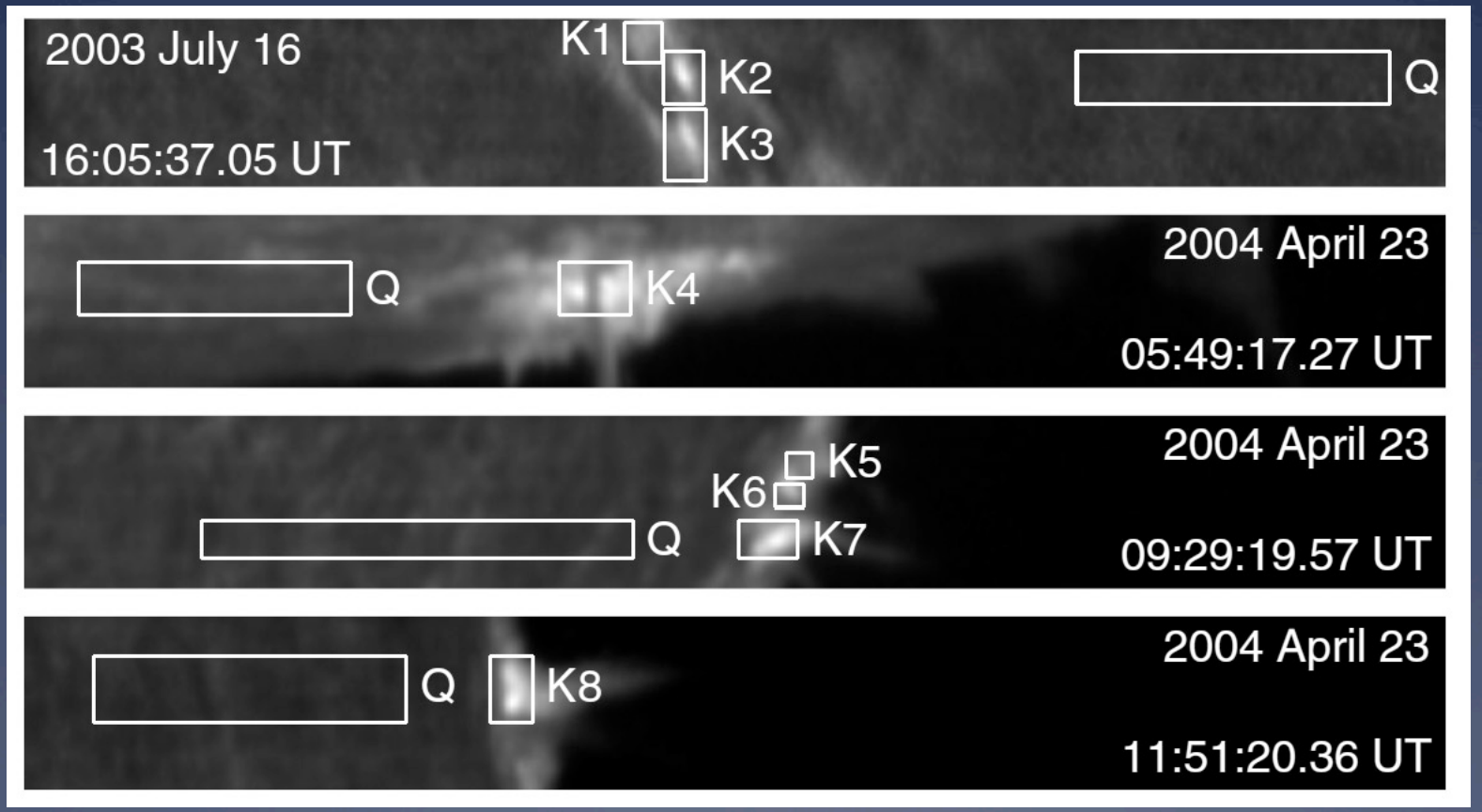
Flare Chromosphere Modeling

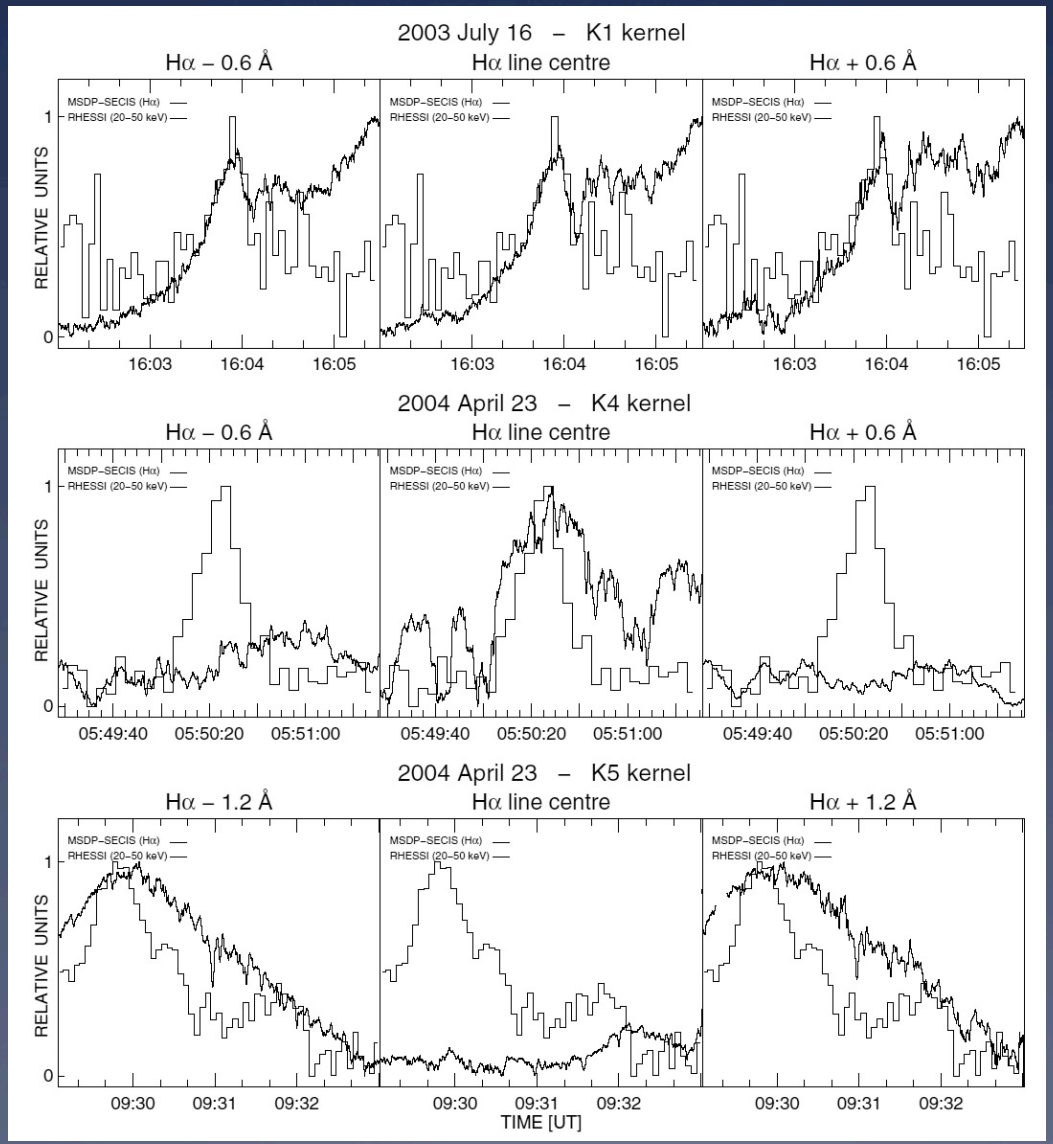
Petr Heinzel

AIAS Ondrejov

2D flare spectra with MSDP (Wroclaw)



Radziszewski, K., Rudawy, P. & Phillips, K. 2007, A&A 461, 303



The plane-parallel equations of radiation hydrodynamics are the equations of mass conservation,

$$\frac{\partial \rho}{\partial t} + \frac{\partial \rho v}{\partial z} = 0 \,, \tag{1}$$

momentum conservation,

$$\frac{\partial \rho v}{\partial t} + \frac{\partial \rho v^2}{\partial z} + \frac{\partial}{\partial z}\,(p + q_v) + \rho g = 0 \,, \tag{2}$$

and internal energy conservation,

$$\frac{\partial \rho e}{\partial t} + \frac{\partial \rho v e}{\partial z} + (p + q_v)\,\frac{\partial v}{\partial z} + \frac{\partial}{\partial z}\,(F_c + F_r) - Q = 0 \,, \tag{3}$$

along with the level population equation

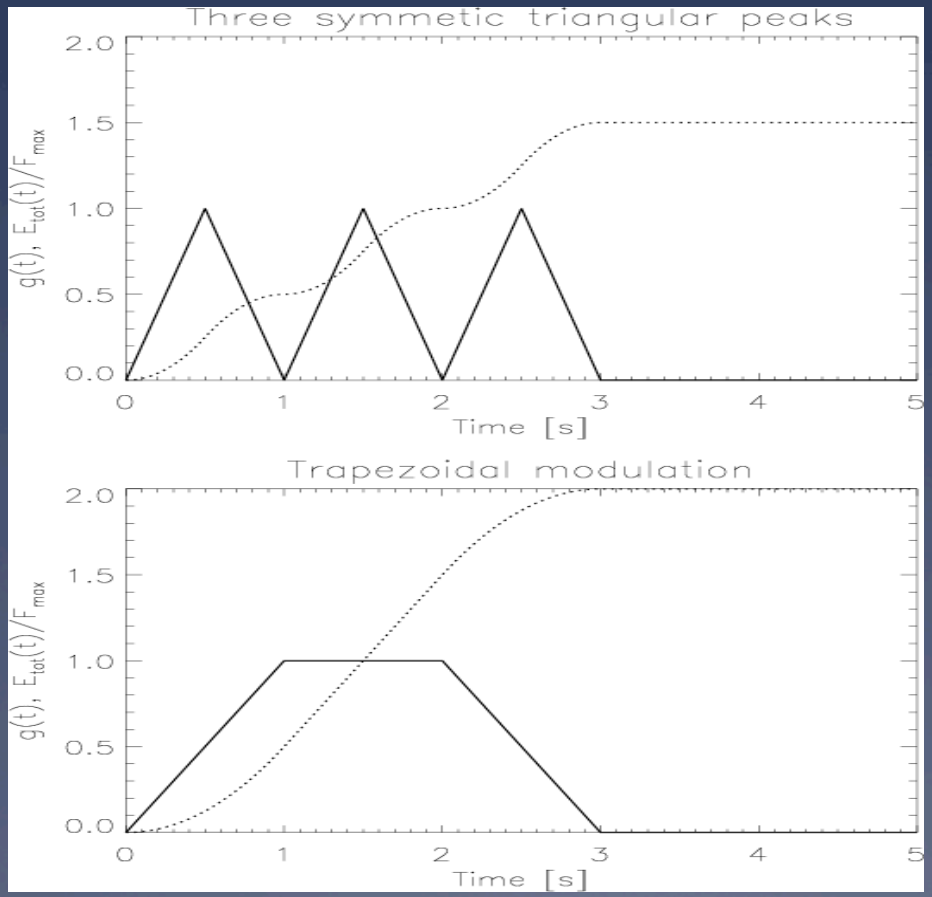
$$\frac{\partial n_i}{\partial t} + \frac{\partial n_i v}{\partial z} - \left(\sum_{j \neq i}^{N'} n_j P_{ji} - n_i \sum_{j \neq i}^{N'} P_{ij} \right) = 0 \,, \tag{4}$$

and the equation of radiative transfer

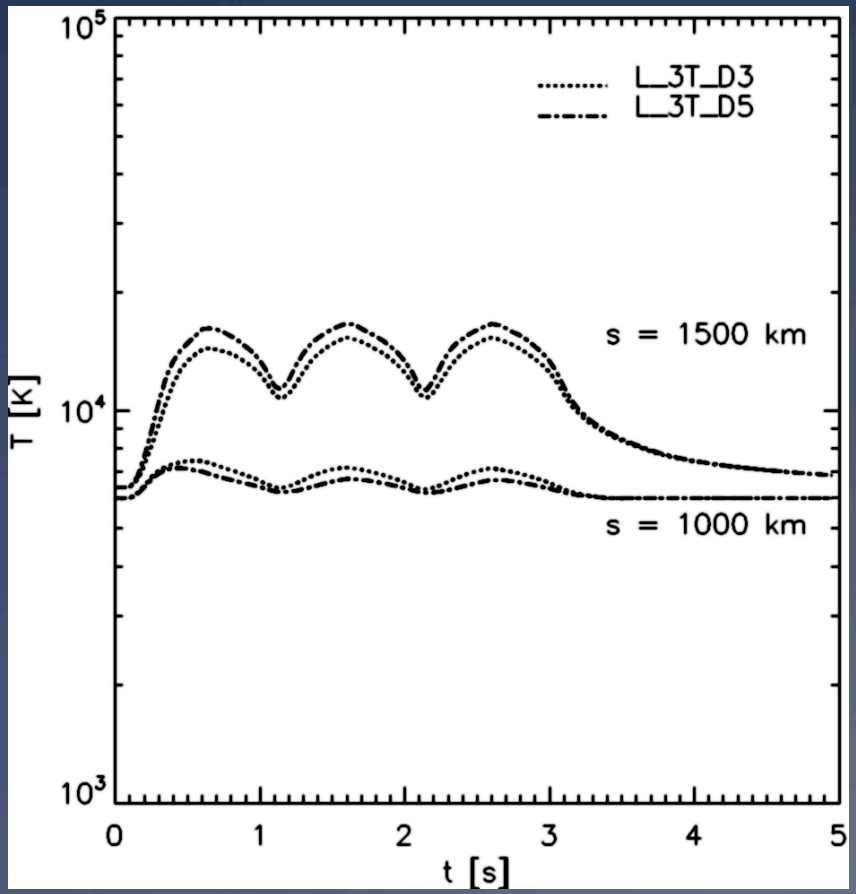
$$\mu\,\frac{\partial I_{\nu\mu}}{\partial z} = \eta_{\nu\mu} - \chi_{\nu\mu}\, I_{\nu\mu} \,. \tag{5}$$

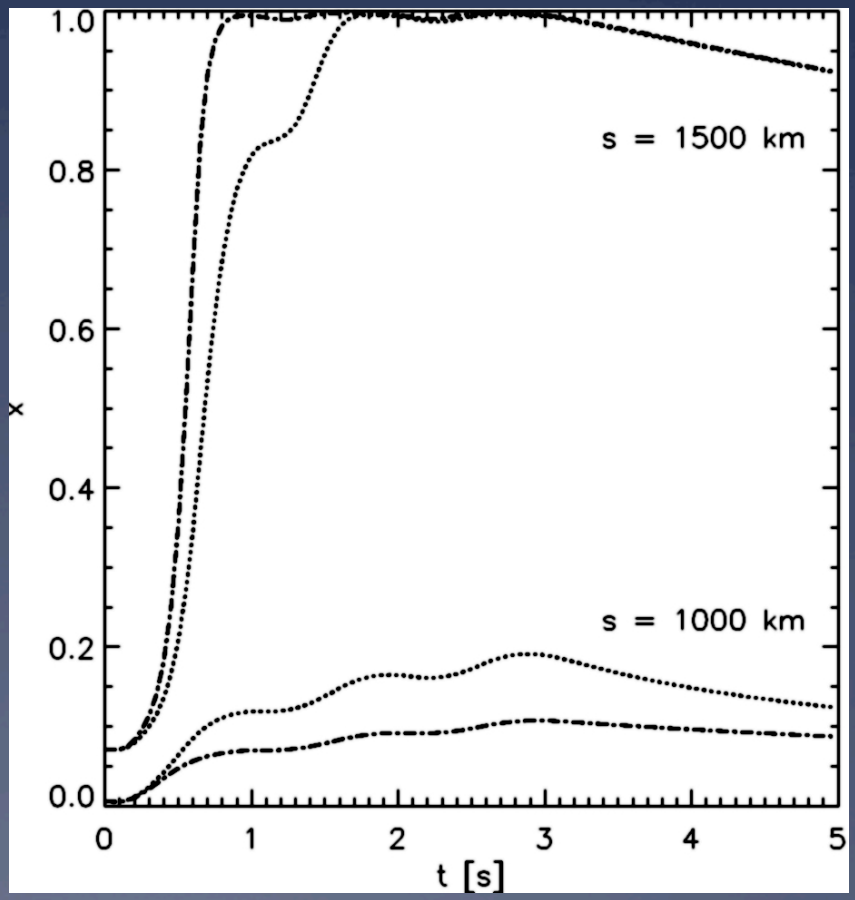
Electron-beam pulse simulations

Kasparova et al. 2009, A&A 499, 923

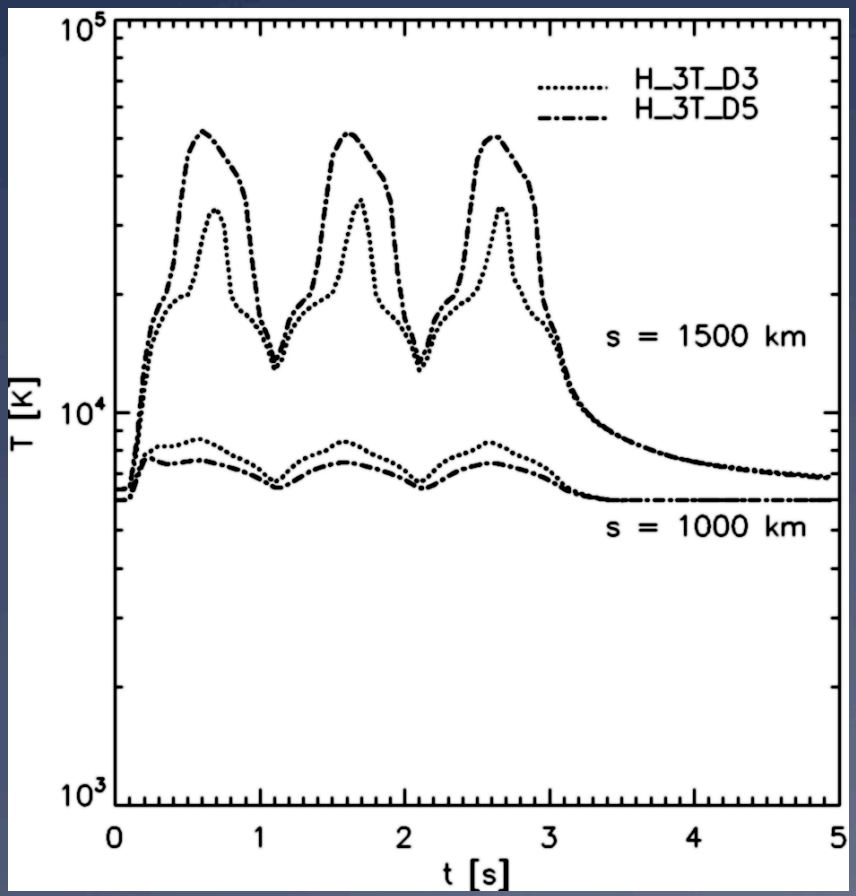


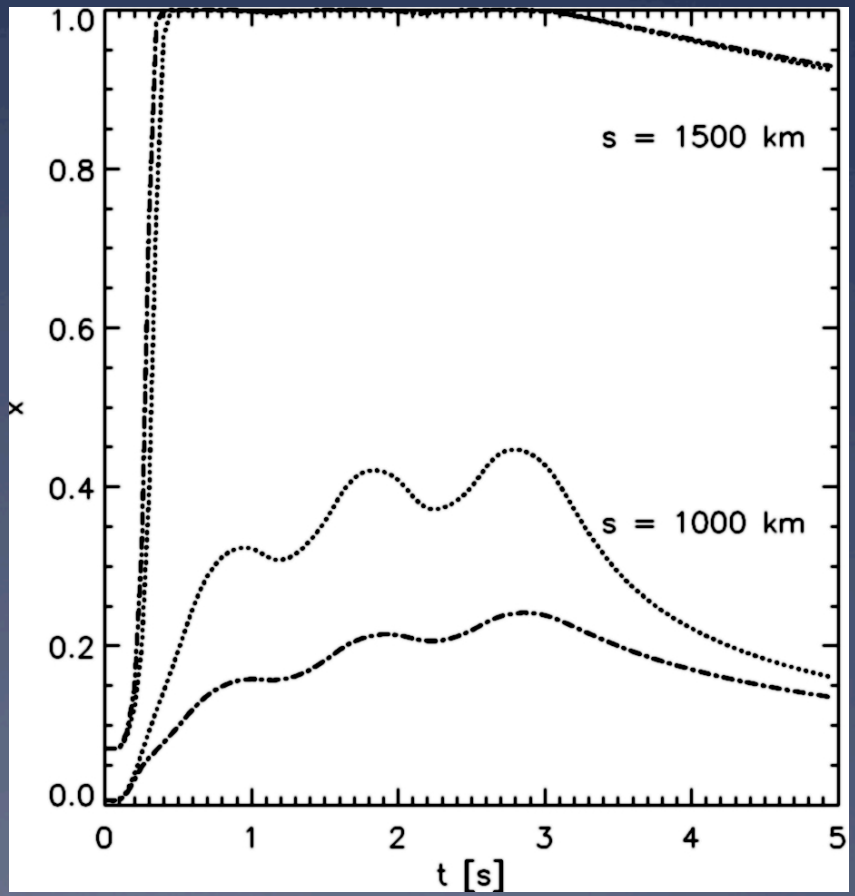
Non-equilibrium models (low flux)



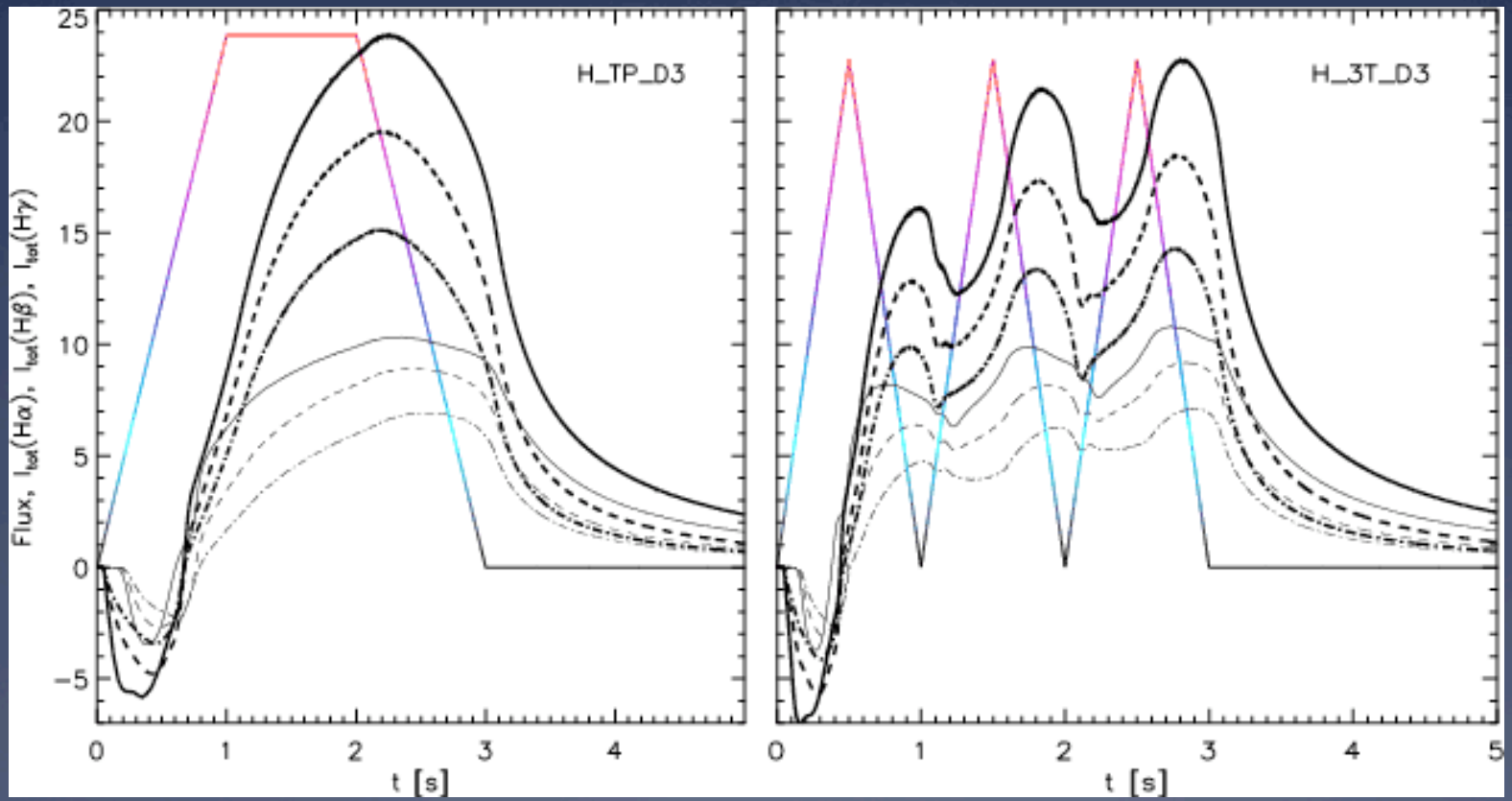


Non-equilibrium models (high flux)





Balmer line intensities



Varady et al. 2010