The coronal properties of a very luminous quasar at $z = 1.77$

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Aim

Assuming Comptonisation models, coronal properties (kT_e, τ) have been determined recently for *local bright Seyfert galaxies* only. However, combining:

1. High *sensitivity* of *XMM-Newton* at soft energies and that of *NuSTAR* at harder energies.
2. High *Redshift & Luminosity* of the source.

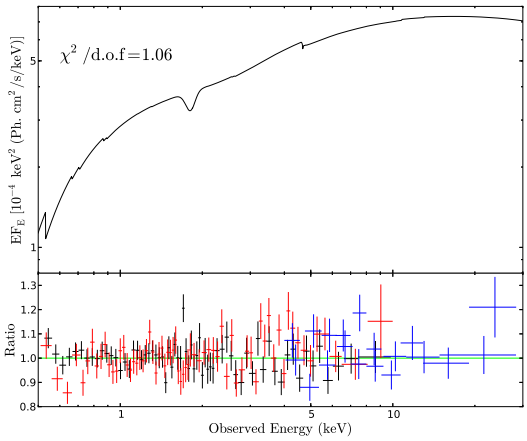
⇒ The **high-energy cutoff** ($E_{\rm cut} \sim 2-3kT_e$) will be *redshifted to lower, observed energies.*
⇒ Determine $E_{\rm cut}$ and the **coronal properties** of a *high redshift & luminous* quasar.

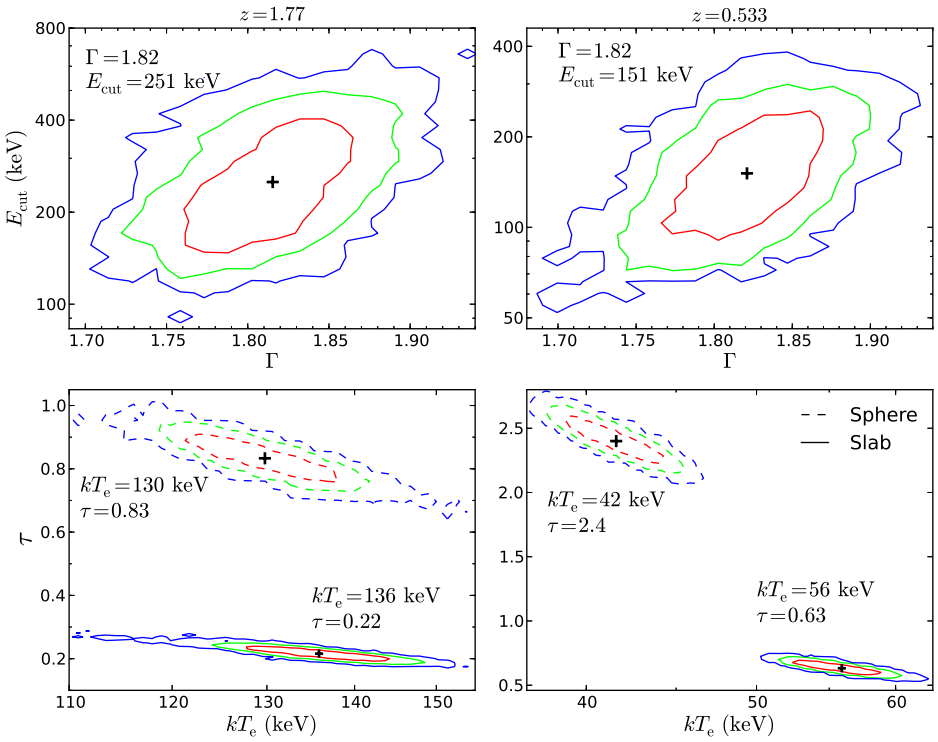
Quasar ID

- Name: QSO B2202–209 (aka PB 5062)
- Type: Radio Quiet
- Redshift: 1.77
- Luminosity: $L_{2-10\,\rm keV} \simeq 2\times10^{46}$ erg/s

Spectral Analysis

- Coordinated ~ 70 ks *XMM-Newton & NuSTAR* observations
- Models fitted to the 0.5–30 keV spectra:
  - + Galactic absorption
  - + Intrinsic neutral absorption
  - + Partially ionised absorber with redshift as free parameters (best-fit values: $z = 0.53$, $N_{\rm H} = 2.3\times10^{23}\,{\rm cm}^{-2}$)
  - + Cutoff power-law / Comptonisation (spherical and slab geometry)





Contour plots (**68%** , **95%** and **99.7%** C.L.) are presented considering both redshifts 1.77 (left panels) and 0.533 (right panels; see below for details).

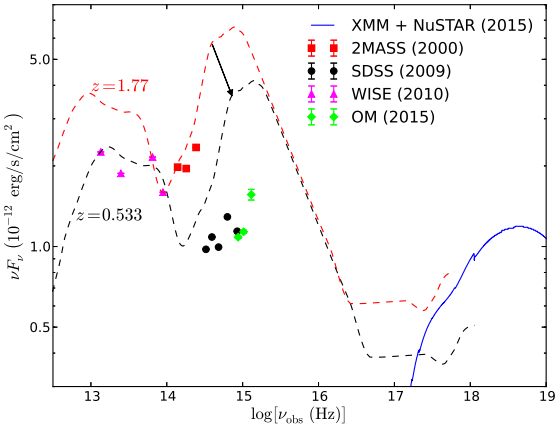
Misidentification of the Redshift?

- Reboul et al. (1987) [1] identified a broad emission line to be *"most likely"* C IV 1549 ⇒ $z = 1.77$
- The broadband SED does not agree with a typical SED of radio-quiet quasar unless shifted to the right ⟹ **z < 1.77 ??**
- If instead of C IV 1549 the broad line is identified to be Mg II 2798

⟹ **z = 0.533**

⟹ [Ne V] 3346 and [Ne V] 3426 emission lines could be identified.

⟹ Agreement between the typical and observed SEDs, with excess in IR (could be contribution of the host galaxy)



⟹ The same redshift of the *partially ionised absorber* identified in the X-ray spectral analysis.

Conclusions

- Compact corona:

  $z = 1.77 \rightarrow R_{\rm corona} < 16\,R_{\rm g}$
  $z = 0.533 \rightarrow R_{\rm corona} < 1.6\,R_{\rm g}$

- For both redshifts, the source is over-luminous in X–ray.
- The coronal properties of QSO B2202–209 are similar to the ones of *nearby less luminous Seyfert galaxies.*
- No reflection component was detected, most likely due to the *high ionisation state of the disc* and low S/N of the observations.
- Agreement with the prediction of pair production models [2].
- High resolution optical/UV spectra are needed in order to *determine accurately the redshift* of the source, and investigate more properly the *corona-accretion disc* connection.
- An accurate modelling of the SED is needed taking into consideration the contribution of the host galaxy.

References

[1] Reboul H., Vanderriest C., Fringant A. M., Cayrel R., 1987, A&A, 177, 337
[2] Fabian A. C., Lohfink A., Kara E., Parker M. L., Vasudevan R., Reynolds C. S., 2015, MNRAS, 451, 4375