and more recent dynamical calculations (e.g., Murray et al. 1995; Proga, Stone, & Kallman 2000), suggest that in AGNs $0.5 \lesssim \beta \lesssim 2$. We have computed models using velocity laws $\beta = 0.5, 1, 1.5$ and 2, representing a range from fast ($\beta = 0.5$) to slow winds ($\beta = 2$). We found that fast winds were not able to simultaneously cover the range in velocity and ionization state observed in the spectrum of NGC 3783, needed for the goal of this work, and that the best-fit velocity law was $\beta = 2$. This is why for the rest of this work we use $\beta = 2$. Then, we rewrite the number density in terms of the velocity law as,

$$n_H(x) = n_0 x^{-2} w^{-1}, \tag{3}$$

where $n_0 = \left(\frac{\dot{M}}{4\pi\mu m_H} r_0^{-2} v_\infty^{-1}\right)$. The absorbing line frequencies are shifted according to the Doppler relation,

$$w = \frac{c}{v_\infty}\left(1 - \frac{\lambda}{\lambda_0}\right), \tag{4}$$

where λ_0 is rest wavelength.

Our models are based on clouds illuminated by a point-like X-ray source. The input parameters are the source spectrum, the gas composition, the gas density $n_H(x)$, and the outflow velocity $w(x)$, where x is the position of each slab inside the cloud normalized to the radius of the most exposed face to the source, r_0. The source spectrum is described by the spectral luminosity $L_\epsilon = L f_\epsilon$, where L is the integrated luminosity from 1 to 1000 Ryd, and $\int_1^{1000\mathrm{Ryd}} f_\epsilon d\epsilon = 1$. This spectral function is taken to be a power law $f_\epsilon \sim \epsilon^{-\alpha}$, with $\alpha = 1$. The gas consists of the following elements, H, He, C, N, O, Ne, Mg, Si, S, Ar, Ca and Fe. We use solar abundances of Grevesse, Noels, & Sauval (1996), in all our models.

Thermal and statistical equilibrium in our models are computed with the code XSTAR (Kallman & Bautista 2001; Bautista & Kallman 2001). The code includes all relevant atomic processes and computes the equilibrium temperature and optical depths of the most prominent X-ray and UV lines identified in AGN spectra.

We consider two types of models, the single absorber model (SA) and the multicomponent model (MC). In both cases the absorption line profiles depend simultaneously upon the ionization and the kinematics of the absorbing gas.

3.1. *The Single absorber Model*

This model consists of a single extended cloud directly in the line of sight between the observer and the central source. Such a cloud flows away from the central source and towards the observed. For this model we make use of the Sobolev approximation for computing the line optical depths (Castor et al. 1975),

$$\tau_\nu(r) = \frac{\pi e^2}{mc} f \lambda_0 n_i(r) \left(\frac{dv}{dr}\right)^{-1}, \tag{5}$$

where f is the absorption oscillator strength, λ_0 (in cm) is the laboratory wavelength of the transition, n_i (in cm^{-3}) is the number density of the absorbing ion, and dv/dr is the velocity gradient in the wind. This gives us the relation between the outflow state and the radiation field. This is different from the calculation of the optical depth in the static case, which is directly proportional to the column density.

Inside the cloud we use a one-step forward differencing formula for the radiation transfer (Kallman & McCray 1982)

$$L_\nu(r + \Delta r) = L_\nu(r) e^{-\tau_\nu(r)} + 4\pi r^2 j_\nu(r) \frac{1 - e^{-\tau_\nu(r)}}{\kappa_\nu(r)}, \tag{6}$$

where $j_\nu(r)$ is the emission coefficient at radius r.

Under ionization equilibrium conditions the state of the gas depends just upon the shape of the ionizing spectrum and the ionization parameter ξ, that we define as in Tarter, Tucker, & Salpeter (1969)

$$\xi(r) = \frac{4\pi F(r)}{n_H(r)}, \tag{7}$$

where $F(r)$ is the total ionizing flux,

$$F(r) = \frac{1}{4\pi r^2} \int_1^{1000\mathrm{Ryd}} L_\nu(r) d\nu, \tag{8}$$

with $L_\nu(r)$ given by equation (6). The requirement that ξ spans various orders of magnitude, as observed, yields a cloud geometrically thick throughout most of the spectrum, i.e. a *photoionization bounded* cloud. For instance, a luminosity $L \sim 10^{44}$ erg s^{-1} and $\Delta\xi = \xi_2 - \xi_1 = \frac{L}{n}(\frac{1}{r_2^2} - \frac{1}{r_1^2}) = 10^3$ yield $n \sim 10^6$ cm^{-3} and the column density of the absorbing material is $N_H \sim n\Delta R \sim 9.7 \times 10^{24}$ cm^{-2}. This is a large value, such that even lines with moderately small oscillator strengths become saturated in the emergent spectrum, unless the metal abundances are reduced by several orders of magnitude with respect to solar.

In Figure 2 we compare the computed optical depth for the Ne X λ12.134 line in a stationary nebula with $L = 10^{44}$ erg s^{-1}, and constant density $n = 10^6$ cm^{-3} with a flow with $n(x) = 3.3 \times 10^6 x^{-0.5} w^{-1}$, a wind velocity function with $\beta = 2$, and $v_\infty =$