Disk Winds - tests?

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Empedocles c.400 BCE

Air
Wind/ Quasar
Atmosphere

Water
Fluid = jet ?

Fire
Radiation = disk ?

Earth
Gravity = black hole ?
5 Chinese elements

- Culturally dependent: No Air - Wood & Metal instead
- Different elements in AGNs?
Elvis 2000: pluses, minuses

- **UV/X-ray connection**
  - FUSE, STIS partial covering, transverse; broader abs = edge-on [Kriss, Kaastra]
  - location: disk or torus [M.E., Kriss, Kaastra]
  - *WA variability. Higher X-ray resolution at <1keV (R~5000), need spectra in ~hours.*

- **Funnel shape**
  - ‘*Vertical*’ region no pro or con? reverberation red/blue symmetry
  - **Radial region - Compton []~1 wind: ASTRO-E2**
    - ✓ Spectropolarimetry: Ha PA, %polz’n [Axon, Kishimoto, Tadhunter]

- **Phases**, pressure Equilibrium/continuous? [M.E., Kaastra, Collin].
  - **BELR in wind?** NGC3227 abs’n event [McHardy]

- **0.1c winds:** part of disk wind? Only Edd.limited? Photosphere [Pounds, Reeves, Lawrence], UV blueshifts-smaller [O’Brien]
  - ASTRO-E2
More Tests & challenges

- **eigenvector 1 = mdot?**
  - Wind moves out, gets stronger at high mdot?
  - SCAR: BH masses too low? [Collin]
  - Variability - FWHM(Hb) [McHardy]
  - BAL quasars: radio-loudness $v_{max}$ link - mdot?[Wills]

- **large scale wind**
  - HI outflows: or radio jet cocoon? [Morganti, Beswick, Axon]
  - How many ways to make type 2 AGNs? [M.E.]

- **Evolution:**
  - Obscured population, vs z. [Simpson] Just a phase black holes go through?
  - Star formation in disk [Nayakshin, Collin]
  - Star formation/AGN link. Black hole growth. SCUBA [Alexander]
  - Is a wind required for accretion to occur? [Fabian]
Black Hole Evolution

- Obscured population, vs z. [Simpson] Just a phase black holes go through?
- Star formation in disk. BELR abundances [Nayakshin, Collin]
- Star formation/AGN link. Black hole growth. SCUBA [Alexander]
- Is a wind required for accretion to occur? All AGNs have BELRs & so wihds? [Fabian, M.E.]
Relativistic Fe-K Em. Lines

- Yes! [Fabian] $2r_g$
- No (mostly) [Reeves] $10r_g$ (?) if present
- Yes, but… Schwartzchild [Done] $6r_g$
- Yes, in spikes [Turner] $6-20r_g$
- … or wind [Turner]
Pharos: A GRB Afterglow Mission
Martin Elvis (CfA), F. Fiore, F. Nicastro., astro-ph/xxxxxx

- MIDEX class mission
- $R > 5000$ X-ray Spectroscopy
  - Out of plane gratings
- $E < 0.87$ keV only
  - large area/mass ratio
- Rapid response
  - GRB afterglows
  - AGN monitoring
- Warm Absorber location (from ionization, recombination) dynamics abundances partial covering
X-ray Polarimetry

- Diagnostic power for AGN & Quasar structure
  - Where does the wind come from?
  - What is the scattering mechanism?
  - What is the geometry of AGN?

- Polarimetry is photon hungry
  - $10^6$ photons to measure 1% at 10s
  - THINK BIG

- MCP optics offer a solution
  - square meters, yet MIDEX scale
  - Link with fundamental physics

- *Extreme Physics Explorer*
Fin

Thanks to Martin Ward
all organizers & speakers
Pat Russell
Ken Pounds
4 themes of early 21st Century astrophysics converge on Gamma ray burst afterglows

- **The most energetic events in the Universe**
  - 1997 1st GRB redshift

- **The fate of the baryons & Large Scale Structure**
  - 1999 1st WHIM simulations
  - 2001 1st WHIM detection

- **Galaxies in the Age of Star Formation**
  - 1997 Hubble Deep Field
  - GRB hosts

- **The Recombination Epoch**
  - 2000 Gunn-Peterson trough @ z~6
# Pressure Balance in X-ray absorbers


<table>
<thead>
<tr>
<th>Parameter</th>
<th>High Ionization</th>
<th>Low Ionization</th>
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<tbody>
<tr>
<td>Log U</td>
<td>0.76 +/- 0.1</td>
<td>-0.78 +/- 0.13</td>
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<tr>
<td>Log N&lt;sub&gt;H&lt;/sub&gt; cm&lt;sup&gt;-2&lt;/sup&gt;</td>
<td>22.20 +/- 0.22</td>
<td>21.61 +/- 0.14</td>
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<tr>
<td>V&lt;sub&gt;turb&lt;/sub&gt; km s&lt;sup&gt;-1&lt;/sup&gt;</td>
<td>300 fixed</td>
<td>==300 fixed</td>
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<tr>
<td>V&lt;sub&gt;Out&lt;/sub&gt; km s&lt;sup&gt;-1&lt;/sup&gt;</td>
<td>788 +/- 138</td>
<td>738 +/- 138</td>
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<tr>
<td>T K</td>
<td>9.52 +/- 0.44 x 10&lt;sup&gt;5&lt;/sup&gt;</td>
<td>2.58 +/- 0.39 x 10&lt;sup&gt;4&lt;/sup&gt;</td>
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<tr>
<td>[Log T (K)]</td>
<td>5.98 +/- 0.02</td>
<td>4.41 +/- 0.07</td>
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<tr>
<td>Log T/U / P</td>
<td>5.22 +/- 0.12</td>
<td>5.19 +/- 0.20</td>
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<tr>
<td>Log M(Hi/Lo)</td>
<td>4.85</td>
<td></td>
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<tr>
<td>Log []</td>
<td>1.02 +/- 0.12</td>
<td>0.99 +/- 0.20</td>
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2-phase gas in pressure equilibrium