

# X-ray example runs

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Dr. Bert Vander Meulen  
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# Technical note: X-ray RT in SKIRT



- All X-ray physics are implemented in the SKIRT class `XRayAtomicGasMix`
  - abundancies: number relative to H (default: angr)
  - temperature: should be low (neutral gas)
  - scatterBoundElectrons:
    - —None
    - Free (“Good” is likely better)
    - **FreeWithPolarization** (for polarisation simulations)
    - **Good** (bound-electron scattering)
    - —Exact

```
<materialMix type="MaterialMix">  
  <XRayAtomicGasMix abundancies="" temperature="0 K" scatterBoundElectrons="Good"/>  
</materialMix>
```

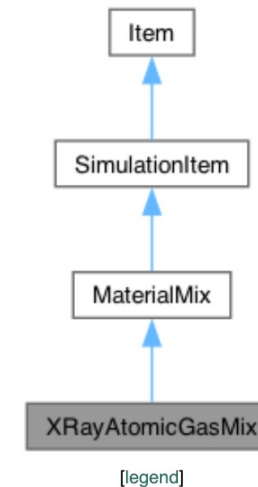
- SKIRT can run in simulationMode="ExtinctionOnly"
  - As fluorescence is internally implemented as scattering

## XRayAtomicGasMix Class Reference

Public Types | Public Member Functions |  
Protected Member Functions | Private Types |  
Private Member Functions | Private Attributes |  
Friends | List of all members

```
#include <XRayAtomicGasMix.hpp>
```

Inheritance diagram for XRayAtomicGasMix:



Fully documented on  
the SKIRT website

- X-ray spectrum: use a tabulated X-ray SED
  - Numpy is your friend to make these
- Be aware of min. and max. wavelengths
  - E.g.: 10 keV – 2 keV
- Use `wavelengthOutputStyle="Energy"` and `fluxOutputStyle="Energy"`
- Run in `simulationMode="ExtinctionOnly"`
  - Much much faster

```
<sed type="SED">  
  <FileSED filename="PL.txt"/>  
</sed>
```

# This session: X-ray tutorial with a bonus

- This session: **First follow the X-ray tutorial:**
  - *X-ray reprocessing in a clumpy AGN torus*
- As an introduction to X-ray SKIRT simulations
- Every simulation element is documented on the website
  - We will walk around to answer questions
- **Bonus:**
  1. Predict the X-ray polarisation for the same model
  2. Add Keplerian velocity field and zoom in on Fe Ka
- We have a break at 15:00 & move to hands-on sessions at 15:15



Level	Type	Topic
		Components of the SKIRT project
		Monochromatic simulation of a dusty disk galaxy
		Panchromatic simulation of a dust torus
		SKIRT Q&A and command line options
		Using PTS on the command line
		MakeUp, the graphical interface for SKIRT parameter files
		The SKIRT parameter file format (ski file)
		Upgrading SKIRT parameter files
		The SKIRT units system & supported units
		Stochastic heating in an SPH-simulated galaxy
		Visualizing SKIRT results with PTS
		X-ray reprocessing in a clumpy AGN torus
		Scattering by dust in a Kelvin-Helmholtz instability
		Building a proper spatial grid for a spiral galaxy
		Spatial grids and meshes overview
		Wavelength treatment during a simulation
		Wavelength grids overview
		Configuring wavelength grids
		Inspecting the built-in broadband filters
		Material mixes (dust, electrons, gas)

[skirt.ugent.be](http://skirt.ugent.be) → Documentation → User Guide

# The SKIRT website



The SKIRT project advanced radiative transfer for astrophysics

Home Community Documentation Reference

The home of the SKIRT project

- SKIRT Reference
- Ski File Reference
  - List of subclasses
  - List of properties
- PTS Reference

ical Observatory, Ghent University.

[https://skirt.ugent.be/root\\_ski\\_file\\_help\\_subclasses.html](https://skirt.ugent.be/root_ski_file_help_subclasses.html)

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SKIRT v9.0 (git dcac71e built on 05/05/2026 at 17:27:00)

## Introduction

This page lists the subclasses for each SKIRT class that may occur as a base class name in a ski file.

The sections are listed alphabetically on class name. To quickly locate the section for a given class, use your browser's find function and precede the class name with a - (dash).

### -AllSkyProjection

[docs] : an all-sky projection

Subclass	props	docs	Description
HammerAitoffProjection	<a href="#">props</a>	<a href="#">docs</a>	the Hammer-Aitoff all-sky projection
MollweideProjection	<a href="#">props</a>	<a href="#">docs</a>	the Mollweide all-sky projection

### -AngularDistribution

[docs] : an angular emission profile

Subclass	props	docs	Description
ConicalAngularDistribution	<a href="#">props</a>	<a href="#">docs</a>	an anisotropic conical emission profile
IsotropicAngularDistribution	<a href="#">props</a>	<a href="#">docs</a>	an isotropic emission profile
LaserAngularDistribution	<a href="#">props</a>	<a href="#">docs</a>	a laser emission profile
NetzerAngularDistribution	<a href="#">props</a>	<a href="#">docs</a>	a Netzer AGN accretion disk emission profile

### -AxGeometry

[docs] : an axisymmetric geometry

Subclass	props	docs	Description
AnnulusGeometry	<a href="#">props</a>	<a href="#">docs</a>	an annulus geometry
BrokenExpDiskGeometry	<a href="#">props</a>	<a href="#">docs</a>	a broken exponential disk geometry
ConicalShellGeometry	<a href="#">props</a>	<a href="#">docs</a>	a conical shell geometry
DonutGeometry	<a href="#">props</a>	<a href="#">docs</a>	a donut torus geometry
ExpDiskGeometry	<a href="#">props</a>	<a href="#">docs</a>	an exponential disk geometry
HyperboloidGeometry	<a href="#">props</a>	<a href="#">docs</a>	a hyperboloid geometry

[https://skirt.ugent.be/root/\\_ski\\_file\\_help\\_properties.html#SkiFileHelpConcreteLaserAngularDistribution](https://skirt.ugent.be/root/_ski_file_help_properties.html#SkiFileHelpConcreteLaserAngularDistribution)

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## -LaserAngularDistribution

[docs] : a laser emission profile

Scalar Property	Type	Description
symmetryX	docs Double	the direction of the positive symmetry axis, x component
symmetryY	docs Double	the direction of the positive symmetry axis, y component
symmetryZ	docs Double	the direction of the positive symmetry axis, z component

## -LaunchedPacketsProbe

[docs] : source: number of photon packets launched from primary and secondary sources

Scalar Property	Type	Description
probeName	docs String	the name for this probe

Compound Property	Type	Base Class	Description
wavelengthGrid	docs Item	WavelengthGrid subclasses	the wavelength grid for this probe

## -LightCurveInstrument

[docs] : a distant instrument that outputs the spatially integrated flux density as a light curve

Scalar Property	Type	Description
instrumentName	docs String	the name for this instrument
distance	docs Double	the distance to the system
inclination	docs Double	the inclination angle $\theta$ of the detector
azimuth	docs Double	the azimuth angle $\phi$ of the detector
roll	docs Double	the roll angle $\omega$ of the detector
radius	docs Double	the radius of the circular aperture, or zero for no aperture
recordComponents	docs Bool	record flux components separately
numScatteringLevels	docs Int	the number of individually recorded scattering levels
recordPolarization	docs Bool	record polarization (Stokes vector elements)
recordStatistics	docs Bool	record information for calculating statistical properties

Compound Property	Type	Base Class	Description
wavelengthGrid	docs Item	WavelengthGrid subclasses	the wavelength grid for this instrument

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