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Density calculations of NGC 3783 warm absorbers using a time-dependent photoionization model

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The distance of the outflowing wind is poorly constrained due to lack of direct imaging observations, which limits our understanding of their kinetic power. One way is that once known the density of the ionized plasma, the distance can be derived from the ionization parameter which measured based on the ionization states. Here, applying a new time-dependent photoionization model, TPHO, in SPEX, we define a new approach, TPHO-delay method, to calculate/predict a detectable density range for warm absorbers of NGC 3783. We also highlight the importance of TPHO model than equilibrium in the delayed state of plasma. Further, we add Be-like ion metastable absorption line method and physical constraints to the map of NGC 3783 warm absorber density, which as a comprehensive estimation/prediction for the future of new observations, such as XRISM. In addition, the counterpart in UV band can be a cross-check to inspect the TPHO-delay method. Finally, we calculate crossing time to consider the effect of the transverse motion of the outflow to the intrinsic luminosity variation.

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