

- **compTT: Comptonization, Titarchuk**

This is an analytic model describing Comptonization of soft photons in a hot plasma, developed by L. Titarchuk (see ApJ, 434, 313). This replaces the Sunyaev-Titarchuk Comptonization model in the sense that the theory is extended to include relativistic effects. Also, the approximations used in the model work well for both the optically thin and thick regimes. The Comptonized spectrum is determined completely by the plasma temperature and the so-called β parameter which is independent of geometry. The optical depth is then determined as a function of β for a given geometry. Thus `par5` switches between spherical and disk geometries so that β is not a direct input here. This parameter **MUST** be frozen. If `par5` ≥ 0 , β is obtained from the optical depth using analytic approximation (e.g. Titarchuk 1994). If `par5` < 0 and $0.1 < \tau < 10$, β is obtained by interpolation from a set of accurately calculated pairs of β and τ from Sunyaev & Titarchuk 1985 (A&A 143, 374).

In this incarnation of the model, the soft photon input spectrum is a Wien law [$x^2 e^{-x}$ photons] because this lends itself to a particularly simple analytical form of the model. For present X-ray detectors this should be adequate. Note that in energy flux space the peak of the Wien law occurs at 3kT as opposed to 2.8kT for a blackbody. The plasma temperature may range from 2-500 keV, but the model is not valid for simultaneously low temperatures and low optical depth, or for high temperatures and high optical depth. The user is strongly urged to read the following references (esp. HT95 Fig 7) before and after using this model in order to fully understand and appreciate the physical assumptions made:

Titarchuk, L., 1994, ApJ, 434, 313; Hua, X-M., Titarchuk, L., 1995, ApJ, 449, 188;
Titarchuk, L., Lyubarskij, Y., 1995, ApJ, 450, 876.

<code>par1</code>	Redshift
<code>par2</code>	Input soft photon (Wien) temperature (keV)
<code>par3</code>	Plasma temperature (keV)
<code>par4</code>	Plasma optical depth
<code>par5</code>	Geometry switch. (sign denotes approximation technique, magnitude determines geometry)
	≤ 1 disk
	> 1 sphere
	≥ 0 use analytic approx for β vs τ
	< 0 β vs. τ from interpolation
<code>norm</code>	normalization