



PhD position available in  
Medical Physics in Radiation Therapy

**Topic: Radiotherapy treatment plan  
optimization in space and time**

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Radiotherapy is one of the main treatment options for cancer and more than half the patients receive radiation as part of their treatment. Radiotherapy is a highly technology-driven field where physicists, engineers, computer scientists and mathematicians apply their knowledge to improve cancer treatment, in close collaboration with radiation oncologists. The main goal of treatment planning for radiotherapy is to deliver a curative dose of radiation to the tumor while minimizing the dose to healthy organs surrounding the tumor. Today, this is a highly computerized process. Mathematical optimization algorithms are applied to determine the optimal intensity profiles of radiation beams to best achieve this goal.

Today, the radiation dose distribution can be shaped quite precisely in *space* to conform to the shape of the tumor. In contrast, the question how to optimally deliver radiation over *time* is less well studied. Most radiotherapy treatments are fractionated, which means that the total radiation dose is not delivered at once but is divided into many fractions that are delivered over several days or weeks. This gives healthy organs the ability to recover between fractions and tolerate higher radiation doses. In current practice, the total radiation dose is split evenly into multiple fractions and the patient is treated with the same dose distribution every day. However, recent work has shown that it can be advantageous to deliver distinct dose distributions in different fractions such that different parts of the tumor are treated on consecutive days. This novel concept has been called *spatiotemporal fractionation*. This project will study this concept further. New treatment planning algorithms will be developed that optimize the delivery of radiation in both space and time.

We are looking for a highly motivated PhD candidate with:

- strong background in physics, computer science, mathematics, engineering, or related field;
- genuine interest in applying computational methods to practical problems in radiotherapy;
- experience and interest in programming (mandatory);
- knowledge in radiotherapy or mathematical optimization (advantageous).

PhD candidates will be enrolled at the science faculty at the University of Zürich UZH and will work in the radiation oncology department at the University Hospital USZ. Zürich offers an attractive environment for medical physics research, including the Paul-Scherer Institute for Proton therapy and diverse of research groups at ETH, UZH and USZ.

Please contact Prof. Jan Unkelbach to apply or to obtain further information, or visit our website. (<http://www.radio-onkologie.usz.ch/forschung/seiten/forschungsgruppe-physik.aspx>)