Warm absorber outflows and feedback processes
The case of Mrk 279

Jacobo Ebrero
SRON Netherlands Institute for Space Research
Outline

- Introduction
- Mrk 279 X-ray observations
- The warm absorber in Mrk 279
- Warm absorber outflows & feedback
- Summary
Introduction

- Signatures of outflowing photoionised gas (warm absorber, WA) are seen in >50% of Seyfert 1 galaxies
- Wide range of ionisation degrees, column densities and outflow velocities
- The geometry, location, and impact in the local environment (feedback) are uncertain
Mrk 279

Isolated RQ Seyfert 1 galaxy @
z=0.0305; F_{0.5-2} = 2 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1}

Observed by Chandra LETGS (~360 ks; 2003) simultaneously with HST-STIS and FUSE.

Observed by XMM-Newton RGS (~160 ks; 2005)

Historical flux variability (up to 50%). Flux variability (20%) during the XMM observation

Very similar SEDs
The WA in Mrk 279

Costantini+07

Wednesday, July 21, 2010
The WA in Mrk 279

\[ \xi = \frac{L}{n R^2} \]

- Two components in the WA (XMM, Ebrero+10):
  - \( \log \xi = 0.7 \pm 0.3, \ N_H = 7 \pm 3 \times 10^{19} \text{ cm}^{-2}, \ v_{out} = -200 \pm 140 \) (CVI, NVI, OVI, OVII)
  - \( \log \xi = 2.6 \pm 0.1, \ N_H = 3 \pm 1 \times 10^{20} \text{ cm}^{-2}, \ v_{out} = -370 \pm 110 \) (OVIII, NeIX, NeX, FeXVII)

- Very similar to Chandra (Costantini+07)
(Possible) WA variability

Hints of variability: lightcurve, emission features in Chandra not present in XMM...

Compare N_{ion} XMM (black) and Chandra (red)

P_{K-S} < 90%

No significant evidences of short- or long-term variability
Derive mild limits for $R$ (Blustin+05)

$2 < R < 20$ pc (high ionisation component)

$6 < R < 260$ pc (low ionisation component)

Lower limits also consistent with lack of variability at shorter timescales

Consistent with a dusty torus wind origin (Krolik & Kriss 2001)
Location of the WA

Blustin+05

Wednesday, July 21, 2010
Feedback

- Mrk 279 WA shows a typical Sy 1 behaviour
- How important are Sy galaxies in the local Universe in terms of energetics and feedback?
Feedback

Mrk 279 WA shows a typical Sy 1 behaviour

How important are Sy galaxies in the local Universe in terms of energetics and feedback?

- Total mass outflow rate: $\sim 0.1 \, M_{\text{Sun}}/\text{yr}$
- Mass accretion rate: $\sim 0.09 \, M_{\text{Sun}}/\text{yr}$

Similarly to 9/13 type-1 AGN in Blustin+05
Feedback

\[ L_{KE} = \frac{1}{2} M_{out} v^2 \sim N_H R v^3 \]

- The total kinetic luminosity is \(~0.003\%\) of the bolometric luminosity
- The outflows play a limited role in the energetics of the system
- \( E_{KE} \sim 10^{55} \) erg (for \( t \sim 10^{8-9} \) yr; e.g. Gilli+09, Ebrero+09)
- \( E_0 \sim 10^{57} \) erg to disrupt ISM (Krongold+10)
Mrk 279 shows a two-component shallow WA with outflow velocities ~few hundreds km/s.

The behaviour is typical of other Sy 1 galaxies.

The WA is likely originated in the dusty torus.

The outflows have little or no impact in the ISM of the host galaxy.