DYNAMICS OF SOLAR MACROSPICULES FROM HIGH-CADENCE EUV OBSERVATIONS

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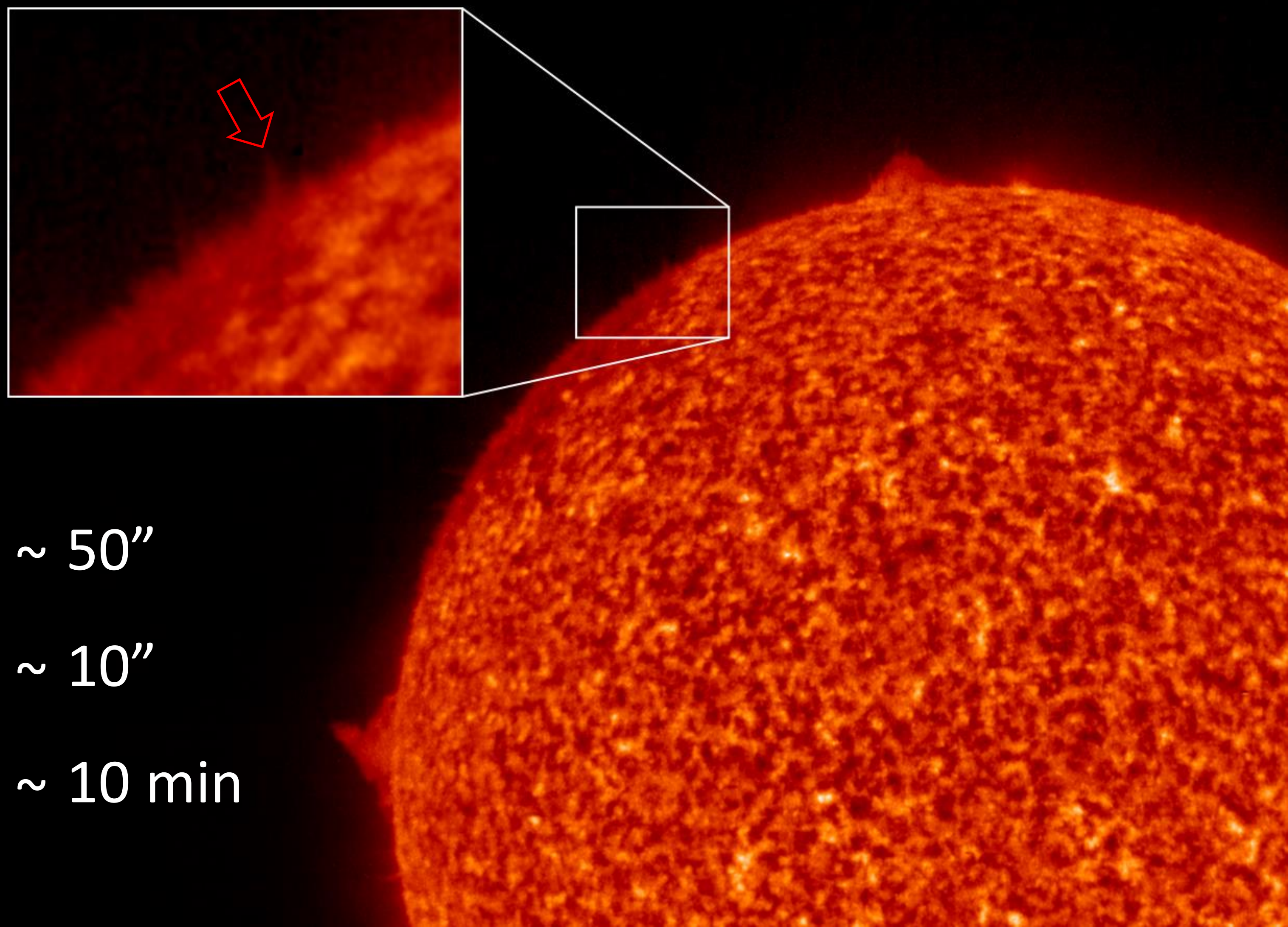
Macrospicules

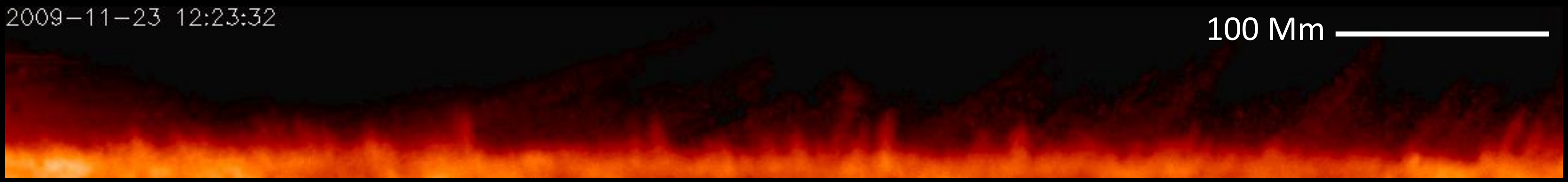


Height ~ 50”

Width ~ 10”

Lifetime ~ 10 min

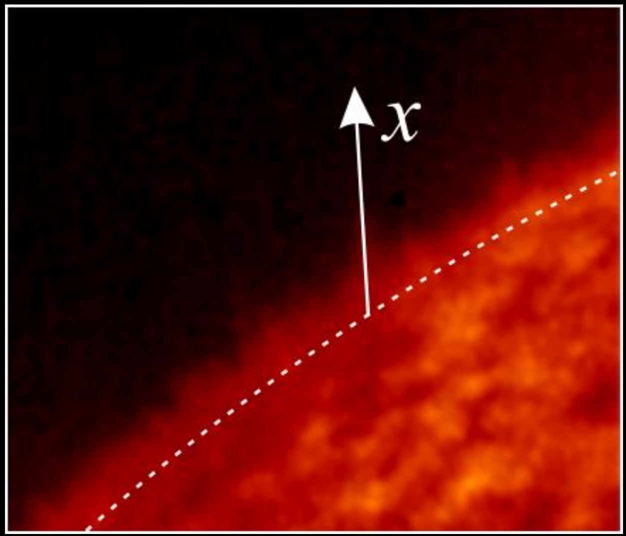
TESIS high-cadence time series

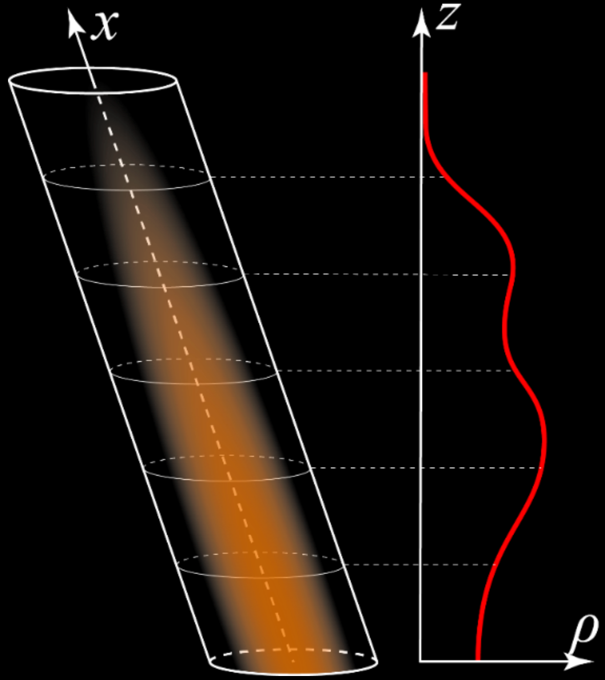


October 2, 2009	17 min	/	299 shots	=	3,5 s
November 23, 2009	49 min	/	489 shots	=	6,0 s

Data processing

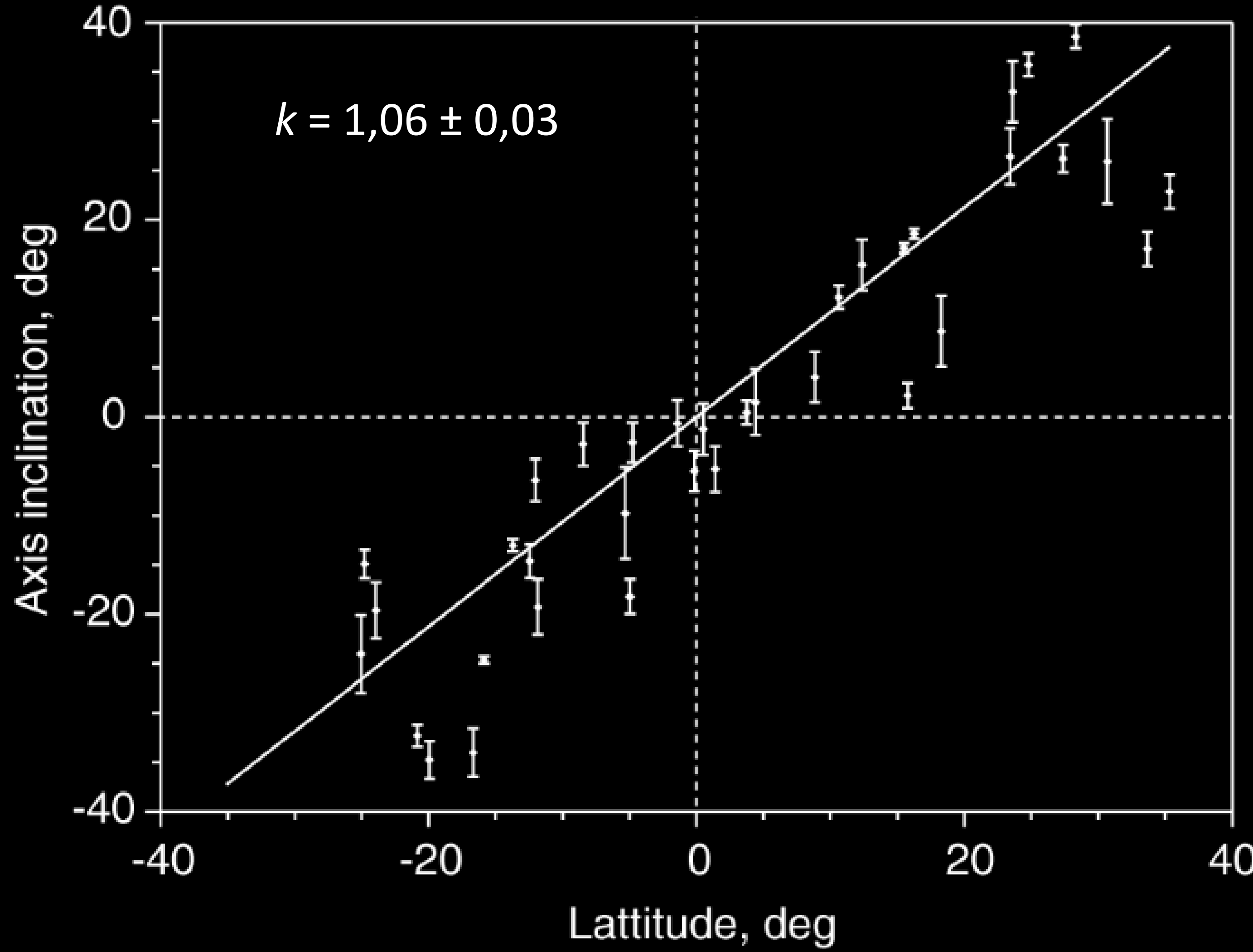
Extracting data from shots





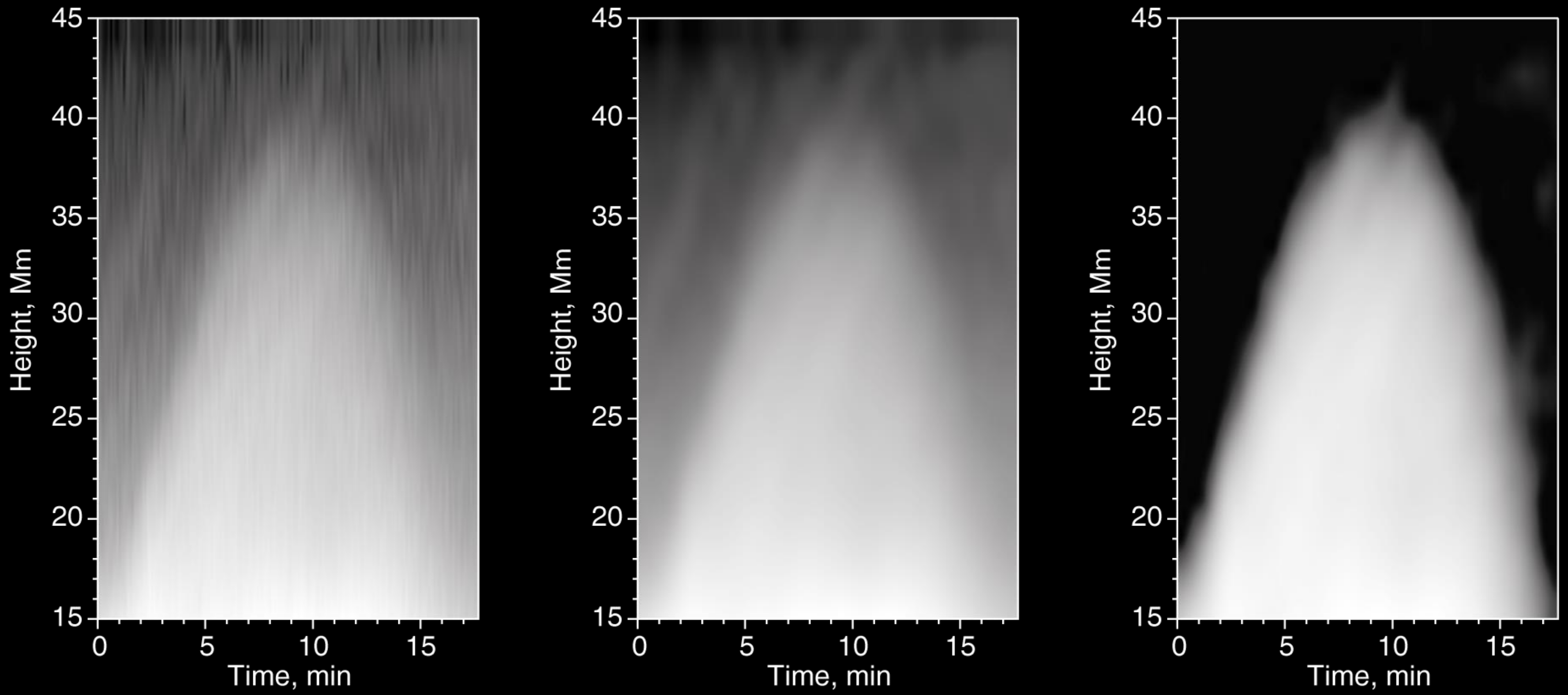
36 macrospicules found, but not all are suitable

Axis inclinations

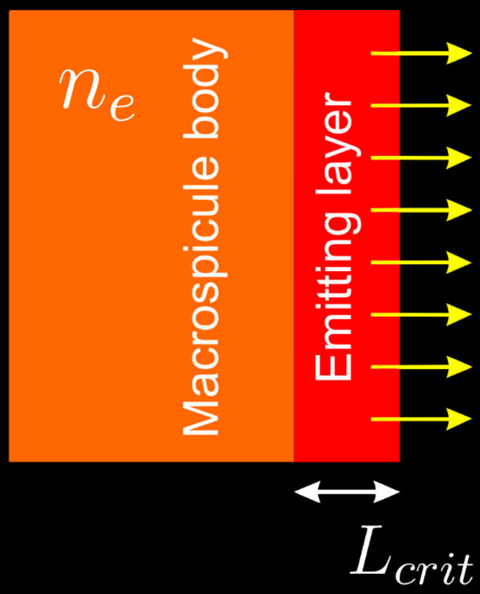


Data processing

Filtering and subtracting background



Data interpretation



Optically thick medium:

$$\left.\begin{aligned} I &\sim L_{crit} N_{He} N_e \sim L_{crit} N_e^2 \\ L_{crit} &= 1/\alpha \sim 1/N_e \end{aligned}\right\} \Rightarrow \quad I \sim N_e \sim \rho$$

Velocity field calculation

Continuity equation: $$\frac{\partial}{\partial t}\rho + \frac{\partial}{\partial z}(\rho v) = 0$$

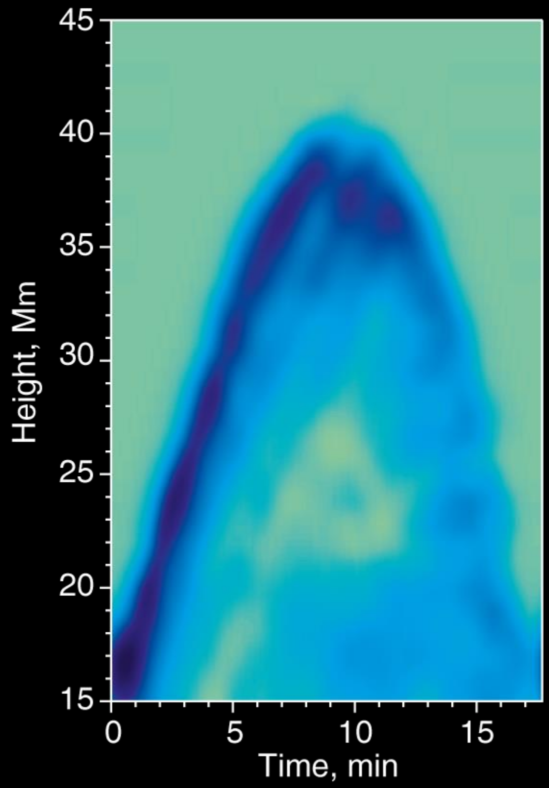
That yields: $$v'_z = f(v, z) = Pv + Q$$

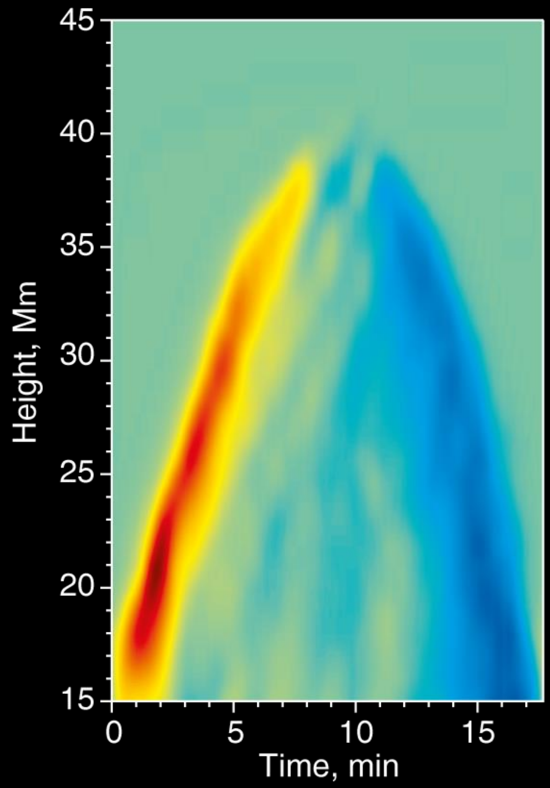
Where $$P = -\frac{1}{\rho}\frac{\partial \rho}{\partial z}$$ and $$Q = -\frac{1}{\rho}\frac{\partial \rho}{\partial t}$$

Boundary conditions: $$v(z_{max}) = 0$$

Velocity field calculation

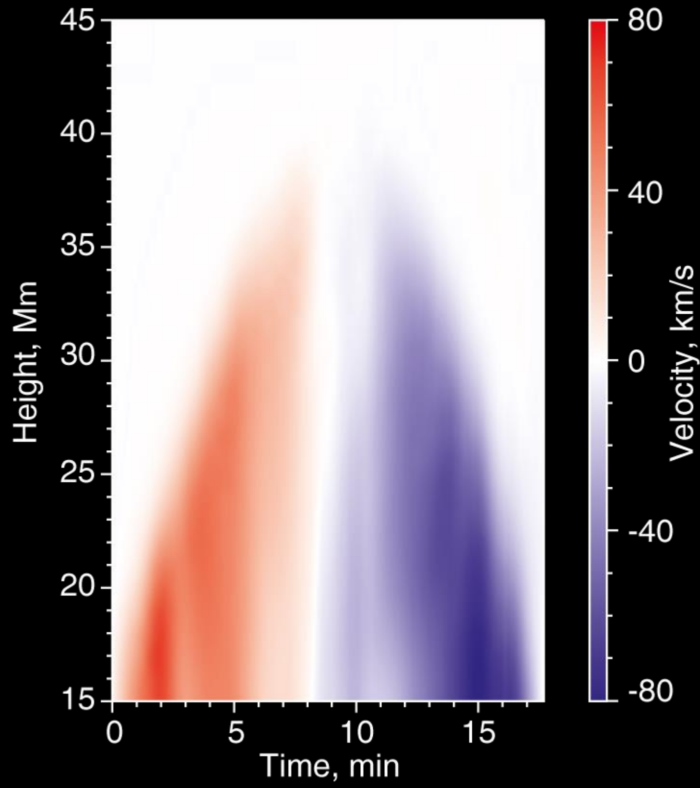
Normalized partial derivatives P and Q

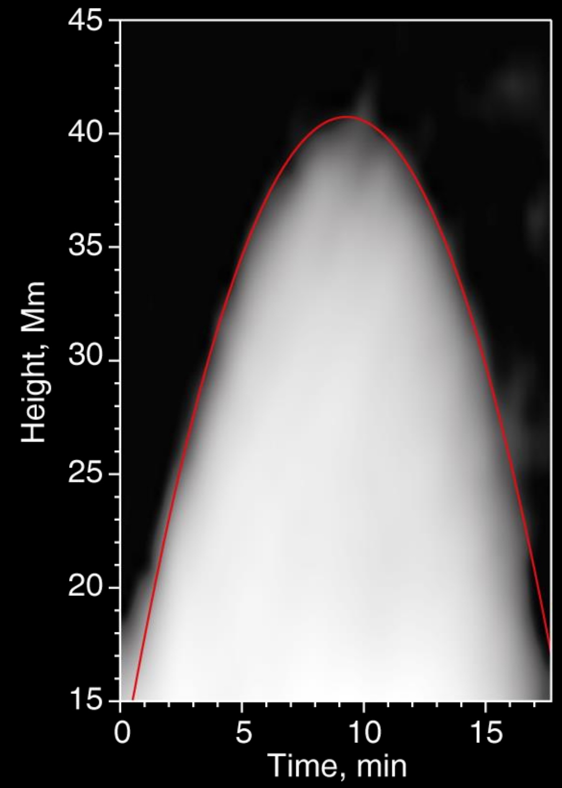




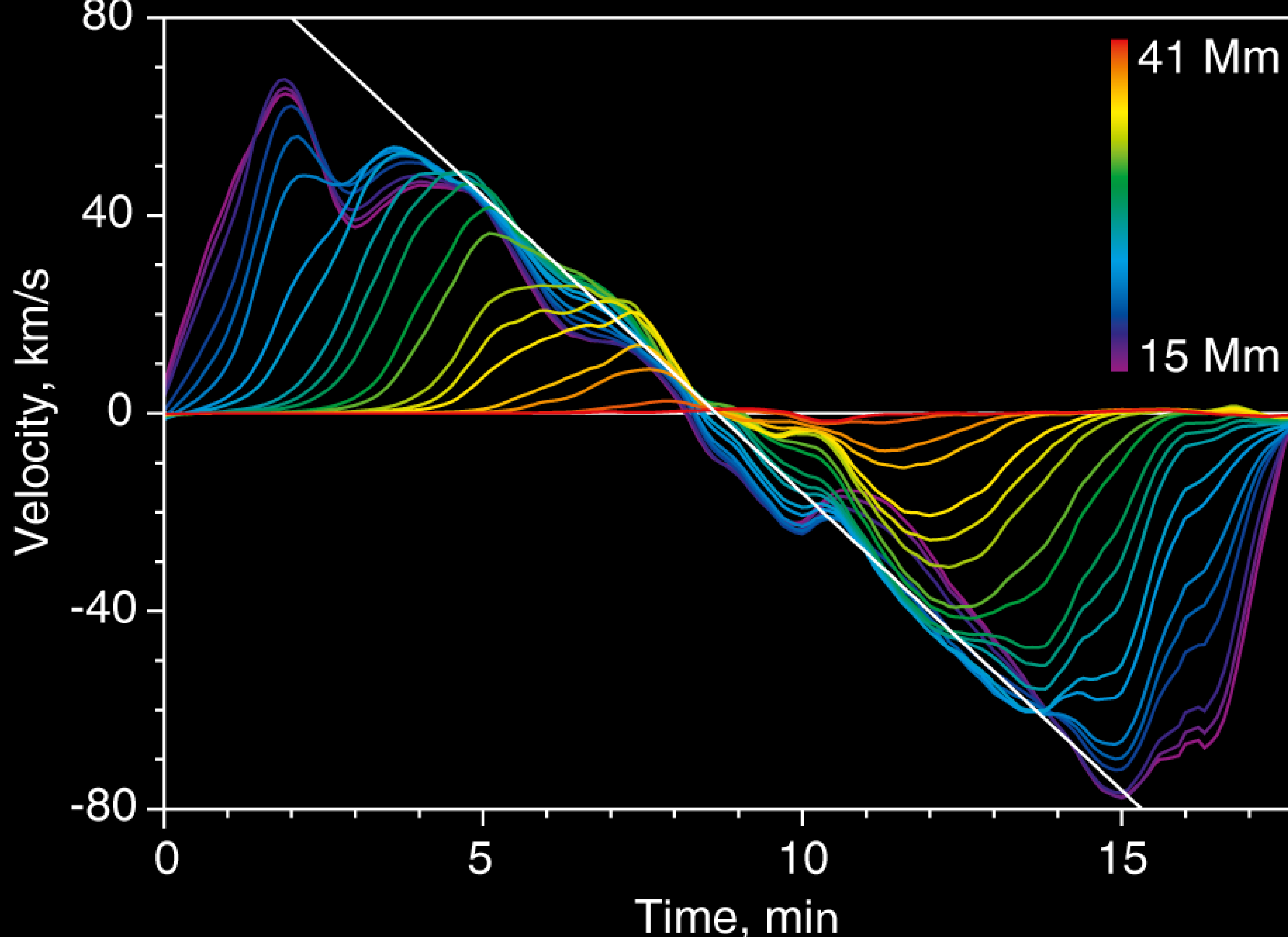
Macrospicule's velocities

Velocity field and parabolic fit

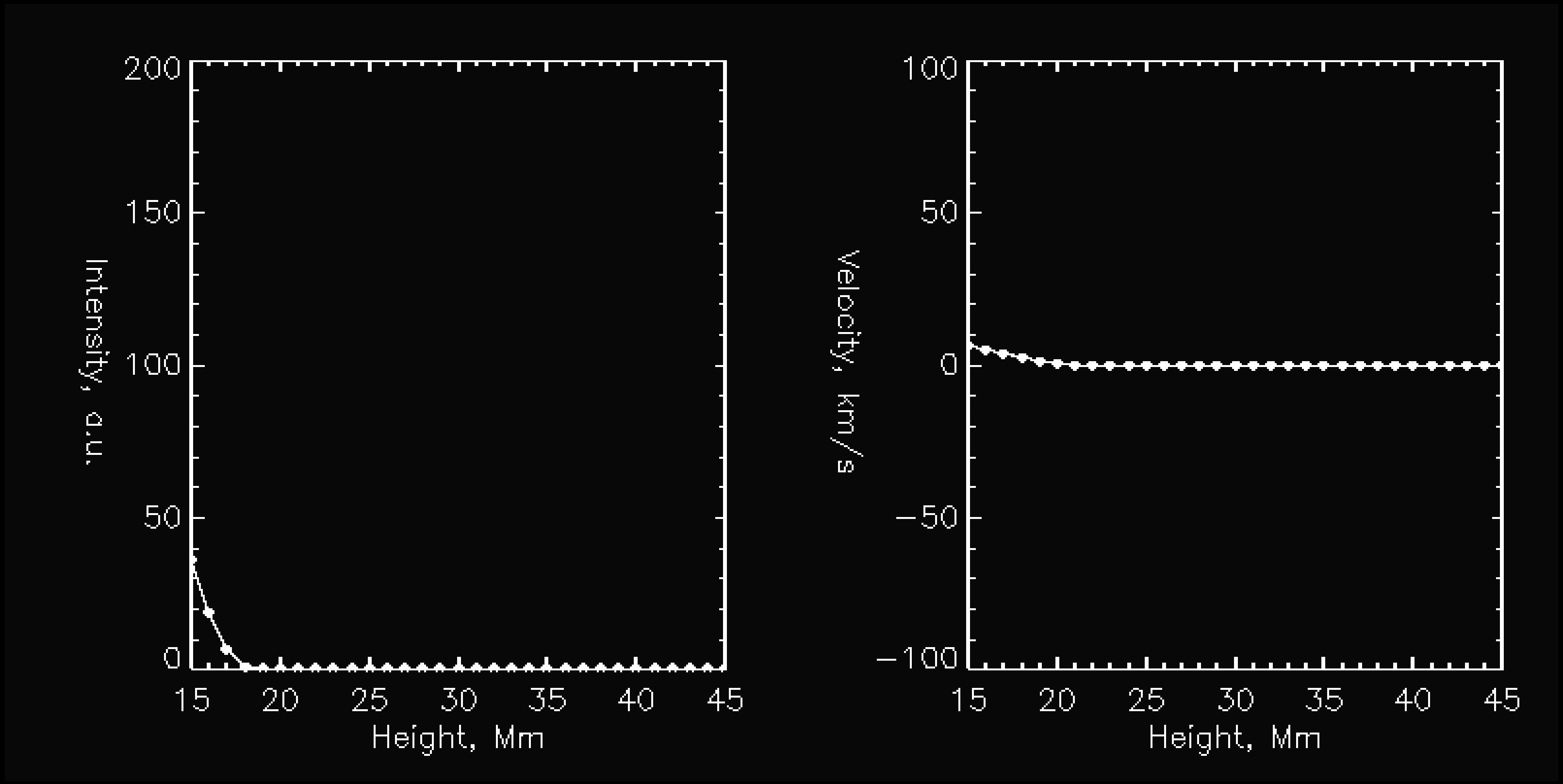




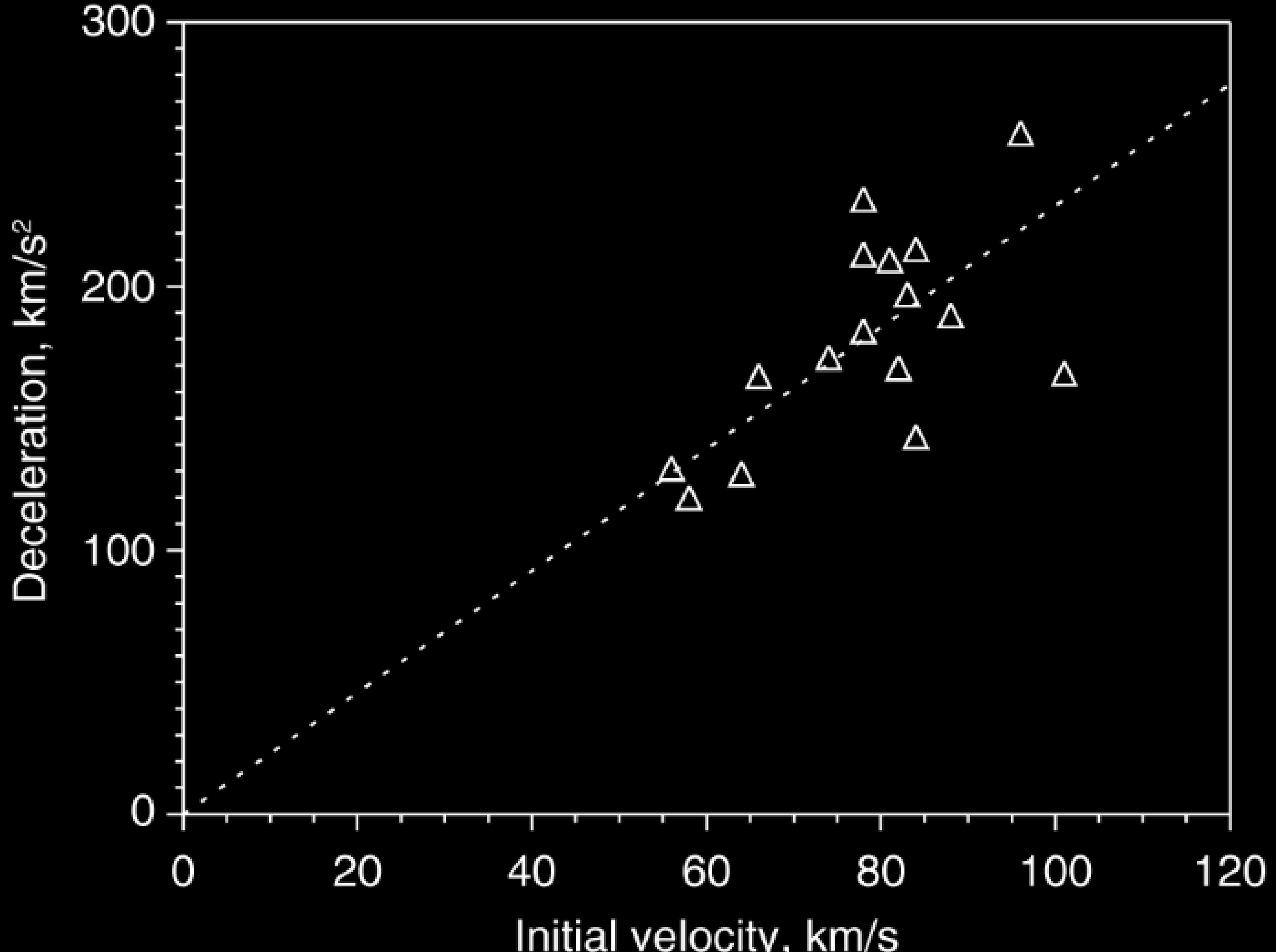
Macrospicule’s velocities



Macrospicule’s velocities



Decelerations and velocities



Mass loss estimation

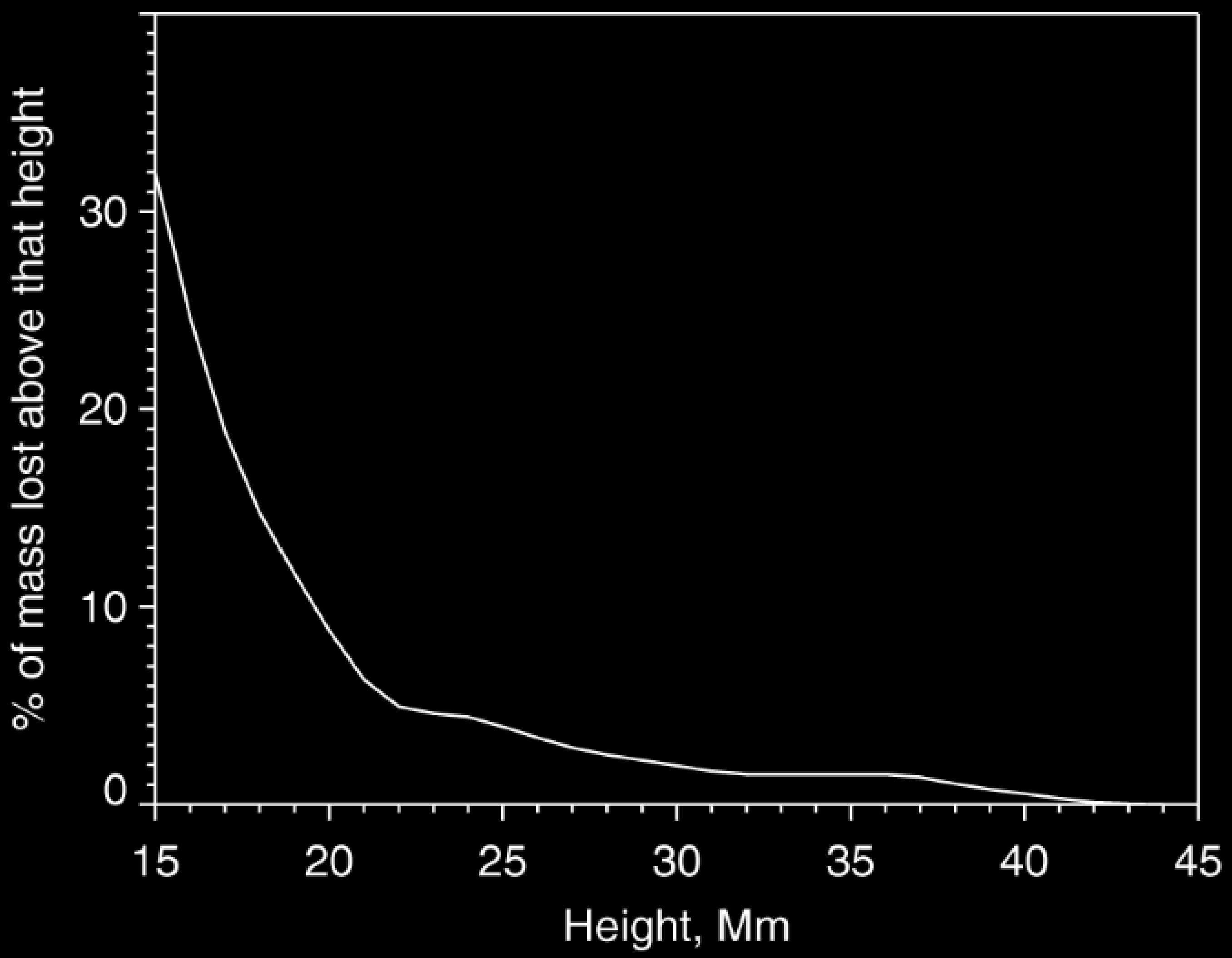
Continuity equation with loss: $$\frac{\partial \rho}{\partial t} + \frac{\partial}{\partial x}(\rho v) = \sigma$$

Where v is taken from parabolic fit

Loss rate is calculated as: $$L = \frac{\iint \sigma \, dt \, dh}{\max_t \left(\int \rho \, dh \right)}$$

10 ÷ 40 % of visible mas is lost at heights ≥ 15 Mm

Mass loss at different heights



THANK YOU FOR YOUR ATTENTION