

Seminar

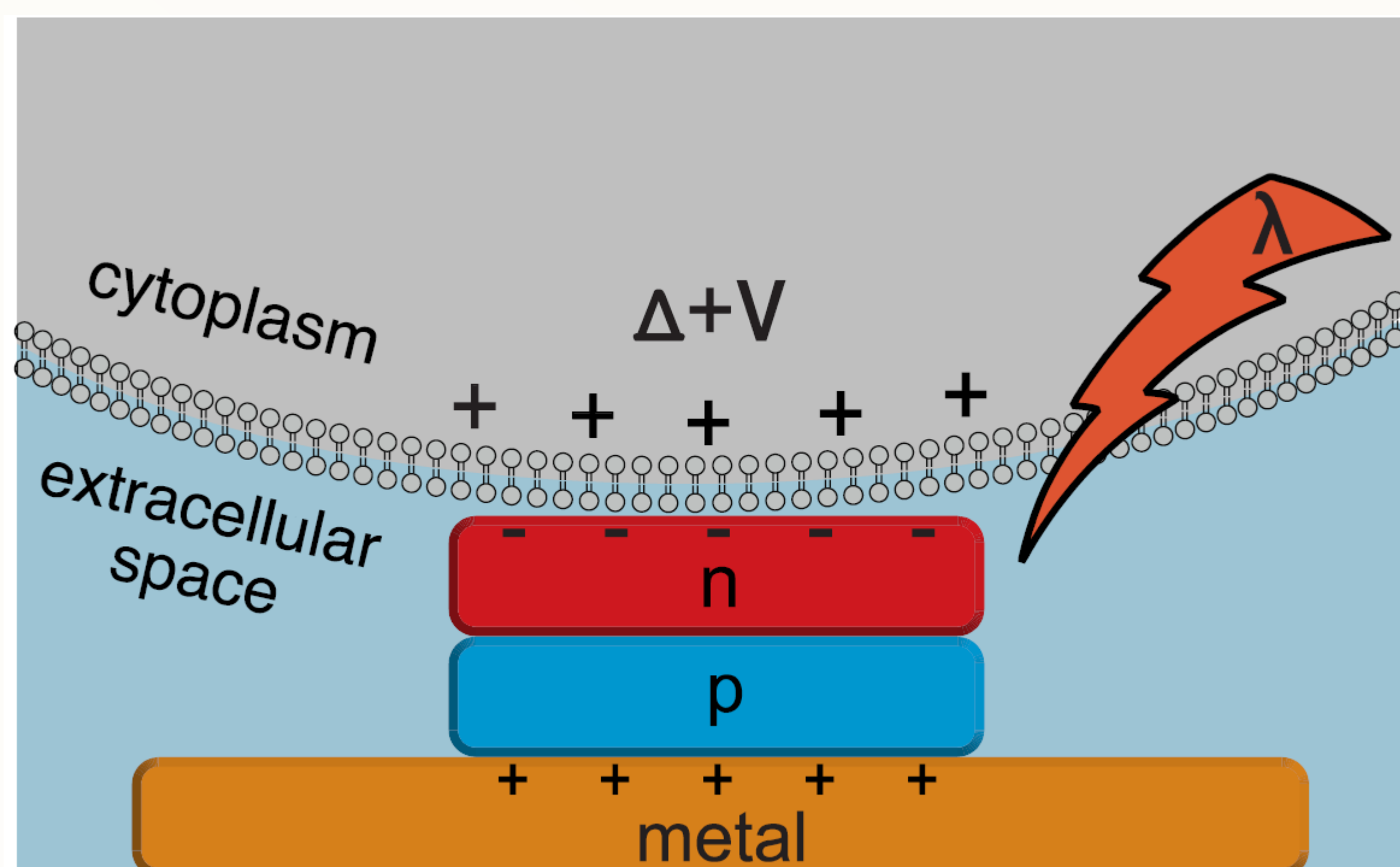
Znanstvenog centra izvrsnosti
QuantiXLie i Fizičkog odsjeka

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Electrolytic photocapacitors based on donor-acceptor organic bilayers for light-induced extracellular stimulation

A safe and efficient localized wireless neuronal stimulation is essential in therapeutical and research applications. Some examples include vision restoration by implantation of artificial retina devices [1], surface and deep brain stimulation [2] and autonomous nervous system stimulation in autoimmune conditions [3]. We report on an organic semiconductor nanoscale device optimized for neuronal stimulation: the organic electrolytic photocapacitor [4]. The devices consist of a trilayer of metal and p and n organic pigment-based semiconductors. When illuminated in physiological solution, these metal-semiconductor devices charge up, transducing light pulses into localized displacement currents that are strong enough to stimulate cells. The devices can be patterned photolithographically [5], are freestanding, requiring no wiring or external bias, and are stable in physiological conditions. We have systematically evaluated the ability of photocapacitor devices to alter the cell membrane potential of single nonexcitable cells, generate action potentials in neuronal cell cultures, and stimulate explanted light-insensitive embryonic retinas.



Mechanism of capacitive coupling of an illuminated photocapacitor with an adjacent cell.

[1] Palanker D, Vankov A, Huie P and Baccus S 2005 Design of a high-resolution optoelectronic retinal prosthesis *Journal of Neural Engineering*

[2] Kim S, Bhandari R, Klein M, Negi S, Rieth L, Tathireddy P, Toepper M, Oppermann H and Solzbacher F 2009 Integrated wireless neural interface based on the Utah electrode array *Biomed. Microdevices*

[3] Sundman E and Olofsson P S 2014 Neural control of the immune system *AJP Adv. Physiol. Educ.*

[4] Rand D, Jakešová M, Lubin G, Vébraité I, David-Pur M, Đerek V, Cramer T, Sariciftci N S, Hanein Y and Głowacki E D 2018 Direct Electrical Neurostimulation with Organic Pigment Photocapacitors *Adv. Mater.*

[5] Đerek V, Jakešová M, Berggren M, Simon D T and Głowacki E D 2018 Micropatterning of organic electronic materials using a facile aqueous



Znanstveni centar izvrsnosti
za kvantne i kompleksne sustave te
reprezentacije Liejevih algebri

Projekt KK.01.1.1.01.0004

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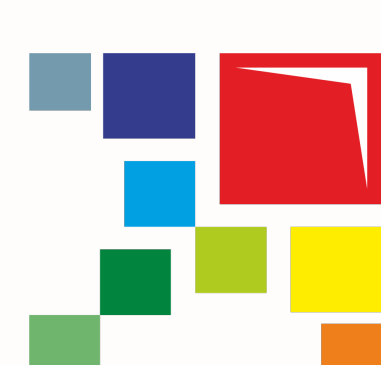
Četvrtak, 20. 12. 2018., 13h Fizički odsjek, F-201 (2. kat)



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