Conference Highlights & Discussion

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Cool New Results (1)

★ **Lots of work presented that is quantifying the demographics of absorption lines in AGN.** [Recall that "population studies" were one of Hagai's two key questions.]

- NAL statisitics: Hamann, Vestergaard, Nestor, Ganguly, Eracleous
- BAL statistics from the SDSS: Richards, Hall
- X-ray weakness of BALS is almost definitely absorption [Gallagher].

★ **On the Lighter Side---Outflows in Emission**
[In the spirit of Martin's admonition to tie everything together.]

- SED seems to play a key role in emission-line profiles:
  - Softer SEDs $\Rightarrow$ more massive, faster outflows [Leighly]
  - Softer SEDs $\Rightarrow$ weaker, blue-shifted high-ionization emission lines [Leighly, Richards]

★ **Accurate covering fractions and abundances measured in an AGN outflow (Mrk 279) [Arav]. (Abundances several x solar.)**

Cool New Results (2)

★ **A single-cloud model with photoionization calculated in pressure equilibrium can yield the observed X-ray spectrum of NGC 3783. [Gonçalves, Rosanska].**

- Question: Can it do the UV lines too?

★ **Large range of Fe ionization states in the X-ray spectrum of NGC 5548 may imply that the gas is *not* in pressure equilibrium. [Steenbrugge]. But there are questions:**

- How accurate are the column densities given that the lines are unresolved, and that the covering fraction is not known?
- Perhaps a narrower range of ionization parameters give the observed ion columns?

Cool New Results (3)

- ★ **A model using a thin, outflowing spherical shell can match *both* emission and absorption lines in at least a couple of FeLoBALs. [Casebeer]**

- ★ **Outflowing CO absorption features in NGC 1068. [Axon]**

- ★ **Magnetic fields cure all ills. [Kőnigl, Everett]**
  - Lift material from the disk
  - Help with angular momentum transport
  - Naturally creates the “obscuring torus” (and its apparent shrinking size with luminosity)
  - Looks promising for explaining lack of BAL outflows in radio-loud objects.

Key Questions (1-4)

★ **Where are the absorbers?**

- Is there more than one region?
  - Are the UV and X-ray absorbers related (and co-spatial)?
  - Are NALs and BALs related?

★ **What is the geometry of the flow?**

- Spherical?
- Filled bicone?
- Funnel/hyperbolic surface with thickened walls?

★ **Related: what is the covering fraction?**

- This has two aspects:

  Global (absorbers seen from the source's perspective)

  Line-of-sight (source seen from observer's perspective)

★ **Also related: what is the filling fraction?**

- Affects range of densities and pressures observed, and mass outflow rate.

Key Questions (5-8)

- ★ **What is the origin of the flow? (Note that where you see it doesn't necessarily mean it started there.)**
  - Inner disk, outer disk, torus, NLR?
- ★ **What is the acceleration mechanism?**
  - Radiation driven?
  - Thermal-pressure driven? [Chelouche]
  - Magnetic fields? [Everett, Kőnigl]
  - [Cosmic rays?]
- ★ **If all gas is co-spatial, is it in pressure equilibrium?**

  (This is relevant for the temporal development and stability of the flow, and the observed absorption features.)
- ★ **How is time-dependent photoionization affecting the interpretation of our measurements?**

Location is Key

★ **Distance → Local Physical Properties (esp. density)**

→ Thickness of the absorber

→ Clues to the origin of the flow

★ **Add in geometry, covering fraction, and filling factor, and we get**

- Mass outflow rate
- Energy of the outflow

Current Distance Estimates

★ **UV absorption, using the CIII* density diagnostic:**

- NGC 3783 (Gabel): Component #1 @ 25 pc
- NGC 4151 (Kraemer): Component D @ 0.5 pc

★ **X-ray absorption, using ionization/recombination timescales:**

- NGC 4051 (Krongold): < 3.5 lt-d (LIP), 0.5—1.0 lt-d (HIP)
- NGC 3783 (Behar): < 6 pc (O VII lines); > 0.5 pc (O K edges);
  > 3 pc (Fe M edges)

★ **Phenomenological arguments (Crenshaw)**

- NLR cores have widths comparable to the AALs in Sey 1s
- NLR cores are at distances of 10s of pc
- NLR core emission lines have physical parameters like the UV absorbing gas
- Ergo, the UV absorbing gas *is* the NLR core gas

Evidence for Co-spatial UV & X-ray Absorbers

★ **Kinematic correspondence of X-ray and UV in NGC 3783**

★ **Pressure equilibrium of UV and X-ray absorbing gas in NGC 3783**

★ **Several sources with at least one UV component that has physical parameters matching that of the X-ray gas (NGC 5548, NGC 3516, NGC 7469, Mrk 509).**

Where do we go from here?

- ★ **The 900 ks Chandra observation of NGC 3783 (coordinated with STIS and FUSE) is the kind of data quality we need.**
  - Many, many lines
    - Weak ones are unsaturated $\rightarrow$ good column densities
    - Many ionization levels $\rightarrow$ good photoionization constraints
    - Many transitions of single ions $\rightarrow$ can evaluate partial covering fraction
  - Extensive temporal sampling
- ★ **One object is not enough!**
- ★ **Strategies:**
  - Large, community based proposal(s) like the AGN Watch campaigns
  - Coordinated UV is essential.
    - FUSE has limited abilities right now, and only gets a few ions (HI, OVI, CIII)
    - Wait for COS, after SM4? (But FUSE may not last …)