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.

Teaching

STANFORD ADVISEES

Postdoctoral Faculty Sponsor

Chenhui Qiu, Liyan Sun, Weiyuan Sun

Publications

PUBLICATIONS

- **High resolution imaging with focused kV x-rays for small animal radio-neuromodulation.** *Medical physics*
  Shi, L., Bennett, N. R., Nguyen, E., MacDonald, C., Wang, A., Liu, W.
  2023

- **3D printing in brachytherapy: A systematic review of gynecological applications.** *Brachytherapy*
  Fahimian, B. P., Liu, W., Skinner, L., Yu, A. S., Phillips, T., Steers, J. M., DeMarco, J., Fraass, B. A., Kamrava, M.
  2023

- **Radio-luminescent imaging for rapid, high resolution eye plaque loading verification.** *Medical physics*
  Yan, H., De Jean, P., Grafil, E., Ashraf, R., Niedermayr, T., Astrahan, M., Mruthyunjaya, P., Beadle, B., Xing, L., Liu, W.
  2022

- **Intravitreal brolucizumab as treatment of early onset radiation retinopathy secondary to plaque brachytherapy for choroidal melanoma.** *American journal of ophthalmology case reports*
  Villegas, N. C., Mishra, K., Steinle, N., Liu, W., Beadle, B., Mruthyunjaya, P.
  2022; 27: 101581

- **Microdosimetric Investigation and a Novel Model of Radiosensitization in the Presence of Metallic Nanoparticles.** *Pharmaceutics*
  Yan, H., Carlson, D. J., Abolfath, R., Liu, W.
  1800; 13 (12)

- **MR to Ultrasound Image Registration with Segmentation-Based Learning for HDR Prostate Brachytherapy**
  Chen, Y., Xing, L., Yu, L., Liu, W., Fahimian, B., Niedermayr, T., Bagshaw, H., Buyyounouski, M., Han, B.
  WILEY.2021

- **MR to ultrasound image registration with segmentation-based learning for HDR prostate brachytherapy.** *Medical physics*
  Chen, Y. n., Xing, L. n., Yu, L. n., Liu, W. n., Fahimian, B. P., Niedermayr, T. n., Bagshaw, H. P., Buyyounouski, M. n., Han, B. n.
  2021

- **Precision radiotherapy using monochromatic inverse Compton x-ray sources.** *Medical physics*
  Simiele, E. A., Breitkreutz, D. Y., Capaldi, D. P., Liu, W., Bush, K. K., Skinner, L. B.
  2020
- **Practice Patterns for the Treatment of Uveal Melanoma with Iodine-125 Plaque Brachytherapy: Ocular Oncology Study Consortium Report 5.** *Ocular oncology and pathology*
  Binder, C., Mruthyunjaya, P., Schefler, A. C., Seider, M. I., Crilly, R., Hung, A., Meltsner, S., Mowery, Y., Kirsch, D. G., Teh, B. S., Jennelle, R. L., Studenski, M. T., Liu, et al
  2020; 6 (3): 210-218
- **Tumor-targeted pH-low insertion peptide delivery of theranostic gadolinium nanoparticles for image-guided nanoparticle-enhanced radiation therapy.** *Translational oncology*
  Liu, W. n., Deacon, J. n., Yan, H. n., Sun, B. n., Liu, Y. n., Hegan, D. n., Li, Q. n., Coman, D. n., Parent, M. n., Hyder, F. n., Roberts, K. n., Nath, R. n., Tillement, et al
  2020; 13 (11): 100839
- **Dosimetry Modeling of Focused kV X-ray Radiotherapy for Wet Age-related Macular Degeneration.** *Medical physics*
  Yan, H. n., Sun, W. n., Mruthyunjaya, P. n., Beadle, B. n., Yu, W. n., Kanwal, B. n., MacDonald, C. A., Liu, W. n.
  2020
- **Adaptive Imaging Versus Periodic Surveillance for Intrafraction Motion Management During Prostate Cancer Radiotherapy** *TECHNOLOGY IN CANCER RESEARCH & TREATMENT*
  Ma, X., Yan, H., Nath, R., Chen, Z., Li, H., Liu, W.
  2019; 18: 1533033819844489
- **Novel Eye Plaque Designs for Brachytherapy of Iris and Ciliary Body Melanoma and the First Clinical Application** *OCULAR ONCOLOGY AND PATHOLOGY*
  Liu, W., Kim, J., Young, B. K., Nath, R., Chen, Z., Decker, R. H., Astrahan, M. A., Pointdujour-Lim, R.
  2019; 5 (3): 220–27
- **Monte Carlo dosimetry modeling of focused kV x-ray radiotherapy of eye diseases with potential nanoparticle dose enhancement** *MEDICAL PHYSICS*
  Yan, H., Ma, X., Sun, W., Mendez, S., Stryker, S., Starr-Baier, S., Delliturri, G., Zhu, D., Nath, R., Chen, Z., Roberts, K., MacDonald, C. A., Liu, et al
  2018; 45 (10): 4720–33
- **On the use of bolus for pacemaker dose measurement and reduction in radiation therapy** *JOURNAL OF APPLIED CLINICAL MEDICAL PHYSICS*
  Yan, H., Guo, F., Zhu, D., Stryker, S., Trumpore, S., Roberts, K., Higgins, S., Nath, R., Chen, Z., Liu, W.
  2018; 19 (1): 125–31
- **Incorporating patient-specific CT-based ophthalmic anatomy in modeling iodine-125 eye plaque brachytherapy dose distributions** *BRACHYTHERAPY*
  Tien, C. J., Astrahan, M. A., Kim, J. M., Materin, M., Chen, Z., Nath, R., Liu, W.
  2017; 16 (5): 1057–64
- **Comparison of 2D and 3D modeled tumor motion estimation/prediction for dynamic tumor tracking during arc radiotherapy** *PHYSICS IN MEDICINE AND BIOLOGY*
  Liu, W., Ma, X., Yan, H., Chen, Z., Nath, R., Li, H.
  2017; 62 (9): N168–N179
- **Tissue feature-based intra-fractional motion tracking for stereoscopic x-ray image guided radiotherapy.** *Physics in medicine and biology*
  Xie, Y., Xing, L., Gu, J., Liu, W.
  2013; 58 (11): 3615-3630
- **Real-time automatic fiducial marker tracking in low contrast cine-MV images** *MEDICAL PHYSICS*
  Lin, W., Lin, S., Yang, S., Liou, S., Nath, R., Liu, W.
  2013; 40 (1): 011715
- **Hybrid MV-kV 3D respiratory motion tracking during radiation therapy with low imaging dose** *PHYSICS IN MEDICINE AND BIOLOGY*
  Yan, H., Li, H., Liu, Z., Nath, R., Liu, W.
  2012; 57 (24): 8455–69
- **Dose verification for respiratory-gated volumetric modulated arc therapy** *PHYSICS IN MEDICINE AND BIOLOGY*
  Qian, J., Xing, L., Liu, W., Luxton, G.

2011; 56 (15): 4827-4838

- **Clinical development of a failure detection-based online repositioning strategy for prostate IMRT-Experiments, simulation, and dosimetry study** *MEDICAL PHYSICS*
  Liu, W., Qian, J., Hancock, S. L., Xing, L., Luxton, G.
  2010; 37 (10): 5287-5297
- **Dose reconstruction for volumetric modulated arc therapy (VMAT) using cone-beam CT and dynamic log files** *PHYSICS IN MEDICINE AND BIOLOGY*
  Qian, J., Lee, L., Liu, W., Chu, K., Mok, E., Luxton, G., Le, Q., Xing, L.
  2010; 55 (13): 3597-3610
- **Trade-Offs in Data Acquisition and Processing Parameters for Backscatter and Scatterer Size Estimations** *IEEE TRANSACTIONS ON ULTRASONICS FERROELECTRICS AND FREQUENCY CONTROL*
  Liu, W., Zagzebski, J. A.
  2010; 57 (2): 340-352
- **A failure detection strategy for intrafraction prostate motion monitoring with on-board imagers for fixed-gantry IMRT** *International journal of radiation oncology, biology, physics*
  Liu, W., Luxton, G., Xing, L.
  2010; 78 (3): 904-911
- **Optimized hybrid megavoltage-kilovoltage imaging protocol for volumetric prostate arc therapy** *International journal of radiation oncology, biology, physics*
  Liu, W., Wiersma, R. D., Xing, L.
  2010; 78 (2): 595-604
- **Real-time 3D internal marker tracking during arc radiotherapy by the use of combined MV-kV imaging** *PHYSICS IN MEDICINE AND BIOLOGY*
  Liu, W., Wiersma, R. D., Mao, W., Luxton, G., Xing, L.
  2008; 53 (24): 7197-7213
- **Acoustic backscatter and effective scatterer size estimates using a 2D CMUT transducer** *PHYSICS IN MEDICINE AND BIOLOGY*
  Liu, W., Zagzebski, J. A., Hall, T. J., Madsen, E. L., Varghese, T., Kliewer, M. A., Panda, S., Lowery, C., Barnes, S.
  2008; 53 (15): 4169-4183
- **Spectral and scatterer-size correlation during angular compounding: simulations and experimental studies.** *Ultrasonic imaging*
  Liu, W., Zagzebski, J. A., Varghese, T., Gerig, A. L., Hall, T. J.
  2006; 28 (4): 230-44
- **Segmentation of elastographic images using a coarse-to-fine active contour model.** *Ultrasound in medicine & biology*
  Liu, W., Zagzebski, J. A., Varghese, T., Dyer, C. R., Techavipoo, U., Hall, T. J.
  2006; 32 (3): 397-408
- **Monitoring stiffness changes in lesions after radiofrequency ablation at different temperatures and durations of ablation.** *Ultrasound in medicine & biology*
  Bharat, S., Techavipoo, U., Kiss, M. Z., Liu, W., Varghese, T.
  2005; 31 (3): 415-22
- **Elastographic versus x-ray CT imaging of radio frequency ablation coagulations: an in vitro study.** *Medical physics*
  Liu, W., Techavipoo, U., Varghese, T., Zagzebski, J. A., Chen, Q., Lee, F. T.
  2004; 31 (6): 1322-32
- **Semiautomated thermal lesion segmentation for three-dimensional elastographic imaging.** *Ultrasound in medicine & biology*
  Techavipoo, U., Varghese, T., Zagzebski, J. A., Chen, Q., Liu, W.
  2004; 30 (5): 655-64
- **Elastographic measurement of the area and volume of thermal lesions resulting from radiofrequency ablation: pathologic correlation.** *AJR. American journal of roentgenology*
  Varghese, T., Techavipoo, U., Liu, W., Zagzebski, J. A., Chen, Q., Frank, G., Lee, F. T.
  2003; 181 (3): 701-7
- **Spectroscopic confirmation of northern and equatorial cataclysmic variables. III. 32 poorly known objects** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*
  Liu, W., Hu, J. Y.

2000; 128 (1): 387–401

- **Spectroscopic identification for 20 cataclysmic variables and related objects** *CHINESE ASTRONOMY AND ASTROPHYSICS*

  Li, Z., Liu, W., Hu, J.

  1999; 23 (3): 324–38

- **Spectroscopic confirmation of 55 northern and equatorial cataclysmic variables. I. 27 confirmed cataclysmic variables** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*

  Liu, W., Hu, J. Y., Zhu, X. H., Li, Z. Y.

  1999; 122 (1): 243–55

- **Spectroscopic confirmation of 55 northern and equatorial cataclysmic variables. II. 28 disproved and suspected cataclysmic variable candidates** *ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES*

  Liu, W., Hu, J. Y., Li, Z. Y., Cao, L.

  1999; 122 (1): 257–68

- **EG Cancri: A new WZ Sge type dwarf nova** *ASTROPHYSICS AND SPACE SCIENCE*

  Liu, W., Li, Z. Y., Hu, J. Y.

  1998; 257 (2): 183–99