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A ghostly damped Ly α system revealed by metal absorption lines

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We report the discovery of the first 'ghostly' damped Ly α absorption system (DLA), which is identified by the presence of absorption from strong low-ion species at $z_{\text{abs}} = 1.704\,65$ along the line of sight to the quasar SDSS J113341.29-005740.0 with $z_{\text{em}} = 1.704\,41$. No Ly α absorption trough is seen associated with these absorptions because the DLA trough is filled with the leaked emission from the broad emission-line region of the quasar. By modelling the quasar spectrum and analysing the metal lines, we derive $\log N(\text{H I})(\text{cm}^{-2}) \sim 21.0 \pm 0.3$. The DLA cloud is small (≤ 0.32 pc), thus not covering entirely the broad-line region and is located at ≥ 39 pc from the central active galactic nucleus (AGN). Although the DLA is slightly redshifted relative to the quasar, its metallicity ($[\text{S}/\text{H}] = -0.41 \pm 0.30$) is intermediate between what is expected from infalling and outflowing gas. It could be possible that the DLA is part of some infalling material accreting on to the quasar host galaxy through filaments, and that its metallicity is raised by mixing with the enriched outflowing gas emanating from the central AGN. Current DLA surveys miss these 'ghostly' DLAs, and it would be important to quantify the statistics of this population by searching the Sloan Digital Sky Survey (SDSS) data base using metal absorption templates.