HelmholtzZentrum münchen
German Research Center for Environmental Health

Master project

Monte Carlo simulation with computational voxel phantoms for external dose rates to comforters in nuclear medicine

Problem: Questions have been raised whether it is safe to come in contact patients undergoing nuclear medicine diagnostics and therapy as family, or other patients in the waiting room, etc. As a part of the collaboration project between EURADOS and EANM, this subproject has been designed as a master project.

Methods to solve the problem: Patients administered by radiopharmaceuticals are defined as radiation sources. The external doses to caregivers nearby will be simulated by using Monte Carlo simulation method and anthropomorphic computational phantoms. In this project, two voxel phantoms standing straight in front of each other face-to-face will be implemented in a Monte Carlo simulation program, e.g., GATE. One phantom, modeled as a patient, will be administered by radiopharmaceuticals, such as ^{18}F-FDG for total body PET scan and Na^{131}I for hyperthyroidism therapy and thyroid cancer therapy. The ICRP reference and new developed pharmacokinetic models of these radiopharmaceuticals will be assumed in the source organs of the voxel phantom patient. The time-dependent absorbed organ dose rates in the other phantom modeled as a comforter's computational model will be calculated. The simulated data will be compared to the dose rates in the clinical nuclear medicine practice, which will be measured in the EURADOS-EANM framework.

Your task: You first will be familiar with the computational voxel phantoms and then implement two voxel phantoms in one of the Monte Carlo simulation codes (GATE, Geant4, TOPAS and MCNP6) depending on your preference. Furthermore, you will learn how to model the biokinetic behavior of radiopharmaceuticals in human body. You will work with other excellent medical physicists in Europe and dive into the computational dosimetry world of the biomedical physics.

Does it make you tempted? Then please contact Prof. Katia Parodi in the Chair or Dr. Weibo Li at Helmholtz Zentrum München for more detail of this project.

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