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PLASMA BASED NANOTECHNOLOGY AND BIOLOGICAL APPLICATIONS

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Non-thermal gas plasma technologies provide environmentally sustainable solutions for pathogen control, environmental remediation, and advanced biomedical applications. This talk highlights plasma-based strategies for decontamination, microbial inactivation, and viral sterilization in soil, water, and air, with particular emphasis on preparedness against future pathogenic threats.
Our laboratory advances green plasma nanotechnology for eco-friendly synthesis of functional nanomaterials and plasma-enabled biomedical applications. We present plasma–liquid interaction–driven approaches for the green synthesis of metallic nanoparticles, offering precise control over composition and functionality without toxic chemicals or high-energy inputs. These nanoparticles exhibit strong antimicrobial and anticancer activities with excellent biocompatibility. In addition, plasma-based pathogen control platforms are explored for emerging and unknown biological threats.
Beyond therapeutics, non-thermal plasma shows significant promise in plasma cosmetics and anti-aging applications through enhanced skin regeneration, collagen stimulation, and tissue rejuvenation. Plasma technologies are further extended to agriculture for pathogen suppression and sustainable crop enhancement, as well as to space technology, where plasma-based sterilization, material modification, and life-support sustainability are critical.

Keywords: Plasma, Nanotechnology, Material Science, Pathogen, Environment

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