Abstract Submitted
for the MAS14 Meeting of
The American Physical Society

A Model of Songbird Song Syntax using Bayesian Nonparametrics SUMITHRA SURENDRALAL, DEZHE Z. JIN, Pennsylvania State Univ — Bird songs are learned sequences of syllables governed by specific rules of arrangement, or syntax. How is syntax encoded in the bird's brain? How is it accessed to produce variability in the vocalizations? These questions are pertinent not only to birdsong, but also to other kinds of learned sequence generation in animals - motor movements, for example. As a first step in addressing these questions, we can construct a probabilistic model of the song syntax. An earlier study has shown that the song syntax of a Bengalese Finch can be described by a Partially Observable Markov Model (POMM), in which a many-to-one mapping scheme between the syllables and associated hidden states was invoked. However, the construction of this model was largely heuristic. We use a nonparametric Bayesian formulation, the Hierarchical Dirichlet Process - Hidden Markov Model, to develop a more principled method of constructing the POMM for birdsong. Importantly, the use of a nonparametric Bayesian inference technique allows us to automatically estimate the optimal number of hidden states in the model. We also make a case for a correspondence between the abstract states in our model and chain networks of neurons in the avian brain region called the HVC.

Mallory Molina
Pennsylvania State Univ

Date submitted: 29 Aug 2014 Electronic form version 1.4