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Experimental and computational studies of nano-structured gold as a radiosensitizer for proton and carbon ion radiation

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Nanostructured materials are widely being studied as radiosensitizers to increase the efficacy of radiation therapy in the treatment of cancer. Here we present recent results for enhanced cell killing for in-vitro irradiation by protons of malignant prostate and breast epithelial cells treated with gold nanoparticles in an energy range approaching the Bragg peak.Theexperiments were conducted in the ion beam facility at East Carolina University using the recently upgradedcell irradiation beamline.

In addition, we are expanding current Monte Carlo track structure simulation models to include swift-ion-induced secondary electron emission from gold; please see the presentation by Michael Dingfelder at this meeting for more details on the simulations. Furthermore, to explore differences between secondary electron production and transport in the bulkfrom nanostructured surfaces, we have measured doubly differential electron emission yields from gold foils and from gold nanostructures, including hydrated gold surfaces, induced by fast proton and carbon ion impact.These data suggest the importance of the surface structure on low-energy electron emission, which may affect radiation damage from secondary electrons in the cellular environment and influence cell killing.

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