1134-18-37 **Blake S Pollard***, bpoll002@ucr.edu, and **John C Baez**. *Compositional modelling of open reaction networks.*

Reaction networks, or equivalently Petri nets, are a general framework for describing processes in which entities of various kinds interact and turn into other entities. In chemistry, where the reactions are assigned 'rate constants', any reaction network gives rise to a nonlinear dynamical system called its 'rate equation'. In this talk, I'll describe 'open' reaction networks, which allow entities to flow in and out at certain designated inputs and outputs. We treat open reaction networks as morphisms in a category. Composing two such morphisms connects the outputs of the first to the inputs of the second. We construct a functor sending any open reaction network to its corresponding 'open dynamical system'. This provides a compositional framework for studying the dynamics of reaction networks. We then turn to statics: that is, steady state solutions of open dynamical systems. We construct a 'black-box' functor that sends any open dynamical system to the relation that it imposes between input and output variables in steady states. This extends our earlier work on black-boxing for Markov processes. (Received June 30, 2017)