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**Sidney Smith Hall, Room 1074**

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## **Mapping the Intergalactic Medium using Lyman-alpha Forest Data**

Light we observe from quasars has traveled through the intergalactic medium (IGM) to reach us, and leaves an imprint of some properties of the IGM on its spectrum. There is a particular imprint of which cosmologists are familiar, dubbed the Lyman-alpha forest.

From this imprint, we can infer the distribution of neutral hydrogen along the line of sight from us to the quasar. The Sloan Digital Sky Survey Data Release 9 (SDSS - DR9) produced over 54,000 quasar spectra that can be used for analysis of the Lyman-alpha forest and, thus, aid cosmologists in further understanding the IGM along with revealing or corroborating other properties of the Universe.

With cosmological simulation output, we develop a methodology using local polynomial smoothing to model the IGM. I will describe the modeling methodology, how to analyze the adequacy of the modeling procedure and discuss some of the issues faced when modeling the real data from SDSS - DR9. Finally, describing the topological features of the IGM can aid in our understanding of the large-scale structure of the Universe along with providing a framework for comparing cosmological simulation output with real data beyond the standard measures.

Accessing important topological features of data can be accomplished with persistent homology - I will introduce persistent homology, and describe an example of how it can be used in this setting.