Codes TITAN+NOAR and VO

TITAN team
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Collaborations (other users)
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Kajal Ghosh…
Outline

- AGN physics
- Codes TITAN + NOAR capabilities (ALI radiative transfer)
- Standard web interface (in progress)
- Future work
- Grid of models (Anabela Gonçalves)
AGN typical continuum

Koratkar & Blaes (1999)
Geometry: transmitted, Outward, reflected fluxes

coverage factor ~1
Primary source
Outward emission Complete Absorption
Absorption model

coverage factor < 1
Partial Absorption Outward emission reflection

Direct primary reflection
An example of reflection model
Photoionized media: various codes

- XMM, Chandra: high-resolution (R=10-1000), detailed atomic data (XSTAR, Cloudy, TITAN)
- Thick absorbing medium line of sight: radiative transfer (TITAN)

Transfer: Escape probability vs. ALI for lines (thick medium)

- typical model for the region emitting the UV-X “continuum” of AGN
- (x10) on resonance lines, because line photons are reabsorbed.
  \( \tau_{es} > 0.001 \) (CD \( 10^{20} \) cm\(^{-2}\))

TITAN (+NOAR) code

- Photoionized non-LTE medium
- Plane-parallel 1D
- Gives consistent T, pops., flux (outward, reflected) in all directions
- Local and global radiative equilibrium
- Modes: constant density, gaseous pressure, total pressure
- NOAR = Monte Carlo, any geometry (accretion)

- 10 atoms: H, He, C, N, O, Ne, Mg, Si, S, Fe
- 102 ions, microturbulence
- Compton heating (NOAR)
- He-like: 15 levels + continuum (Godet et al., A&A 2004)
- Accuracy: order 10% for the triplet
- Previous 11 levels model:
- 50% accuracy (Coupé et al., A&A 2004)
- -> XSTAR atomic data
- log CD < 26, 5 < log n_H < 14, 1 < log ξ < 4
- 4 < log T < 8
Web interface - 1

- Observatory Paris, Simulations, Franck le Petit / Damien Guillaume,
- Launch models, tools to analyse and visualize
- User portal (client) + application server
- Java technology for communication, XML configuration files

![Diagram of web interface]

- Launch and store model
- Get analysis (image, tables)
- Get results
- Form to input parameters
- User portal

Java server listen on port 4321 to portal orders
Web interface - 2

- Vo.obspm.fr:8888/simulation/
- Private identified access
- List of applications
**Web interface - 3**

- French or english form (browser dependent)

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**TITAN : Modélisation des milieux photoionisés**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enregistrer l'ensemble de paramètres sous le nom:</td>
<td>user-defined by this form</td>
</tr>
<tr>
<td>Type de paramètres d'entrée [parfile]:</td>
<td>Choisir le fichier</td>
</tr>
<tr>
<td>Upload an input parameter file:</td>
<td>aucun fichier sélectionné</td>
</tr>
<tr>
<td>Session name [titre]:</td>
<td>tata</td>
</tr>
<tr>
<td>Type of atomic data [fichatomic]:</td>
<td>atomic13.hhe15libeo4fe</td>
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<tr>
<td>Upload an atomic data file:</td>
<td>Choisir le fichier</td>
</tr>
<tr>
<td>hydrostatic equilibrium [idens]:</td>
<td>constant density</td>
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<tr>
<td>Surface hydrogen density (units cm) [nhinit]:</td>
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<tr>
<td>Initial temperature (units K) [tinit]:</td>
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</tr>
<tr>
<td>Total column density (units cm^-2) [coldens]:</td>
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<tr>
<td>Turbulent velocity (units km/s) [vturb]:</td>
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<tr>
<td>Index for a power-law density [dendex]:</td>
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</tr>
<tr>
<td>Distance from the central source (units cm) [rmincm]:</td>
<td>1.0E13</td>
</tr>
</tbody>
</table>
Web interface - 4

- List of results, links
Web interface - Summary

- List of results, links, email to user
- Easy to install (cluster, local java, local programs on non-root account)
- Comparison with PDR: same parameter name, launch on cluster, one file of results: archive instead of bin
- Wished improvements: better form (titles), better name of items in results list, launch several models by a list of one input parameter
Future work

- Atomic Data (XSTAR database: 1000 to 20000 lines), VO like PDR code?
- Acceleration (GS/SOR, other, parallel)
- VO interface (AIDA, Astrogrid, ASAP), workflow (build grid of models, iteration TITAN/NOAR with intermediate fit of Compton heating)
- Definition of UCDs and DM
- Why VO?