q2
Q-index (Qi) for the result		3
<i>high orange</i>		

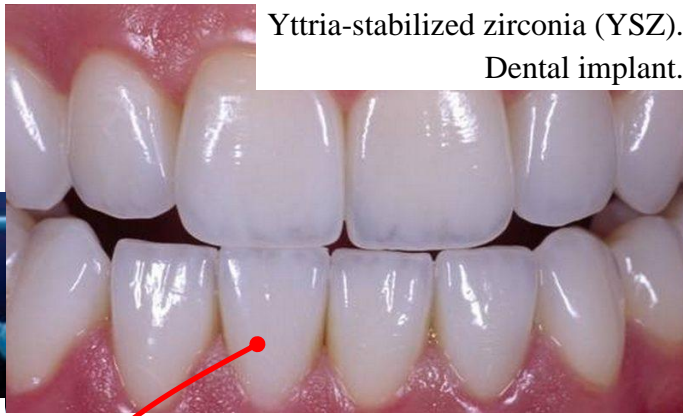
In collaboration	-
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Yttria-stabilized zirconia (YSZ).
Dental implant.

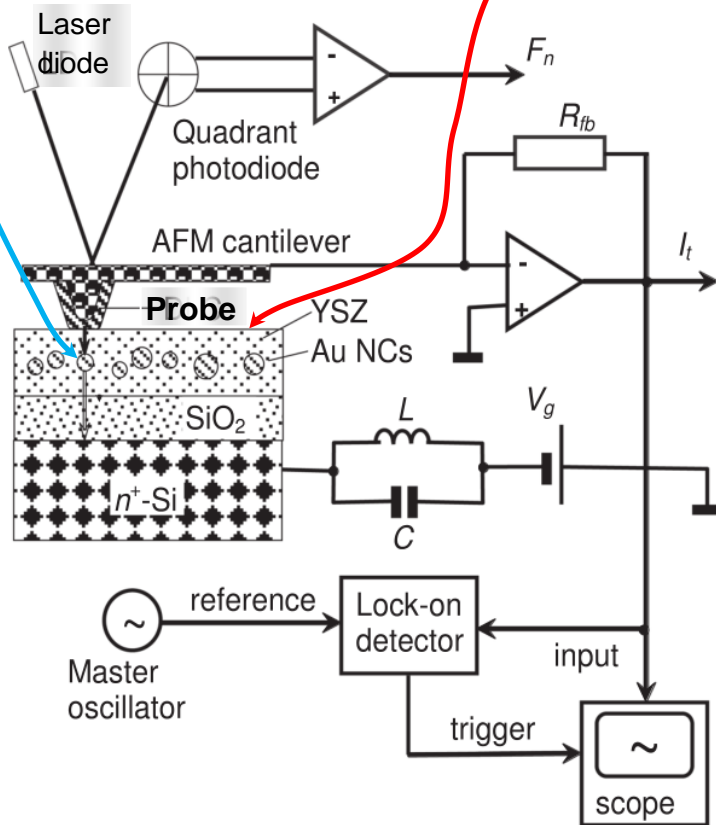
Au nanocluster
(Au NC)



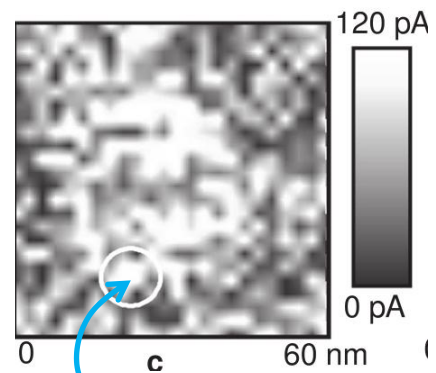
2,5 nm



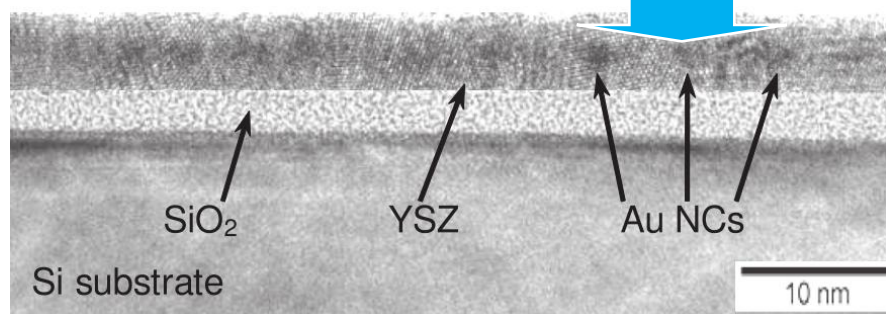
Experimental setup



Tunnel current distribution
in YSZ film



Cross section of
YSZ film with
nanoparticles



A waveform of the
probe current

