Effects of porosity on emergent synthetic spectra of Massive stars in the X-ray domain

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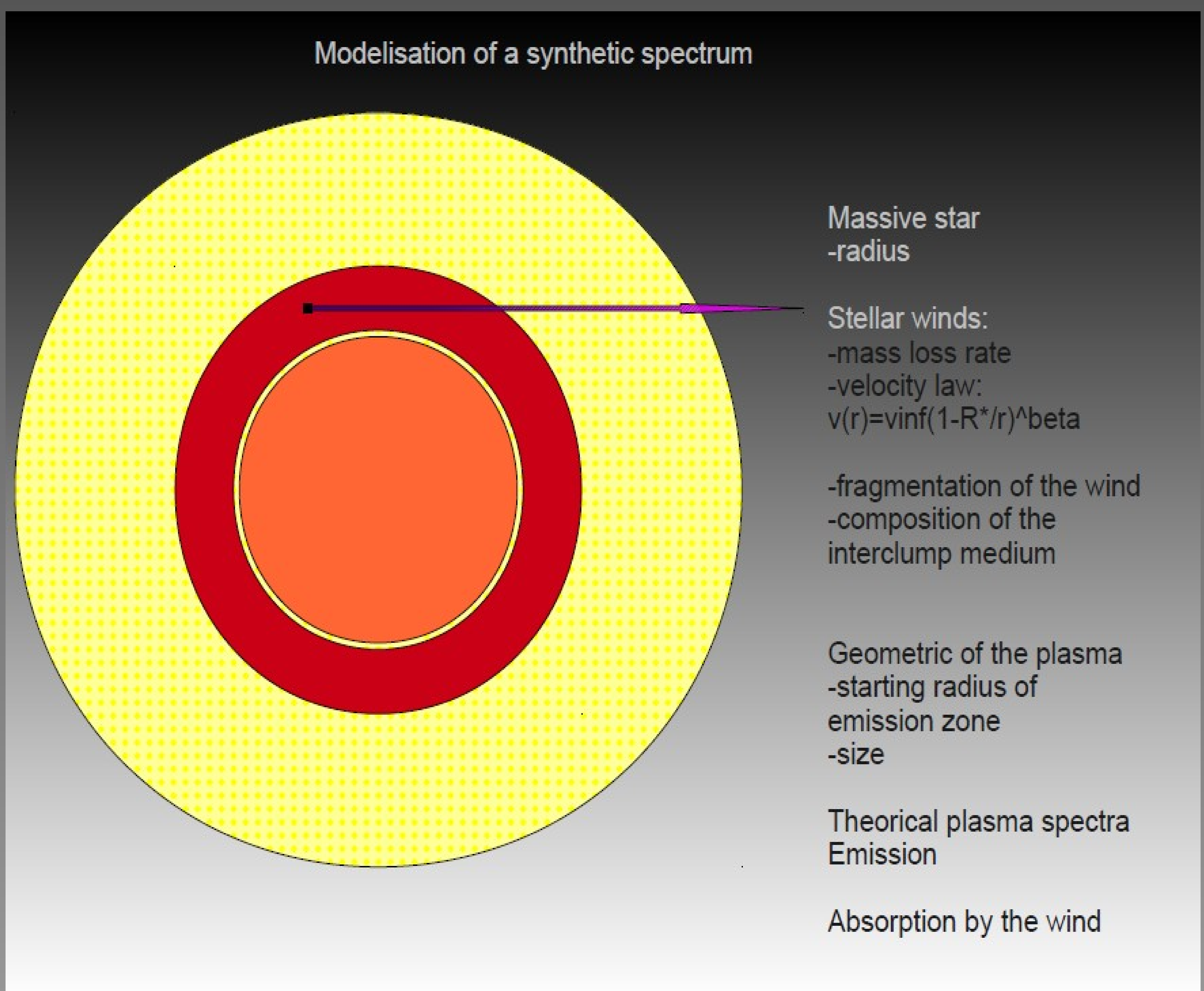
Abstract:Massive stars possess powerful stellar winds. Studies over the last decade revealed the importance of wind fragmentation and clumping and led to a downwards revision of the mass-loss rates. In this poster, we present the results of our code that allows to compare two models of wind fragmentation, and their consequences on the emergent X-ray spectra of massive stars.

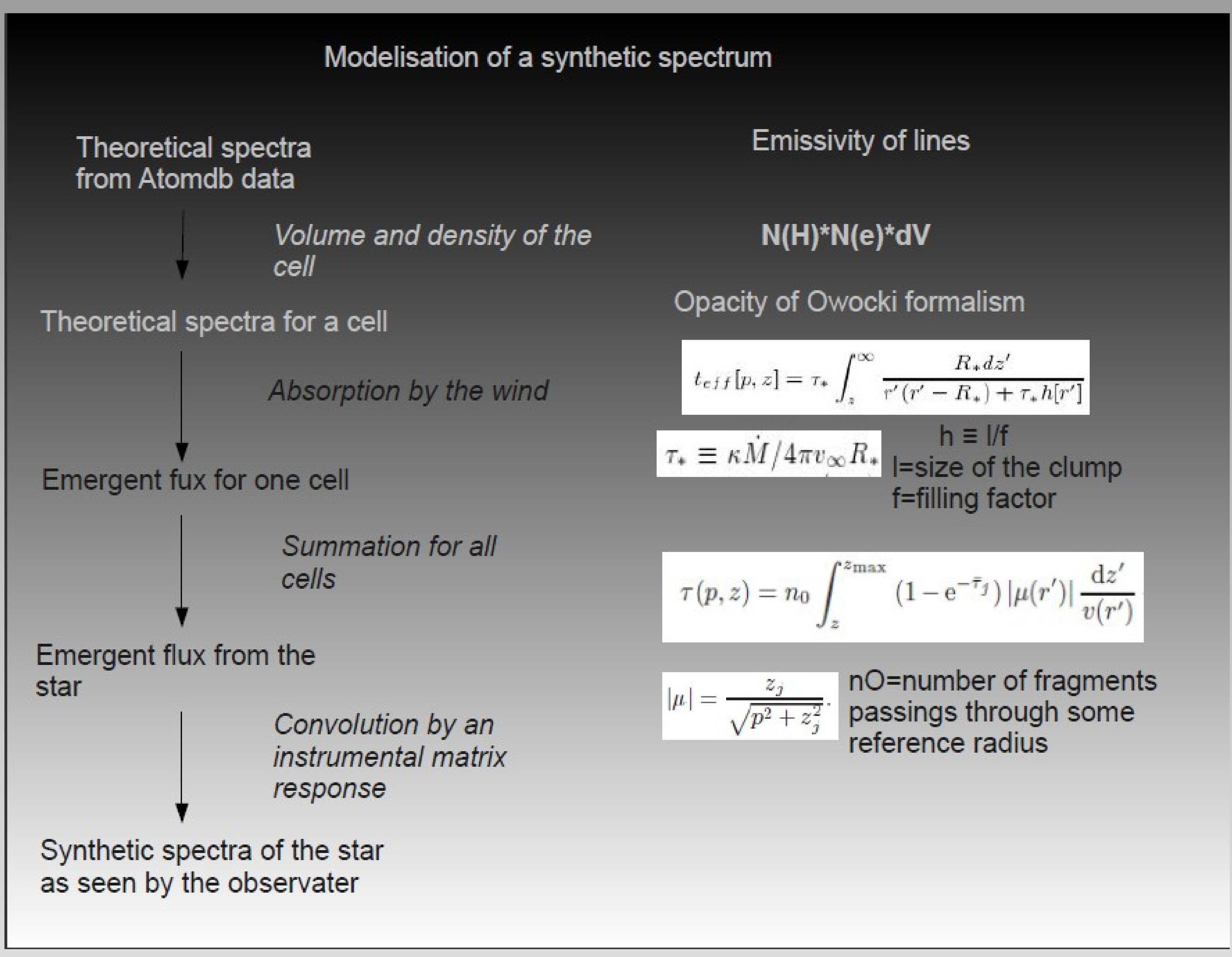
Introduction: The fragmention of stellar winds is now widely admitted.(Eversberg, Lépine & Moffat (1998) Bouret et al. (2005))
Different theories exist to explain the absorption of X-rays by fragmented winds.
We have developped a code to simulate X-ray spectra in order to compare the porosity of Owocki's formalism (Owocki et Cohen 2006; spherical, optically thin clumps) to the fragmentation frequency of Oskinova's theory (Oskinova et al 2006; oblate, partially optically thick clumps) in a first time. and to analyse the consequences of the fragmentation on the emergent flux and finally to compare our models to observations.

Our models:

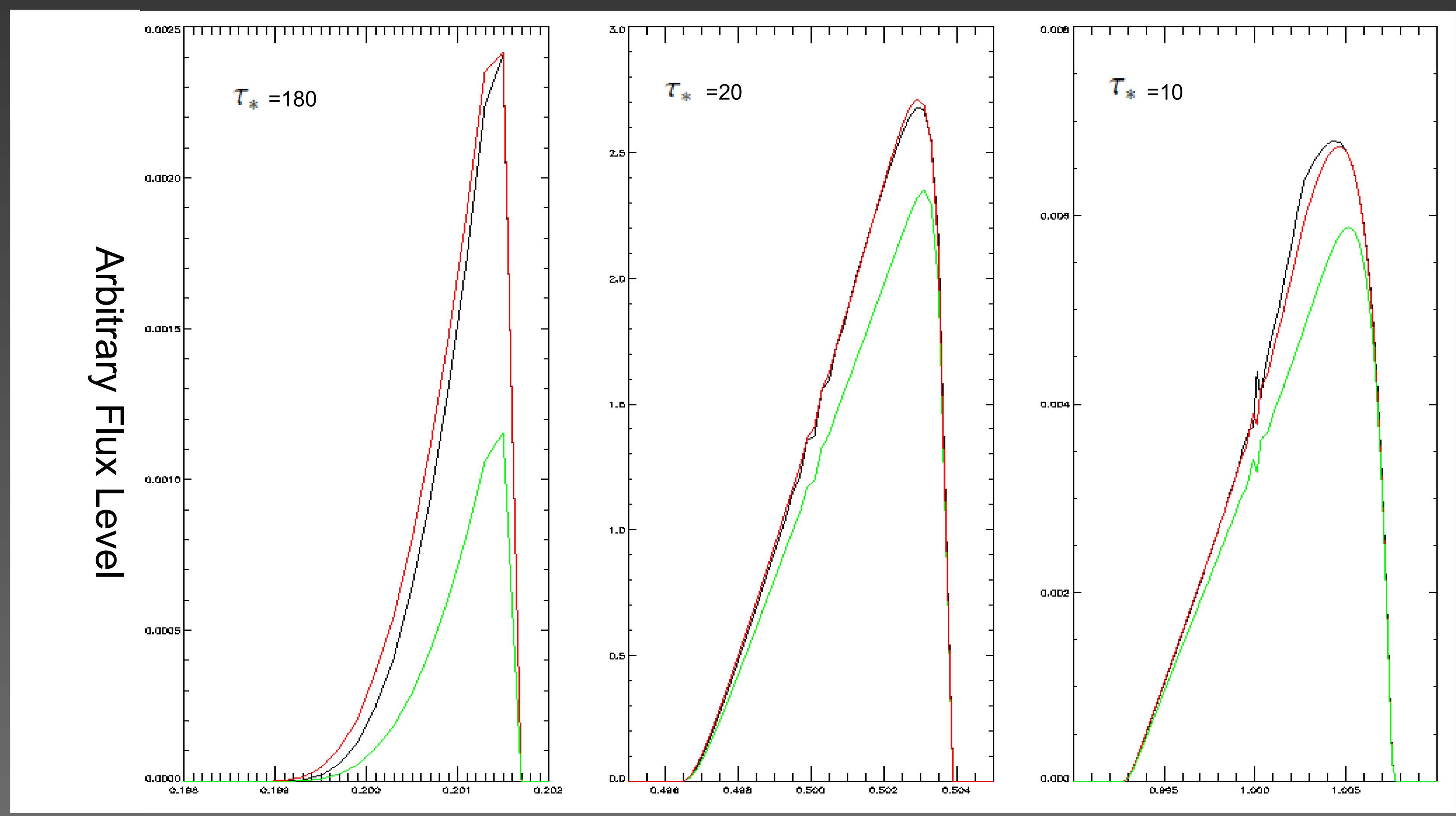
Geometry of the model



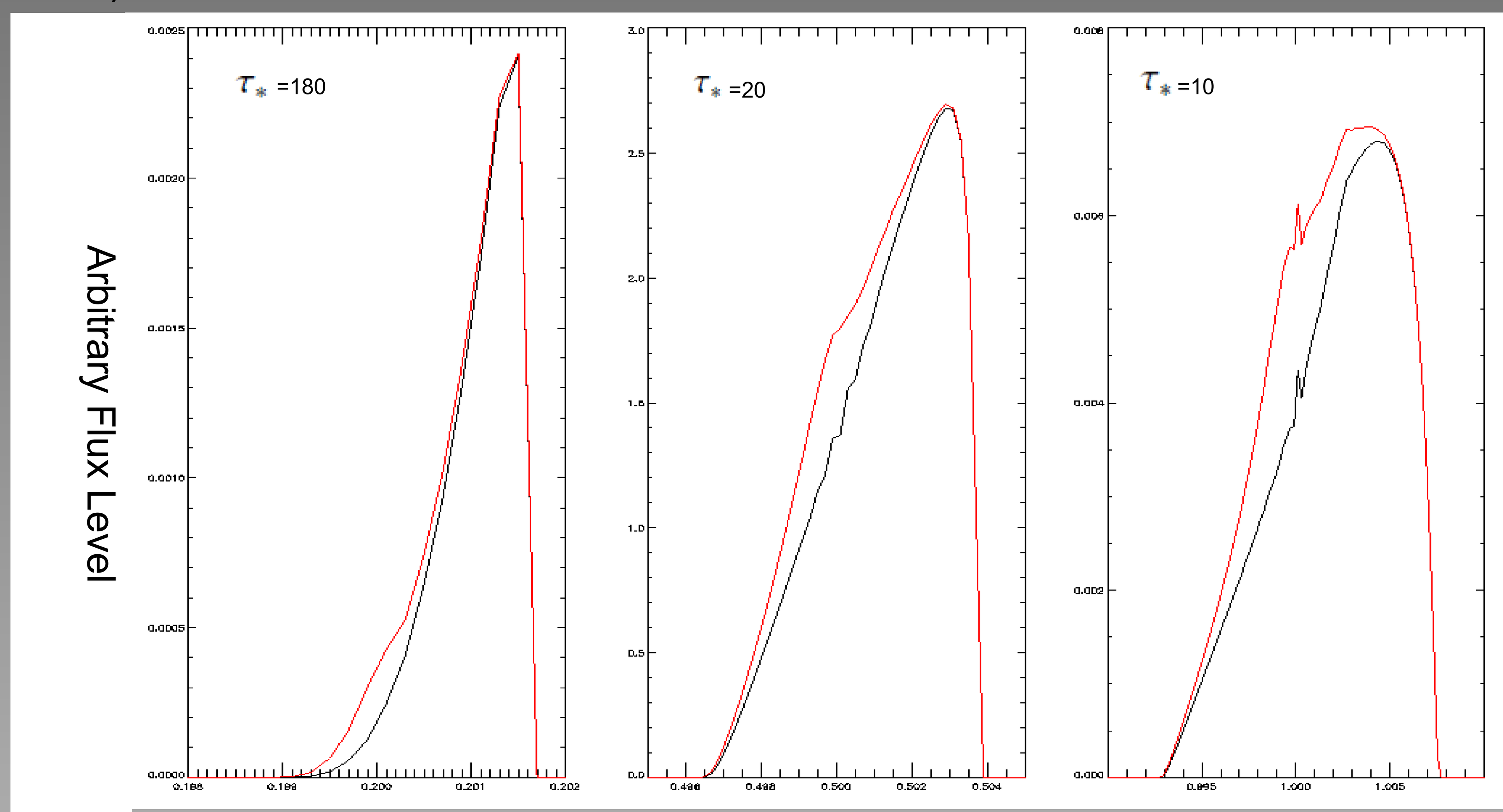
Construction of a synthetic spectrum



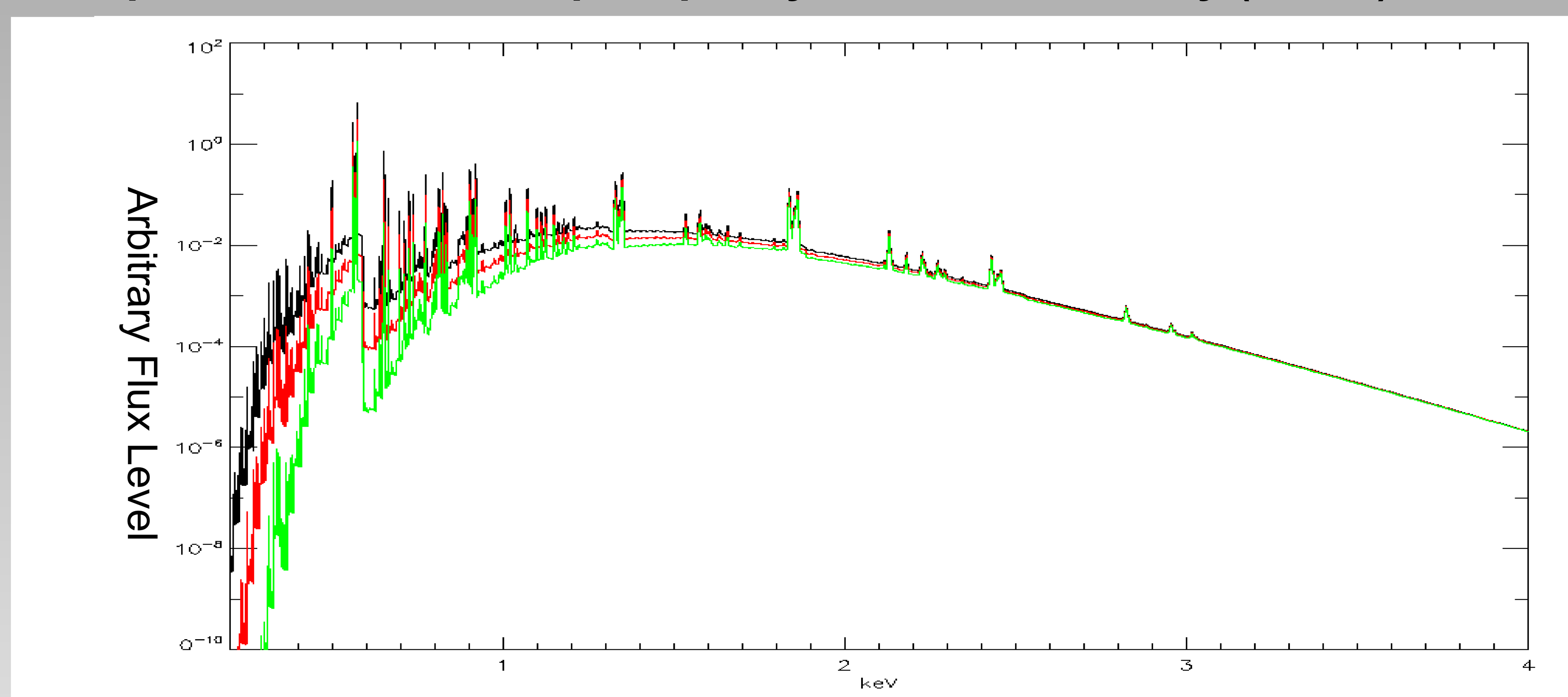
Results: In a first time, we present the difference of the two formalisms by comparing single X-ray with different τ* in the case of an isotrpic opacity (μ is omitted in the Oskinova's theory). After what we show the impact of the anisotropism of opacity on the emergent flux. And then we present the impact of porosity on emergent flux spectra.



X-ray profiles for isotropic Oskinova's theory (in black with n_o=1.7 10^{-4}) compared to Owocki's formalism (in red with h=0.07,0.09 and 0.09 from the left to the right) and homogenous models (in green). (Energies are in keV)



X-ray profiles for isotropic opacity in the Oskinova's theory (in black) compared to an anisotropic opacity Oskinova's theory (in red).



Emergent X-ray spectra with different porosity (In green h=0. In red h=0.05 In black h=0.1 with kT=0.2keV)

Conclusion:

- flux of X-rays is more important in fragmented stellar winds than in the homogenous. (Oskinova's theory and Owocki's formalism). An anisotropic opacity makes the stellar winds less absorbent than in an isotropic case. The profiles of X-ray are also modified compared to homogenous model.
- we can find a factor of porosity to reproduce the X-ray profile simulated by the Oskinova's formalism in the case of an isotropic opacity. But this parameter is not the same for all the spectrum.
- The greatest impacts on emergent X-ray spectra are expected in the low energy band where the stellar opacity is the greatest.