The Warm Absorber of the Seyfert Galaxy
NGC5548

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We present a spectral analysis of the Seyfert 1 Galaxy NGC 5548 data, which were obtained by CHANDRA with HEGT and LEGT, adding a total exposure time of 800 ks. The warm absorber of NGC 5548 was modeled with the code PHASE. We detected two different outflow velocity systems in the absorption lines present in the spectra of this source. One of the absorbing systems has outflow velocity of \(-1091\pm 63\) kms\(^{-1}\) and the other of \(-568 \pm 49\) kms\(^{-1}\). Each system required two absorption components with different ionization level to fit the observed features. Each velocity system is consist of a multi-phase medium.

THE WARM ABSORBERS
In 50% Seyferts 1 and Quasars there are intrinsic absorption lines with a blueshift \(-100\) to \(-2500\) kms\(^{-1}\) with respect to the AGN host rest frame. This phenomenon, observed in the X-ray band, is caused by warm ionized gas (10^4-10^5K). The absorption lines are, between others, caused by the different transitions of Oxygen (\(O_{VI}, O_{VII}, O_{VIII}\)), or the different transitions of Iron (\(Fe_{VI-XII}\) and \(Fe_{XVII-X XII}\)). This phenomenon is observed in the spectrum of NGC 5548. NGC5548. The Sy 1 Galaxy NGC5548 is at \(z=0.01717\) with \(L_{2.5\text{-keV}}=2.016\times 10^{41}\) ergs\(^{-1}\). It was observed by CHANDRA with HEGT and LEGT adding a total exposure time of 800 Ks.

RESULTS
We detected two different outflow velocity systems in the absorption lines present in the spectra of this source. For the system with \(V_{outf} = -568\) kms\(^{-1}\), one phase with \(logU=-0.52\) contributes to the O\(_{VI-VII}\) and Fe M-shell UTA, while another phase with \(logU=0.67\) contributes to the Si\(_{XII-XIV}\), Mg\(_{XI}\), Fe\(_{VII-XII}\) (See Fig.2).

For the other system, \(V_{outf}=-1091\) kms\(^{-1}\), one phase with \(logU=0.74\), produces absorption by Si\(_{XII-XIV}\), Mg\(_{XI}\), Fe\(_{VII-XII}\), and another, with \(logU=1.26\), contributes to the O\(_{VIII}, Ne_{X}, Mg_{XII}, Si_{XI-XII}\), Mg\(_{XI}\), Fe\(_{VII-XII}\).

THE MODEL.
The continuum (in the spectral range between 0.4-8 KeV) was well represented by a power law (\(\Gamma=1.55\)) with the addition of a blackbody component (\(kT = 0.1\)KeV). The warm absorber of NGC 5548 was modeled with the code PHASE (See Fig.1). This code fits 3 free parameters to each absorption component in the spectrum: 1) \(U=Q(H)/(4\pi n_{H}R)\) - ionization parameter, where \(Q(H)\) is the rate of H ionizing photons, \(R\) is the distance to the source, \(n_{H}\) is the hydrogen density and \(c\) is the speed of light, 2) \(V_{outf}\) - outflow velocity, 3) \(N_{H}\) - equivalent hydrogen column density.

The two absorbing components that form each velocity system are in pressure equilibrium with the each other (See Fig.3).

Fig.2- Absorption lines produced by Mg, O, Fe, and Ne ions, each one show the two velocity outflow systems of the absorber.

Fig.3- Curve of thermal stability for the SED used in this analysis. Both graphs show the two-phase absorber in pressure equilibrium. The HIP and the LIP have very different equilibrium temperatures but lie close to each other in the \(U/T\) axis. With the adopted definition of the ionization parameter \(U\), this ratio is inversely proportional to \(P\), the gas pressure. Hence assuming that the HIP and the LIP have the same location, the gas pressure between them is indistinguishable.

This suggests that each velocity system consists of a multi-phase medium. The kinematic components found on the X-rays are in agreement with the kinematic components forming the UV absorber. This supports the idea that the UV and X-ray absorption are part of the same phenomenon. The data do not require a model consisting of a continuos radial range of ionization structures, as suggested by a previous analysis. Such structure is actually ruled out, by the presence of similar charge states producing absorption with different outflow velocities.