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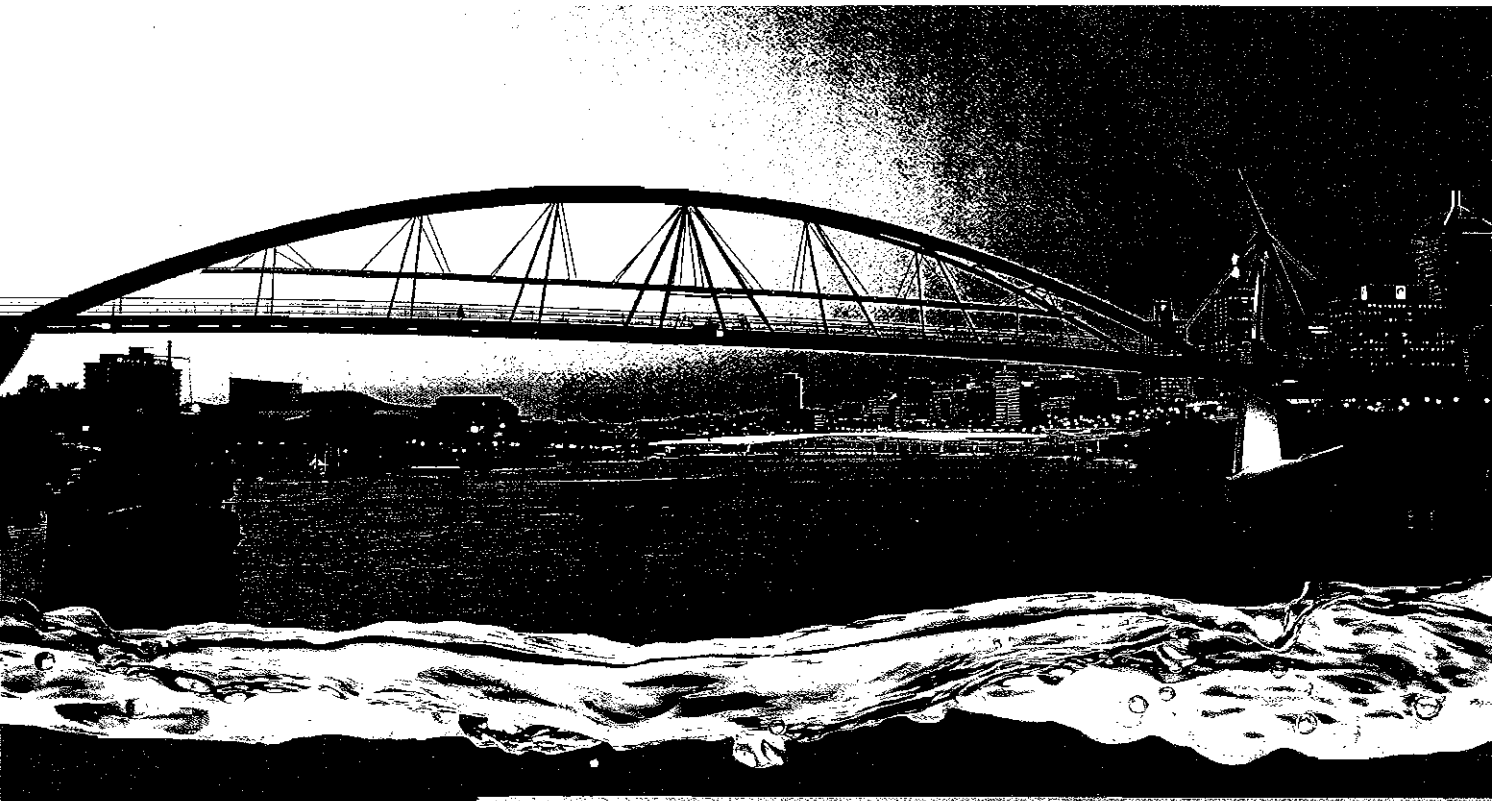

## Final Program & Abstract Book

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## 857

### $SF_6$ Plasma functionalisation of Carbon surfaces

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Since their discovery in 1991 by Sumio Iijima, carbon nanotubes (CNTs) have been the focus of many research groups because of their highly desirable electrical and mechanical properties, and potential applications in nanoelectronics. Fabrication of such devices requires however that these materials be easily handled, and their properties tailored to suit the application. Functionalisation of CNTs enhances solubility, alters electrical conductivity and field emission properties, and allows for further attachment of active chemical species. Highly ordered pyrolytic graphite (HOPG) has also proven to be a very useful material as it is easy to prepare, gives atomically flat surfaces, and is a model substrate for glassy carbon and biosensor supports. Fluorination of carbon surfaces has been investigated using chemical species such as $F_2$, HF, and more recently using $CF_4$ and $SF_6$ plasmas. HOPG and CNT surfaces have successfully been fluorinated in our laboratory using radio frequency $SF_6$ plasma, and has been shown to be an efficient fluorination technique without sulphur contamination. XPS, STM, SEM, and ToFSIMS techniques have been utilised for characterisation of the surfaces before and after fluorination. Studies on the kinetics of the fluorination process have been undertaken, focussing on the influence of plasma power, gas pressure, and exposure time on the extent of functionalisation.

## 858

### Stability of horseradish peroxidase on plasma modified ultra high molecular weight polyethylene

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Increasing the binding of proteins to surfaces on which their biological function is retained is important for the development of biodevices such as biosensors and diagnostic protein arrays. Polymers provide convenient, low cost surfaces for such devices. In this paper we report on the use of plasma ion immersion implantation (PIII) to enhance the functional attachment of horseradish peroxidase (HRP) on ultra high molecular weight polyethylene (UHMWPE). Treated and untreated surfaces were soaked in bufter solution containing HRP protein and subsequently washed in fresh 10mM phosphate buffer. The relative amount of active HRP was monitored using an enzyme activity assay. We found a twofold increase in active HRP on the treated surface compared to the untreated surface. The retention of enzyme activity over a period of 5 days with daily washing in fresh buffer was also significantly enhanced on the plasma treated surfaces. Similar enhancements in functional binding on plasma treated surfaces were seen on surfaces stored for up to 4 weeks before testing.

## 859

### Electron transport in crossed E and B fields of a closed electron drift discharge

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Electron conductivity across magnetic field in the low-density low-temperature plasmas is a key process that determines plasma parameters in the devices with crossed electrical and magnetic fields (E-B devices), such as Hall thrusters and sputtering magnetrons. A classical collisional mobility mechanism cannot adequately describe the electron currents observed in the experiments. At present, the two main phenomenological or anomalous mechanisms of the electron conductivity are being widely discussed, namely the Bohm conductivity related to the fluctuations of electric potential P = 1/(16*B), where B is the magnetic field, and so-called near-wall conductivity.

In this work, the electron cross-field conductivity was studied experimentally and numerically in E-B discharge with a closed electron drift. To describe plasma transport in the crossed magnetic and electric fields, we used a hybrid model based on the assumption of the plasma quasi-neutrality. A comparison of the measurements and calculations suggests a dominant role of the Bohm-type mobility in this type of gas discharges. The results obtained show that the classical mobility showing the electron energy of only 2 eV near electrode cannot provide a reasonable agreement with the experiment, whereas the Bohm mobility shows rather good agreement. As a result, the calculated plasma density was lower than that observed in the experiments.

Thus, the hypothesis about electron - turbulence "collisions" seems to be applicable to this kind of gas discharges. It is evident that the particular mechanism of the electron dispersion of plasma density fluctuations depends on the frequency-and-amplitude spectrum, and the further investigations of the electron conductivity in the plasma with known turbulence characteristics could elucidate this question and premote the development of more physical models.

## 860

### Complex plasma afterglow

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Dynamic of the dust clusters and dust clouds with different numbers of nano/micron-sized particles was studied experimentally in gas discharge plasma afterglow. Sub-micron dust particles are grown by sputtering a polymer material previously deposited on the electrodes. The effect of magnetic field and temperature gradient on control and stability of such structures have been investigated. It has been shown that dust in afterglow plasma retains a residual charge after plasma extinction of about 2 % of its original one. Coexistence of non-charged or negatively and positively charged grains has been observed. It was found that in the presence of external electric field the micron-sized dust dynamics is governed by residual dust charge. For the nanoparticles temperature gradient is the key parameter.

## 861

### Dynamics of two particles in a plasma sheath

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The physics of complex plasma systems containing a micro-particle component (dust) is a new and quickly emerging area at the frontier of physics and theoretical physics, plasma physics, solid-state physics, space physics and astrophysics. Structures in complex plasma systems, especially such non-extensive structures as dust particle clusters, strings, vortices, and voids, attract particular attention since they can be easily obtained in experiments and allow theoretical treatment at the most fundamental level.

The nature of particle arrangements in systems containing large number of particles can be understood by considering simplified systems of just a few (e.g. two particles). It is well known that even an interaction between two dust particles in the complex environment of the plasma sheath is highly complicated. The interaction involves both a symmetrical Debye-type interaction as well as an asymmetric attractive interaction induced by ion focusing downstream the particles in the presence of ion flow.

In this presentation main attention is paid to symmetry breaking disruption which occurs in a system of two dust particles when the key parameters (such as confinement, dust charge and separation, ion flux) have been reached the critical values. We discuss the possible equilibria of a dust molecule in a variety of confinement potentials. Our analysis suggests that the parabolic potential well admits only horizontal and vertical stable dust alignments which is in agreement with an recent prediction. We also suggest that continuous changes in particle alignment are possible not just with a quadratic potential well, but also cubic due to particle asymmetry and variation of grain charge with elevation in the sheath. The horizontal alignment instability at the critical confinement provides a new diagnostic tool for determining the wake parameters.

## 862

### Small-world quantum routers

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The study of mechanisms to transport quantum information in quantum networks has recently attracted much attention [Bos03, CFG02, CCD+03, CDEL04, CDD+05, KS05, FT06]. Particular attention has been paid to developing transport schemes