## STATISTICAL MODELING AND ESTIMATION OF CAUSAL EFFECTS IN CONTINUOUS TIME

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This talk deals with the estimation of the causal effect of a time-varying treatment on a timeto-an-event outcome or on some other continuously distributed outcome. In particular, this talk applies to the situation where the treatment is repeatedly adapted to time-dependent patient characteristics. In this setting, the treatment effect cannot be estimated by simply conditioning on time-dependent patient characteristics, as they may themselves be indications of the effect of the treatment. This type of time-dependent confounding is common in observational studies. Robins has proposed the so-called structural nested models to estimate treatment effects in the presence of time-dependent confounding. In this talk I will provide a conceptual framework and a formalization for structural nested models in continuous time. I will show that estimators based on structural nested models are consistent and asymptotically normal. Moreover, I will prove that a test for treatment effects can be performed without specifying a model for treatment effects, as conjectured in Robins (1998). In addition, I will show that a subclass of structural nested models can be estimated with standard software. I will illustrate these ideas with an example of the effect of prophylaxis treatment for PCP on the survival of AIDS patients.