X-RAY RESONANT IRRADIATION AND HIGH-Z RADIOSENSITIZATION IN CANCER THERAPY USING PLATINUM NANO-REAGENTS

SULTANA N. NAHAR, *Department of Astronomy, The Ohio State University, Columbus, OH 43210*; S. LIM, *Biophysics Program, The Ohio State University, Columbus, OH 43210*; M. MONTENEGRO, *Catholic University of Chile*; A.K. PRADHAN, *Department of Astronomy, Biophysics Program, Chemical Physics, The Ohio State University, Columbus, OH 43210*; R. BARTH, *Pathology Department, The Ohio State University, Columbus, OH 43210*; E. BELL, *Radiation Oncology, The Ohio State University, Columbus, OH 43210*; C. TURRO, R. PITZER, *Department of Chemistry, The Ohio State University, Columbus, OH 43210*.

We describe the atomic-molecular-bio physics of X-ray irradiation of High-Z heavy-element nanomaterials as radiosensitizing agents in cancer therapy. Our reports in past few ISMSs showed that compounds of High-Z elements, Pt and Au, embedded in tumors could provide the most efficient therapy and diagnostics (theranostics) when X-rays are targeted at their resonant energies. Harmful damages due to unnecessary broadband radiation from conventional X-ray sources can be reduced considerably by using a monochromatic X-ray source at resonant energy. We will present our recent findings from Monte Carlo simulations, using Geant4 code, for X-ray energy absorption and dose deposition in tissues where the broadband X-ray sources have three different peak voltages, 100 keV, 170 keV and 6 MeV. We use platinum as an agent for killing cancerous cells via increased linear-energy-transfer (LET) and dose enhancement. We find that X-ray energies in the range below 100 keV are most efficient in achieving both the required tissue penetrative depths and deposition of energy. This confirms the previous results for Au that it is only the low-energy component around 100 keV from the 6 MV linear accelerator (LINAC) that is most effective in dose-enhanced cell killing. Preliminary experimental results cancer cells with Pt and results on K_α radiation of Al will also be presented.[a]

[a] Acknowledgement: Partially supported by DOE, NSF; Computational work was carried out at the Ohio Supercomputer Center