starView   REFERENCE SHEET

edited by Yinggang Li, Chi-Wing Fu

starView is a novel learning tool that realistically models and visualizes stars from Hipparcos catalogue. It provides an interactive GUI to explore interstellar space.
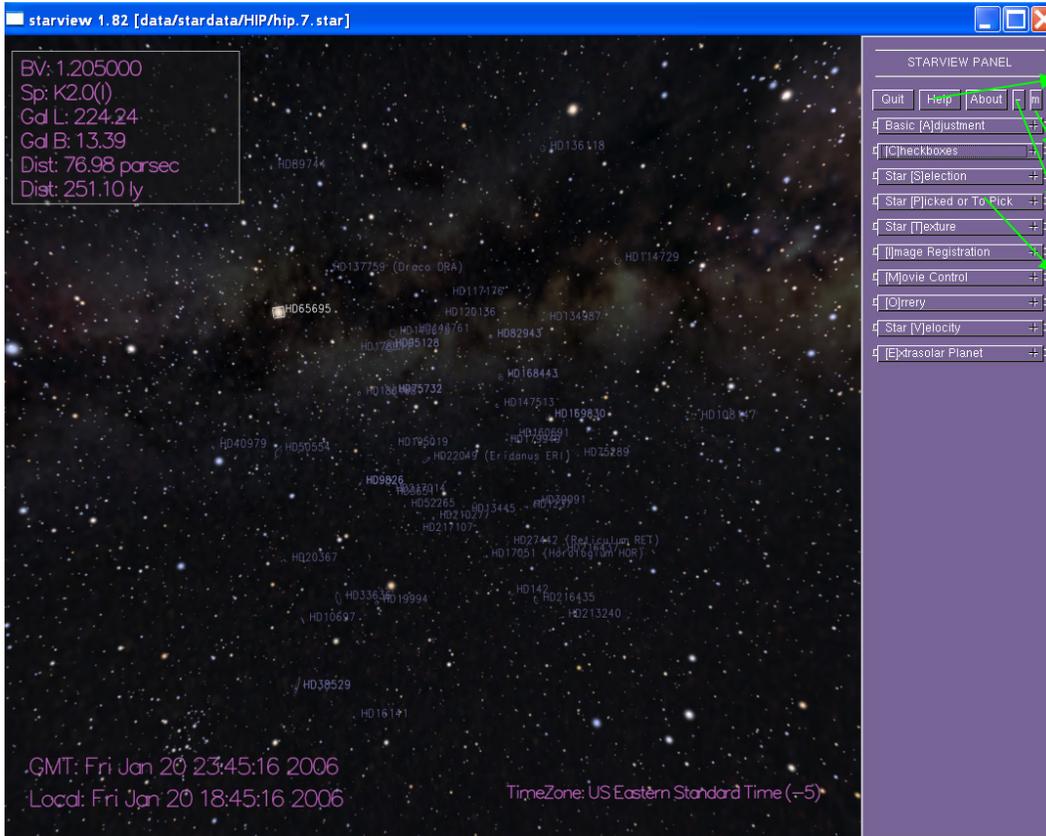

INTERFACE

- **Help**: To access information on the starView, including mouse and keyboard control
- **m** :   Rotate order of drop-down control lists
- **--** :   Collapse all opened drop-down control lists
- **Collapsed control dialog** : click '+' to expand/open.

A launch script is provided to start up starView with a default Hipparcos star file. You can change to other star data files from the script file.

CONTROLS
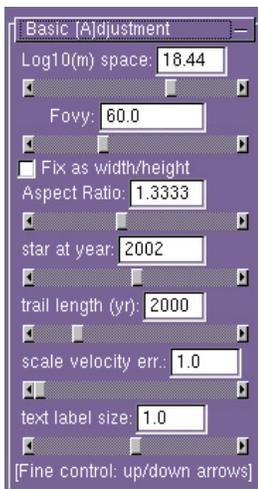
Adjustment

- Change Fov to Zoom In/Out
- Log10 space change the current position in space while keep the direction fixed
- Dynamic star position by changing star year
- When "Show star velocity trail is enabled", trail length shows star movement trace over time.
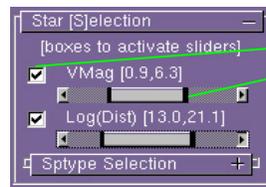
Star Selection

- Enble this selection
- Slider handle. Press and drag either end to set range
- VMag sets the selection filter based on apparent magnitude range
- Log(Dist) chooses star within the selected range

CONTROLS

Checkboses

```
[C]heckboxes           —
☑ show stars
☑ show Milkyway (M)
☐ show galactic axes (a)
☐ show meters cubes (b)
☐ show parsec cubes (B)
   ☐ (cube at picked star)
☐ show galactic grid (G)
☐ show equatorial grid (E)
☐ show grid detail (D)
☐ show constellat.lines (s)
☐ show constellat.names (s)
☐ show constellat.bound (S)
   ☐ (show picked only)
☑ show extrasolar planets ()
   ☑ (show star name)
☑ show the Sun (u)
☑ show solar system (U)
☑ show planet labels
☐ show dark sky
☑ show color map (m)
☑ show textured stars (t)
☐ show Ra/Dec
☐ show common name
☐ Lock view (l/L)
☐ show error bar (dist.)
☐ error bar (picked stars)
☐ show star velocity trail (y)
☐ show star velocity Err. (Y)
☐ show anchor (A)
milkyway alpha 0.35      ⬍
```

- Show a Power 10 Cube in meters as scale cue.
- Lock view to disable view transformation from user interface.
- Milkyway alpha controls the transparency of background image of milkyway.

Star Picking Control

```
Star [P]icked or To Pick   —
☑ show star info.(p)
   ☑ planet info. (if any)
print (console)   look at star
HD number: 65695
HIC number: 39079
Common name: ---
Constellation: ---
Constellation Code: ---
⊏ 1.Color Info.           + ⊐
⊏ 2.Position Info.        + ⊐
⊏ 3.Velocity Info.        + ⊐
[pick by right mouse click]
```
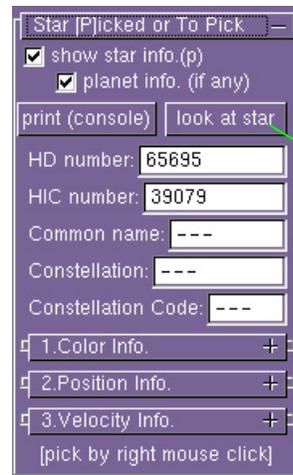
- Use right mouse to pick star
- Allow display of picked star information on screen, console or dialog here
- Change view to the picked star

Image Registration

```
[I]mage Registration      —
   toggle image/stars (|)
   ☐ show image (\)
image opacity 1.0         ⬍
┌ 1. Open Alignment File  —
   Load        Export
Align File: imagereg/

Image File:
⊏ 2. Set Correspondence + ⊐
⊏ 3. Error Measurement   + ⊐
⊏ 4. Data Measurement    + ⊐
```
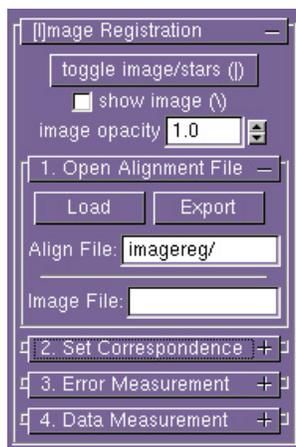
- Align real sky image against rendered starry sky
- Refer to the next page for Image Registration HowTo.

Movie

```
[M]ovie Control           —
☐ show frame num. (n)
   Play/stop (loop) (z/Z)
   Rewind & Play (x/X)
    <-        ->
[F1-F10 - goto frame]
   Reload script
Script: scripts/fixed.scp
   Dump the movie to
header: Movie/starview
  Dump the screen (INS) to
ppm file: starview.ppm
```
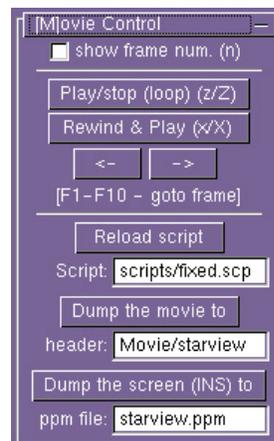
- starview is also a functional animation making suite. Load a movie script describing keyframe camera view, and dump frames into avi movie. Refer to the provided document for movie script format.
- Individual screen can be also captured through this panel.

IMAGE REGISTRATION

[Begin]
1. Put the "ImageReg" directory in the package under the starview directory such that this directory is at the same level as "bin", "data", and "scripts".
2. Prepare your own ppm file of the sketch you want to use e.g. "ImageReg/Images/orion_sketch.ppm".
3. Prepare the .aln file (alignment file) of the image e.g. "ImageReg/orion_sketch.aln" (the aln has a strict format - please use the above .aln, copy it to your own .aln file, and modify the "IMAGE").
4. Start the starview program by "run" script and under **Basic Adjustment** -> **Log10(m)** space tune the scale to about 7.0 to make sure we are at the Earth's scale to look at the sky.
5. Open the image registration panel and then the subpanel
   [1. Open Alignment file]
   In the "**Align File**" edit box, type in "ImageReg/orion_sketch.aln"
   and click the "**Load**" button.
6. Check the "**show image**" checkbox or press key '\' to show the image. You may want to tune down the transparency of the image to better see through the stars.
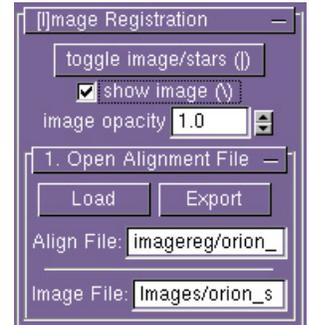
[Editing]
7. In case you are using your own image (instead of the orion_sketch.aln that we have aligned already), you will see your own image mapped over orion, which is wrong of course. Now open the subpanel
   [2. Set Correspondence]
   You need to pick 3 stars in the star dataset and corresponds them to the image (an image/tex coordinate) and the system can then compute a transformation matrix from texture coordinates to 3D coordinate.
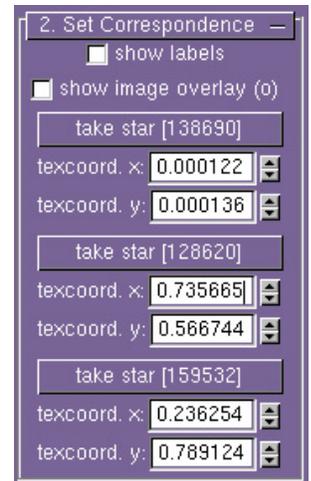
8. Now, the important steps:
   - Right click on a 3D star of your choice.
   (You wil see the name of the star appears when the star is selected. You have to make sure that this star appears in your sketch picture)
   - click on the "**take star**" button in the "**set correspondence**" subpanel
   - Repeat this two more times and take two more stars

9. Now, you've selected three stars as the three 3D points in the space. Next, you may press key "o" or check the **"show image overlay"** checkbox to bring up your picture on screen. In the image overlay, you will see three green dots with numbers "1", "2", and "3" above the dots. These dots corresponds to the three stars your selected. Drag the dots to the corresponding stars over the image overlay to match the stars on your sketch image. You will see the 3D image starting to match the 3D stars accordingly. Note: you may drag the edge/corner of the image overlay to make it bigger.

10. To fine tune the matching, you may use the texcoord spinners below the "take star" buttons.

11. After you are satisfied with the alignment, you may export the .aln file (e.g. orion_sketch.aln) and you will see that your .aln is updated. And inside the .aln file, you will find a matrix that transforms the 2D texture coordinate to the corresponding 3D position for you to put in your picture in 3D.

12. As I know, even using the fine tuning in (13), you may not get the stars aligned well. Because the three stars you selected are too close to each other in the image and a small change in their tex.coord. will cause a big difference in the overall transformation. You can pick another star, which is further away to the edge of your sketch and do (12) and (13) again for that star. Repeat until you are satisfied and export the .aln file.

Note: If you want to get better result, the three selected stars are further away between each other. The hint is that you can start with three stars in the middle of the pictures, and replace them (one at a time) by stars closer and closer to the edge of the sketch image. Later, if you want to improve the result, you may restart starview with the .aln you modified and polish the result. You don't have to redo the whole process from the beginning. You have to make sure the space scale is 7.0 or at least a lot smaller than the star scale.

Note: You may use right mouse button to pick a star and rotate view direction to look at a desired constellation. Or in the "**star [p]icked or to pick**" subpanel, type the first few characters of the constellation e.g. sco for Scorpios then click on the "look at star" button to rotate your view to there. You may also want to use "shift + right mouse button" and drag to rotate the view about the screen center so that the constellation up and down are better for you.