# Modeling of plasma motion in the eruptive prominences and the coronal mass ejection

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This program has been made in the frame of diploma thesis with the name 'Modeling of plasma motion in the eruptive prominences and the coronal mass ejections'. It illustrates the possible kinds of mass motion in the prominences in the form of several objects. In addition it is possible to cut the objects by the spectrograph slit plane and generate corresponding spectra.
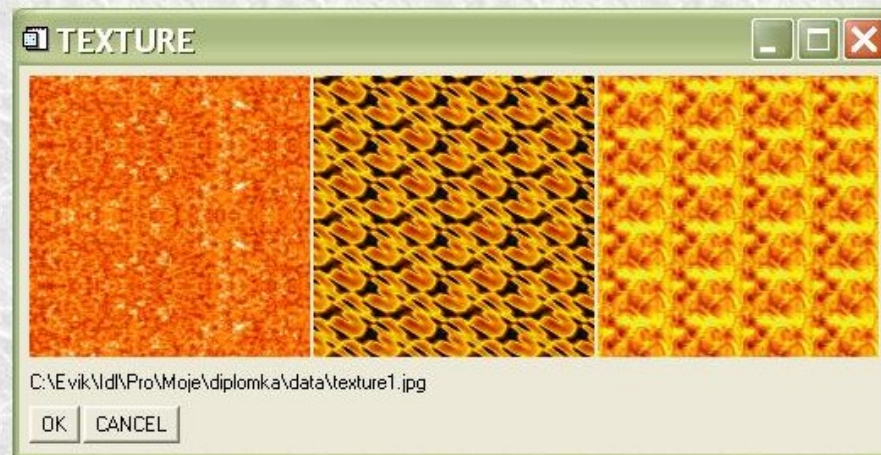
MAIN MENU

Main menu consists of 'FILE' menu, 'OPTIONS' menu and 'HELP' menu, see the illustration 'I1'.
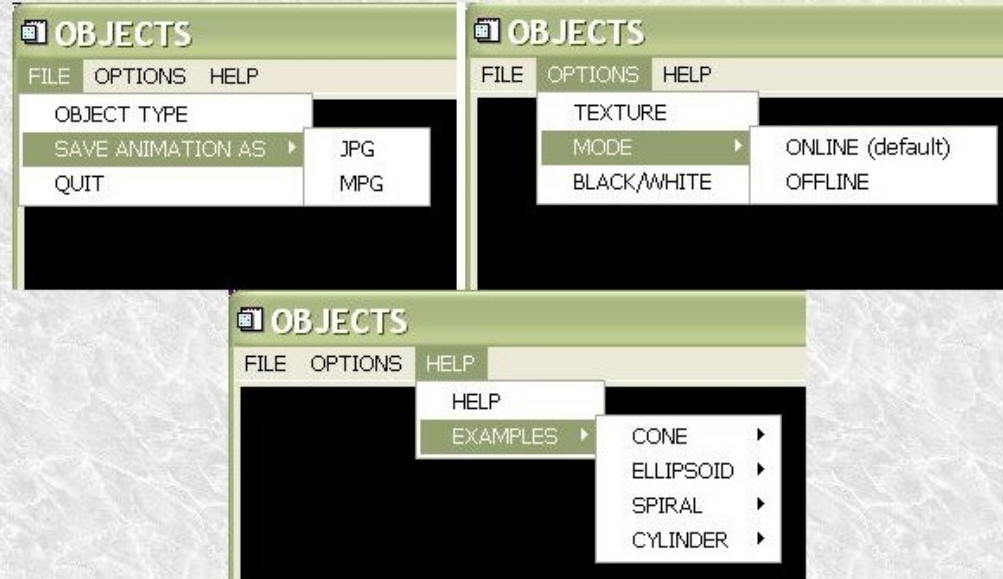
I1 (Menu)

OPTIONS MENU

In 'OPTIONS' menu we can change the texture of the objects. After clicking on 'TEXTURE' button we will see the window depicted in 'I2'. Choosing the texture is executed by clicking into it.


I2 (Texture window)

By the help of 'MODE' button we can set the way of displaying the spectra. Online mode means that the spectra will be generated after each change of the parameters influencing the spectral feature, while in the case of offline mode clicking the 'GENERATE' button is necessary for generating the spectra. The 'GENERATE' button is part of 'CONTROL PANEL' window, that will be mentioned below. Offline mode is useful when the computation of spectral feature takes a long time (for example when we work with spiral object or when we work with wide spectrograph slit).

Next option is a possibility to change color of the background by clicking on 'BLACK/WHITE' button.

FILE MENU

In 'FILE' menu we can run the program by choosing the type of the object. After clicking on 'OBJECT TYPE' button we will see the window depicted in 'I3'. Choosing the object is executed by clicking into it.
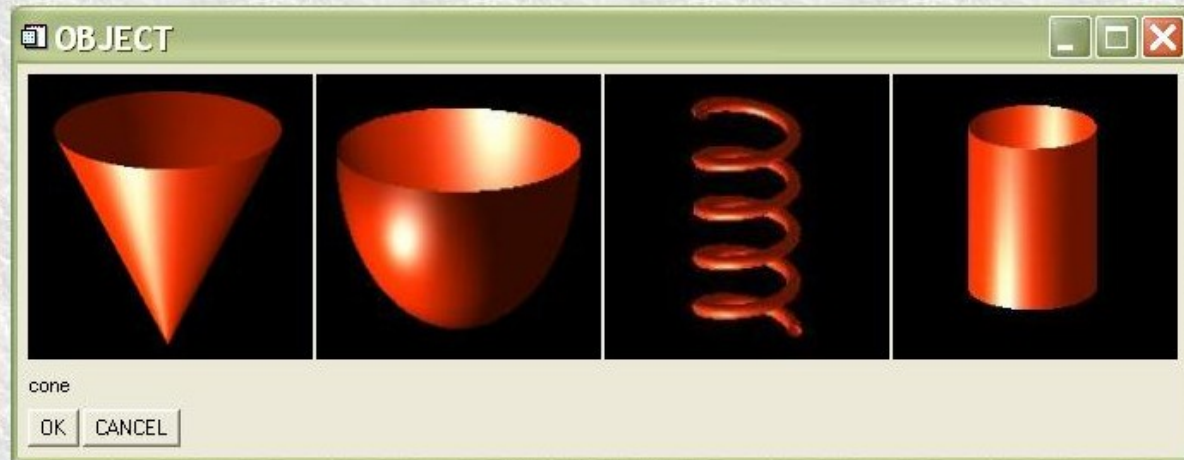

I3 (Object window)

After confirming the selection by 'OK' button we can see two screens and the 'CONTROL PANEL' window. The left screen serves for displaying the object and the right one for displaying the spectra.

The user has a possibility to save the animation in the left screen by the help of 'SAVE ANIMATION AS' button. There are two ways of saving the animation, it can be saved either as mpg file or as series of jpg files. The spectra in the right screen is automatically saved along with the animation. All the outputs are located in 'SAVE' subdirectory of the main program directory.
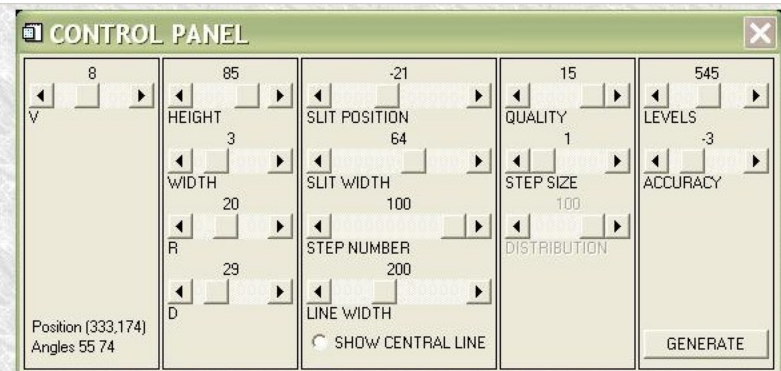
'CONTROL PANEL' window allows the user to change parameters of the object and the spectra. It is devided into several parts (five parts in the case of spiral object and four parts in the case of the other objects). The illustrations of 'CONTROL PANEL' are depicted in 'I4', 'I5' and 'I6'. The corresponding results can be seen in the end of the help.
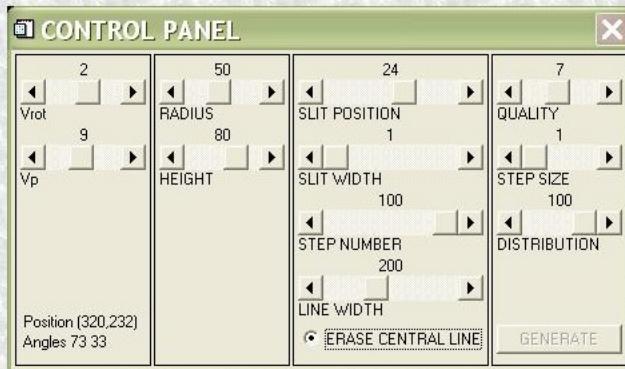
I4 (Control panel - cone object, online mode)
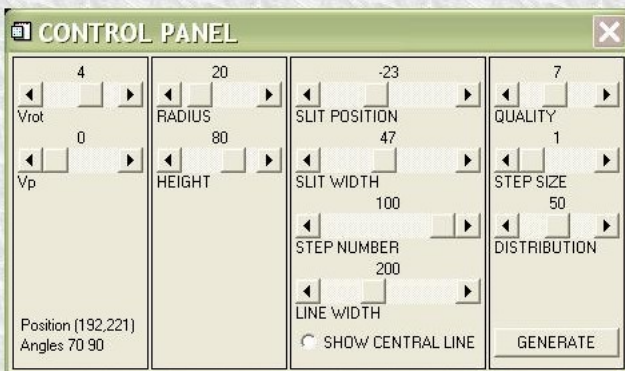
I5 (Control panel - cylinder object, offline mode)

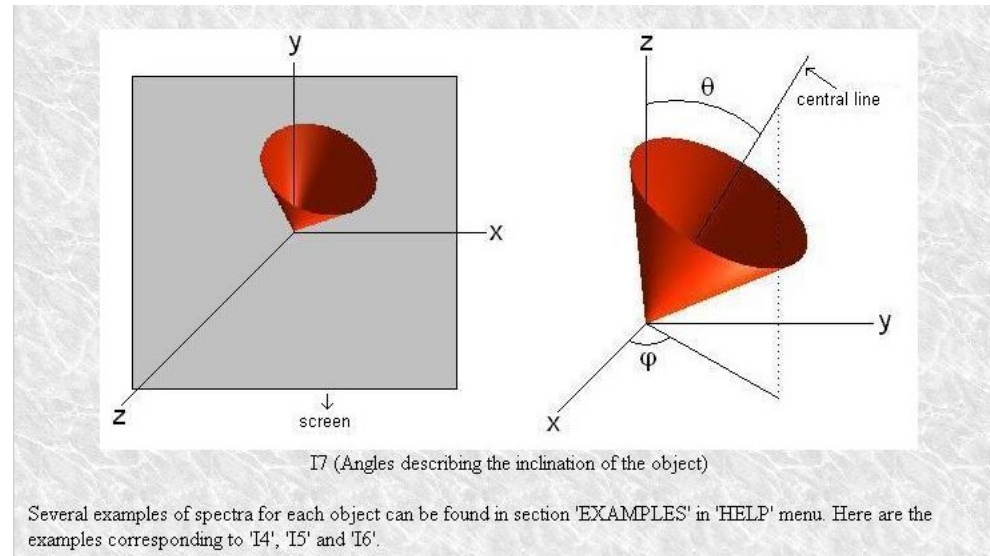I6 (Control panel - spiral object, offline mode)

The first part of the 'CONTROL PANEL' window controls velocity of the mass motion and the second part allows to change object parameters such as height, radius, etc. The Inclination of the object to the observer can be changed by tracking the mouse accross the object.
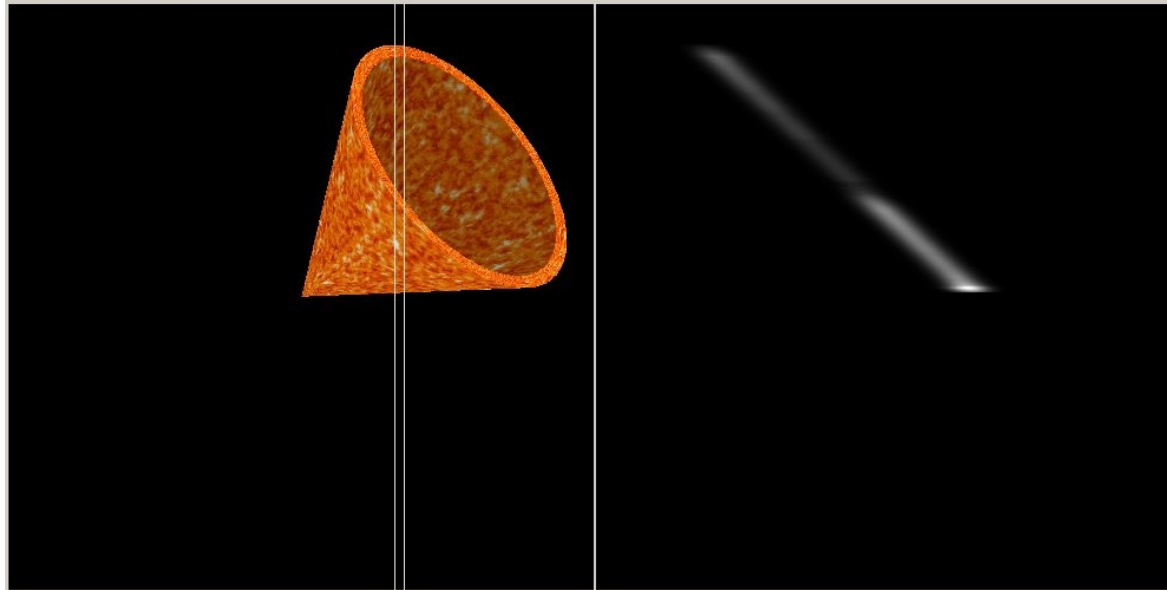
The third part of the 'CONTROL PANEL' window controls the spectra. With the 'SLIT POSITION' slider we control the position of the spectrograph slit and with the 'SLIT WIDTH' slider we can change the width of the slit. The value of 'STEP NUMBER' slider is taken into account only if the slit width is not minimal and as its name says it is the number of steps for the integration of spectral contributions across the whole width of the slit. The bigger value of slider means more accurate result. But note, when the value of the slider is bigger then the value of the 'SLIT WIDTH' slider, the 'SLIT WIDTH' slider value is taken into account, because it gives the sufficient results. With the 'LINE WIDTH' slider we change the halfwidth of the spectral line and finally the 'SHOW CENTRAL LINE' button allows the user to unhide the position of zero doppler shift in the spectra (it is always in the middle of the right window).

The fourth part of the 'CONTROL PANEL' window contains 'QUALITY' slider, which controls the quality of object dispaying. 'DISTRIBUTION' slider allows to change the mass distribution in the object. Minimum value means that we work with the object surface only and maximum value means that we work with the object fully filled by the matter. The 'STEP SIZE' slider controls the size of the step for the integration of spectral contributions across the object. The smaller value means more accurate result. It is recommended to set its value to 1 in the case of spiral object while in the other cases values bigger than 1 are sufficient.

In the case of spiral object, the 'CONTROL PANEL' contains one more part, which is related to the numerical calculations executed during the generation of the spectra. The 'ACCURACY' slider controls the accuracy order for computing the points of intersection of the object and the slit plane. The value -3 is sufficient. The 'LEVELS' slider controls the number of levels which the spiral is divided into during the searching the points of intersection. The bigger value means that the bigger number of the points of intersection will be found. Sufficient value depends on the inclination of the object.

The user have a possibility to take horizontal profiles across the spectra and save them. The profile will be shown after clicking to the selected position in the right window with the spectra. Actual position of the cursor in the right window is displayed on 'CONTROL PANEL'. Here we can find also the angles describing the inclination of the object to the observer. First value is value of θ angle and the second one is the value of φ anlge. The meaning of these angles is described in the following illustration.
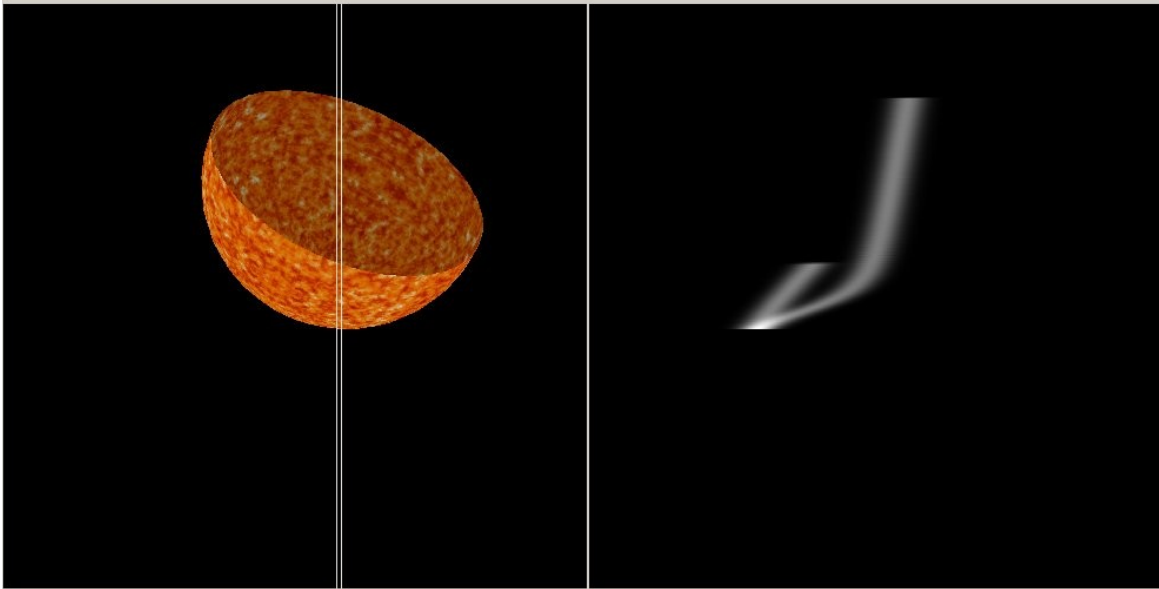

I7 (Angles describing the inclination of the object)

Several examples of spectra for each object can be found in section 'EXAMPLES' in 'HELP' menu. Here are the examples corresponding to 'I4', 'I5' and 'I6'.

FILE   OPTIONS   HELP

CONTROL PANEL

4
Vrot

0
Vp

50
RADIUS

80
HEIGHT

32
SLIT POSITION

4
SLIT WIDTH

100
STEP NUMBER

200
LINE WIDTH

7
QUALITY

5
STEP SIZE

10
DISTRIBUTION

Position (25,186
Angles 61.39

FILE   OPTIONS   HELP

CONTROL PANEL

-4	0	14	7
◄ ▶	◄ ▶	◄ ▶	◄ ▶
Vrot	EXCENTRICITY	SLIT POSITION	QUALITY
5	50	3	5
◄ ▶	◄ ▶	◄ ▶	◄ ▶
Vp	A	SLIT WIDTH	STEP SIZE
		100	0
		◄ ▶	◄ ▶
		STEP NUMBER	DISTRIBUTION
		200	
		◄ ▶	
Position (159,3)		LINE WIDTH	
Angles 58 65			GENERATE

FILE OPTIONS HELP

CONTROL PANEL ✕

8
◄ □ ►
V

80
◄ □ ►
HEIGHT

-30
◄ □ ►
SLIT POSITION

7
◄ □ ►
QUALITY

100
◄ □ ►
LEVELS

5
◄ □ ►
WIDTH

5
◄ □ ►
SLIT WIDTH

5
◄ □ ►
STEP SIZE

-5
◄ □ ►
ACCURACY

20
◄ □ ►
R

100
◄ □ ►
STEP NUMBER

100
◄ □ ►
DISTRIBUTION

20
◄ □ ►
D

200
◄ □ ►
LINE WIDTH

Position (255,13
Angles 103 134

GENERATE

FILE   OPTIONS   HELP
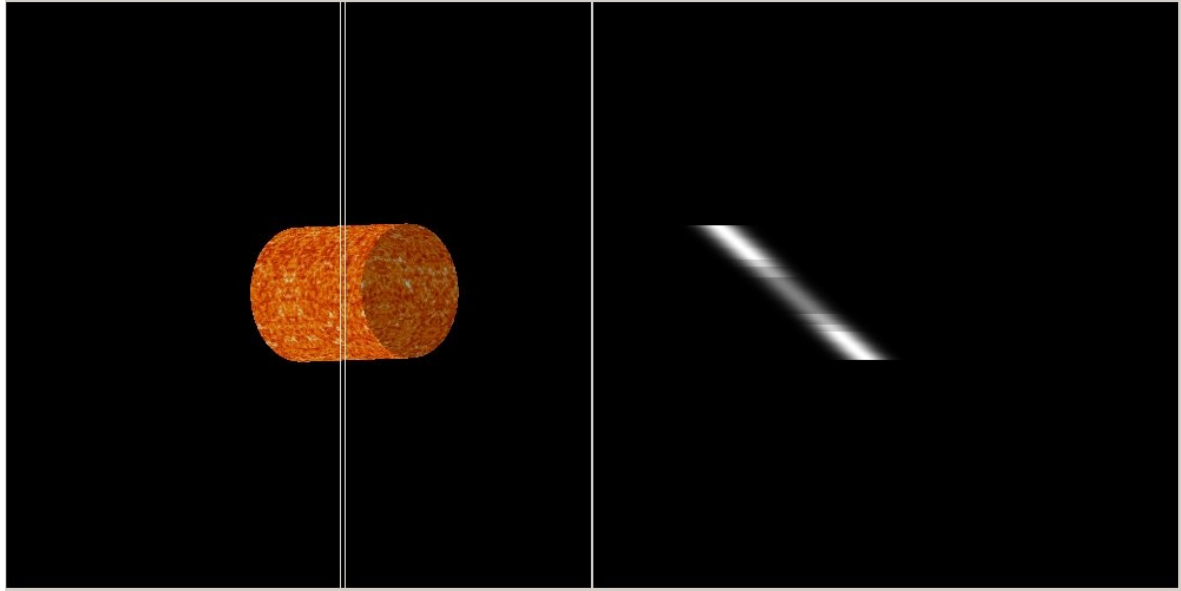
CONTROL PANEL   ✕

4	23	14	7
◄ ▶	◄ ▶	◄ ▶	◄ ▶
Vrot	RADIUS	SLIT POSITION	QUALITY
11	55	3	5
◄ ▶	◄ ▶	◄ ▶	◄ ▶
Vp	HEIGHT	SLIT WIDTH	STEP SIZE
		100	0
		◄ ▶	◄ ▶
		STEP NUMBER	DISTRIBUTION
		226	
		◄ ▶	
Position (10,275		LINE WIDTH	GENERATE
Angles 44.2			