

New Approaches towards Organic Photodetection and Bio-Integration

M.R. Antognazza,¹ E. Lanzarini,^{1,2} D. Ghezzi,³ M. Dal Maschio,³
F. Benfenati,³ and G. Lanzani^{1,2}

¹Center for Nanoscience and Technology of IIT@POLIMI
via Pascoli 70/3, 20133 Milano (Italy)

mariarosa.antognazza@iit.it

²Politecnico di Milano, Physics Dept., p.zza L. da Vinci 32,
20133 Milano (Italy)

³Italian Institute of Technology, Neuroscience and Brain
Technologies Dept., via Morego 30, 16163 Genova (Italy)

We demonstrate hybrid, solid-liquid photodiodes, using semiconducting conjugated polymers as active materials and ionic liquids as unconventional cathodes (water, saline solutions, physiological buffers, cell-culturing media). We give a complete opto-electronic characterization in photovoltaic regime, investigate the interface phenomena by means of several time-domain optical probes, and propose a physical-chemical explanation of the working principle, taking into account the key-role of the ionic transport. Additionally, we demonstrate that this hybrid device can be an interface for communicating with a neuronal network grown on top of the organic layer. The organic semiconductor behaves as photo-window for unconventional and unprecedented organic-bio communication protocols.