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## **First Stars and Quasars: What are their Effects on the IGM?**

**Michael Shull**, University of Colorado

**Abstract** Sometime between redshifts  $z = 10-30$ , the first stars and pre-galactic objects formed out of the primordial IGM. I will describe recent theoretical models of the first massive stars, low-mass galaxies, and active galactic nuclei, and speculate about their observable effects on the IGM:

- (1) double reionization of the IGM
- (2) high-redshift metal pollution
- (3) dwarf galaxies and high- $z$  black holes
- (4) relics in the cosmic microwave background optical depth
- (5) anomalous He II/H I absorption ratios in the voids