FAKULTÄT für PHYSIK
LUDWIG-MAXIMILIANS-UNIVERSITÄT
MÜNCHEN/GARCHING

PHYSIK-DEPARTMENT
TECHNISCHE UNIVERSITÄT MÜNCHEN
MÜNCHEN/GARCHING

MLL-KOLLOQUIUM

Donnerstag, 11.01.2018, 16^{15} Uhr

Hörsaal der LMU in Garching, Am Coulombwall 1
Treffen zum gemeinsamen Kaffee 16 Uhr

Dr. Dietrich Walsh

(Universität der Bundeswehr und TU München)

Mitochondrial cell damage irradiation experiments at the MLL

The cytoplasm is the major component of every cell and encompasses all of the area in a cell apart from the nucleus, which contains the genome (DNA). To date the effect of ionizing radiation on the cytoplasm is still a largely unknown and unexplored in the field of radiation biology. The cytoplasm consists of a large number of different constituents required for cellular survival and is therefore a complex milieu to study. To understand the effects of radiation on the cytoplasm, its individual components must be studied. Mitochondria are the component of interest in this work as they are a ubiquitous component of the cytoplasm of all mammalian cells and are the main source of cellular energy. Mitochondria are the 'powerhouse' of the cell and convert glucose from food into cellular energy which is required for all cellular processes. This makes mitochondria a very interesting and important component to study. The aim of the project is to irradiate single mitochondria in live cells using the ion microbeam SNAKE 'Superconducting Nanoprobe for Applied Nuclear (Kern) physics Experiments', (MLL, Munich) and AIFIRA 'Applications Interdisciplinaires des Faisceaux d'Ions en Région Aquitaine' (CENBG, Bordeaux). These microbeams have beamspots of $\sim 1\mu$m and 2μm, respectively, and are capable of depositing counted ion numbers into biological samples. The ultimate goal is to be able to irradiate individual mitochondria in live cells and to track the biological responses following the irradiation to further understand the biological response to ionizing radiation.
Experiments involved the use of breast and lung cancer cells, which were irradiated and consequently imaged, using live cell time-lapse fluorescence microscopy, during and after irradiation. The cells were labeled and tracked with a fluorescent mitochondrial dye to monitor mitochondrial activity. Using carbon-ions and protons, mitochondria were irradiated with a variety of beamspots and ion numbers. After targeted irradiation of mitochondria with carbon ions and protons, mitochondria are deactivated nearly instantly without any visible effect on the remaining mitochondria in the cell. This ability to induce highly localized and quantifiable damage to mitochondria in live cells using a variety of particles with varying linear energy transfer (LET) enables for a greater understanding of the role of mitochondria in ionising radiation induced damage in cells.

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