Title:	How robust are the inferred density and metallicity of the circumgalactic medium?
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Abstract:	Quantitative estimates of the basic properties of the circumgalactic medium (CGM), such as its density and metallicity, depend on the spectrum of incident UV background radiation. Models of UV background are known to have large variations, mainly because they are synthesized using poorly constrained parameters, which introduce uncertainty in the inferred properties of the CGM. Here, we quantify this uncertainty using a large set of new UV background models with physically motivated toy models of metal-enriched CGM. We find that the inferred density and metallicity of low-density (10−5 cm−3) gas is uncertain by factors of 6.3 and 3.2, whereas high-density (10−3 cm−3) gas by factors of 4 and 1.6, respectively. The variation in the shape of the UV background models is entirely responsible for such a variation in the metallicity, while variation in the density arises from both normalization and shape of the UV background. Moreover, we find a harder (softer) UV background infers higher (lower) density and metallicity. We also study warm-hot gas at T = 105.5 K and find that metallicity is robustly estimated but the inferred density is uncertain by a factor of 3 to 5.4 for low to high-density gas. Such large uncertainties in density and metallicity may severely limit the studies of the CGM and demand better observational constraints on the input parameters used in synthesizing UV background.
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