Stanford

Wu Liu

Associate Professor of Radiation Oncology (Radiation Physics)

Radiation Oncology - Radiation Physics

Bio

BIO

Wu Liu is an associate professor and clinical medical physicist at Department of Radiation Oncology, Stanford University, Stanford, CA, USA. He was born and raised in Beijing, China. He received B.S. degree in Astronomy from Nanjing University, Nanjing, China and M.S. degree in Astrophysics from Chinese Academy of Sciences, Beijing, China. He obtained his M.S. degree in Computer Science and Ph.D. degree in Medical Physics (2007) from University of Wisconsin-Madison, Madison, WI, USA. He then completed his postdoctoral training at Stanford University. Before re-joining Stanford, he was a medical physicist at Yale-New Haven hospital and an assistant professor at Yale University.

ACADEMIC APPOINTMENTS

- Associate Professor - University Medical Line, Radiation Oncology - Radiation Physics
- Member, Bio-X
- Member, Stanford Cancer Institute

PROFESSIONAL EDUCATION

- PhD, University of Wisconsin-Madison , Medical Physics
- MS, University of Wisconsin-Madison , Computer Sciences
- MS, Graduate School of Chinese Academy of Science, Beijing, China , Astrophysics
- BS, Nanjing University, Nanjing, China , Astronomy

LINKS

- lab site: https://med.stanford.edu/liulab/about.html
- personal site: https://web.stanford.edu/~wuliu/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Theranostic nanoparticles for radiosensitization and medical imaging. Novel treatment technique for ocular disease radiotherapy. Radio-neuromodulation using focused kV x-rays. Use artificial intelligence in image and biological guided radiotherapy and medical image analysis (PET, x-ray, and CT images). Ultrasound parametric imaging.

Tumor-targeted delivery and cell internalization of theranostic gadolinium nanoparticles for image-guided nanoparticle-enhanced radiation therapy

The goal of this research is to develop gadolinium nanoparticles linked to pH-Low Insertion Peptides as a novel means for simultaneously imaging and radiosensitizing solid tumors and to develop a novel mechanistic biophysical model to predict radiosensitization by nanoparticles. Conjugation of pHLIP to gadolinium nanoparticles actively targets solid tumors' acidic microenvironment and also delivers cell-impermeable, radiation sensitizing nanoparticles into cancer cells, which is critical for the nanoparticle-induced short-range Auger and photoelectrons to reach the vital cellular targets. The magnetic resonance imaging property of gadolinium can be used to examine in vivo nanoparticle distributions and facilitate enhanced quantitative treatment planning for radiation therapy.

Focused kV X-ray Modulated Conformal Radiotherapy for Small Targets

The proposed focused kV x-ray technique by polycapillary lens can deliver personalized highly-conformal radiation treatment to small targets a few millimeters in size, which is not possible by current radiation devices, and has numerous potential applications in medicine. It can treat neovascular age-related macular degeneration of different sizes with conformal lesion coverage in contrast to the current way of using collimated divergent beams to deliver a universal treatment to all patients resulting in incomplete dosimetric coverage and/or toxic treatment. The ability of conformally treating ultrasmall targets also enables a new set of preclinical small animal researches with target sizes comparable to the relative sizes in humans, such as radiation-based neuromodulation, which can alter local neuronal function without ablative nerve destruction.

Publications

PUBLICATIONS

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- **3D printing in brachytherapy: A systematic review of gynecological applications.** *Brachytherapy*
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- **Intravitreal brolucizumab as treatment of early onset radiation retinopathy secondary to plaque brachytherapy for choroidal melanoma.** *American journal of ophthalmology case reports*
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- **Microdosimetric Investigation and a Novel Model of Radiosensitization in the Presence of Metallic Nanoparticles.** *Pharmaceutics*
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- **MR to Ultrasound Image Registration with Segmentation-Based Learning for HDR Prostate Brachytherapy**
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- **Practice Patterns for the Treatment of Uveal Melanoma with Iodine-125 Plaque Brachytherapy: Ocular Oncology Study Consortium Report 5.** *Ocular oncology and pathology*
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- **Tumor-targeted pH-low insertion peptide delivery of theranostic gadolinium nanoparticles for image-guided nanoparticle-enhanced radiation therapy.** *Translational oncology*
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- **Dosimetry Modeling of Focused kV X-ray Radiotherapy for Wet Age-related Macular Degeneration.** *Medical physics*
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- **On the use of bolus for pacemaker dose measurement and reduction in radiation therapy** *JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS*
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- **Comparison of 2D and 3D modeled tumor motion estimation/prediction for dynamic tumor tracking during arc radiotherapy** *PHYSICS IN MEDICINE AND BIOLOGY*
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