# Automated Astrophysical Modeling with *Shape*

- S. Wenger (1), W. Steffen (2), N. Koning (3), C. Morisset (2), and M. Magnor (1) -

1 - Computer Graphics Lab, TU Braunschweig, Germany
2 - Instituto de Astronomía, Universidad Nacional Autónoma de México, Mexico
3 - Space Astronomy Laboratory, University of Calgary, Calgary, Canada

Poster 5007
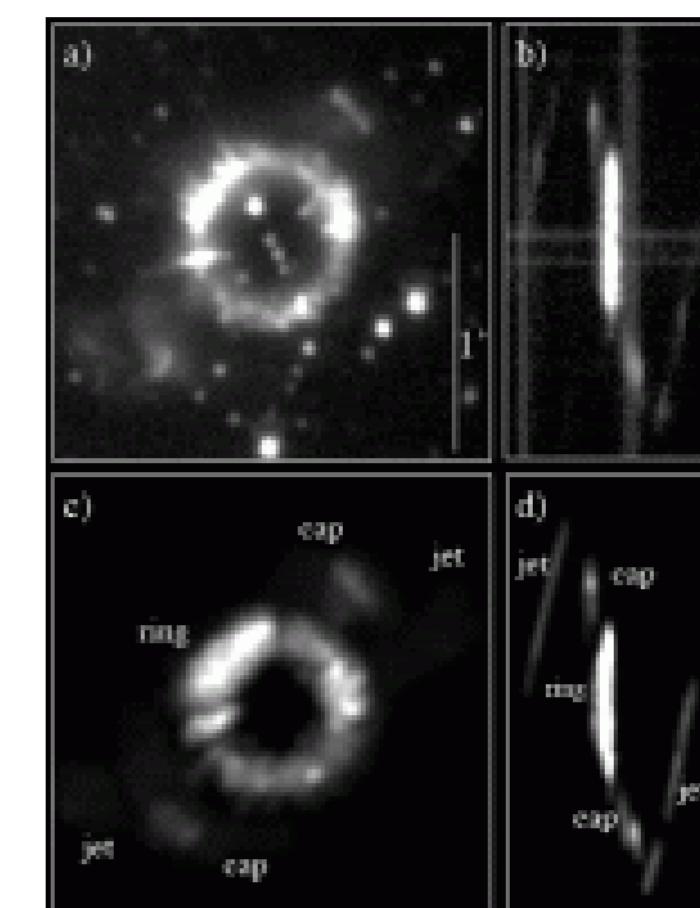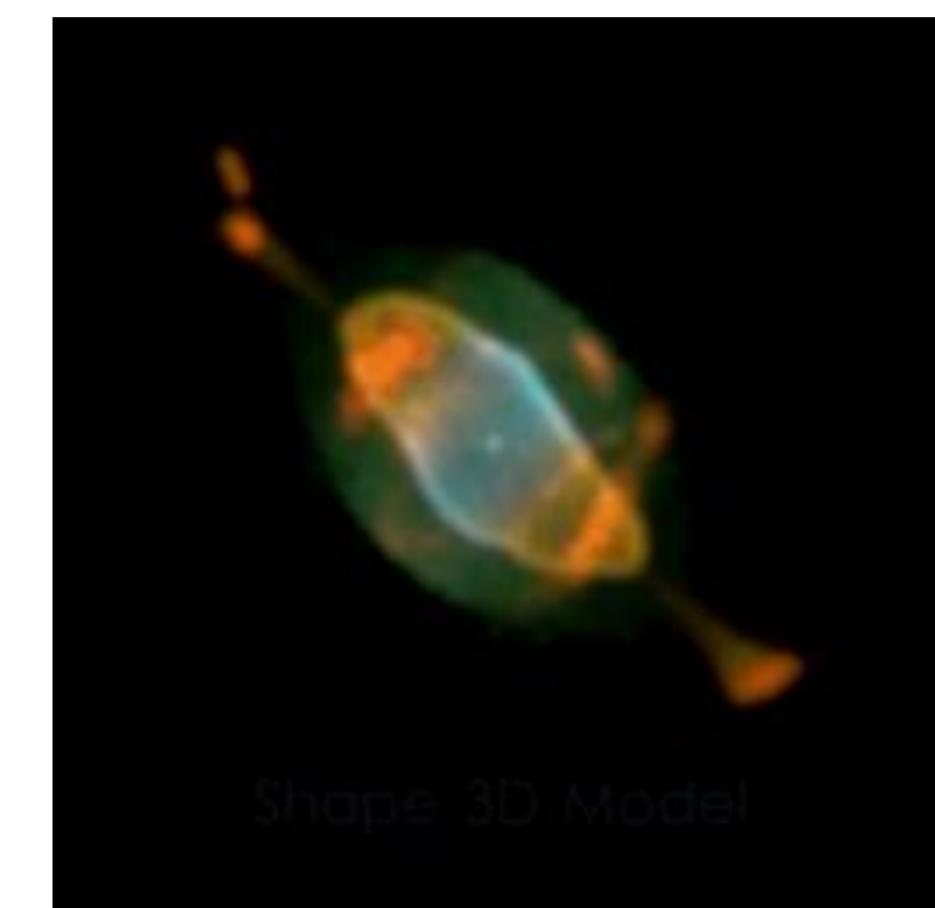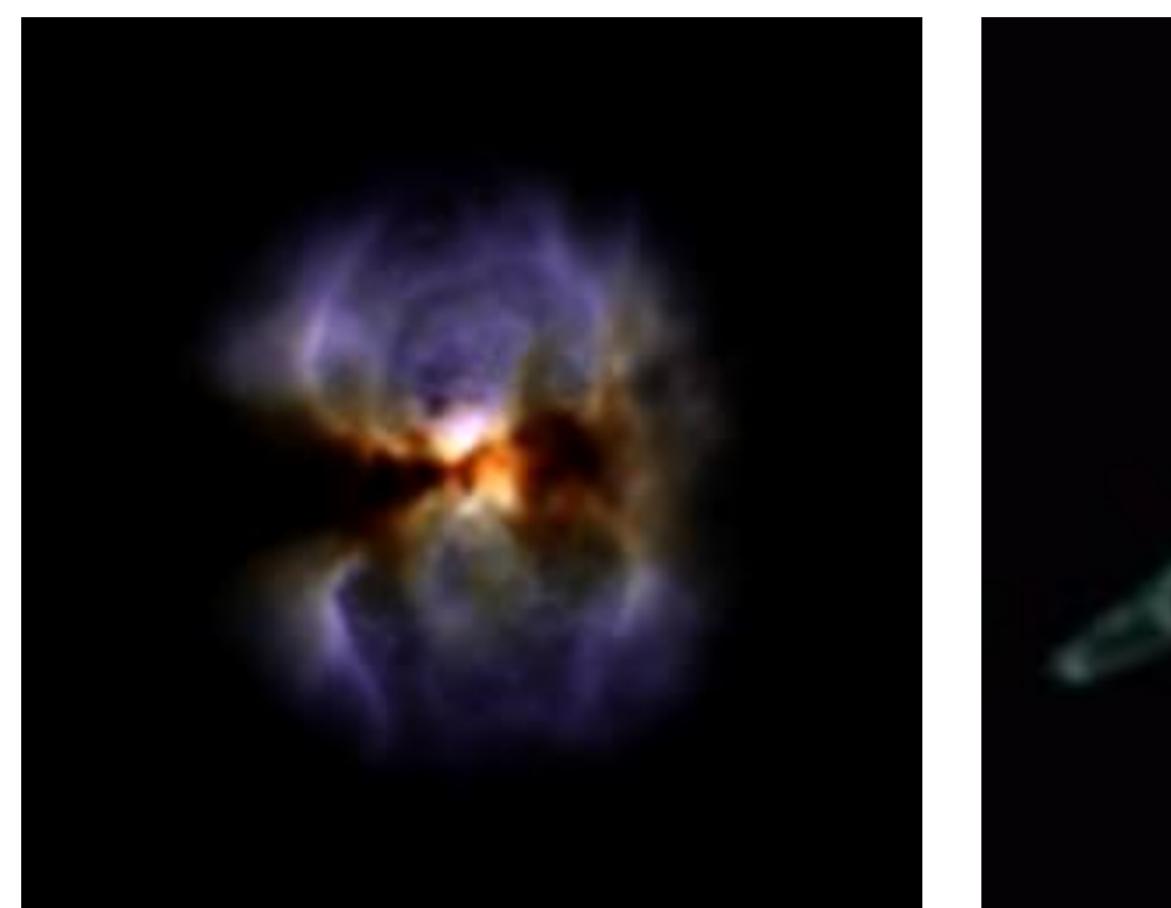
Example images of astrophysical nebulae generated in *Shape*.

Motivation

- Modeling and visualization for research and science popularization, e.g. planetary nebulae or rotating disks

- 2D images & spectra observable from Earth

- 3D reconstruction usually a lot of manual work

- **Automatic parameter optimization**

Model optimization

- **Optimization system to simultaneously fine tune model parameters**

- Least squares minimum difference data-model

- Modes: image, spectrum, data plot

- Multi-parameters

- User guided optimization by restricted parameter variation
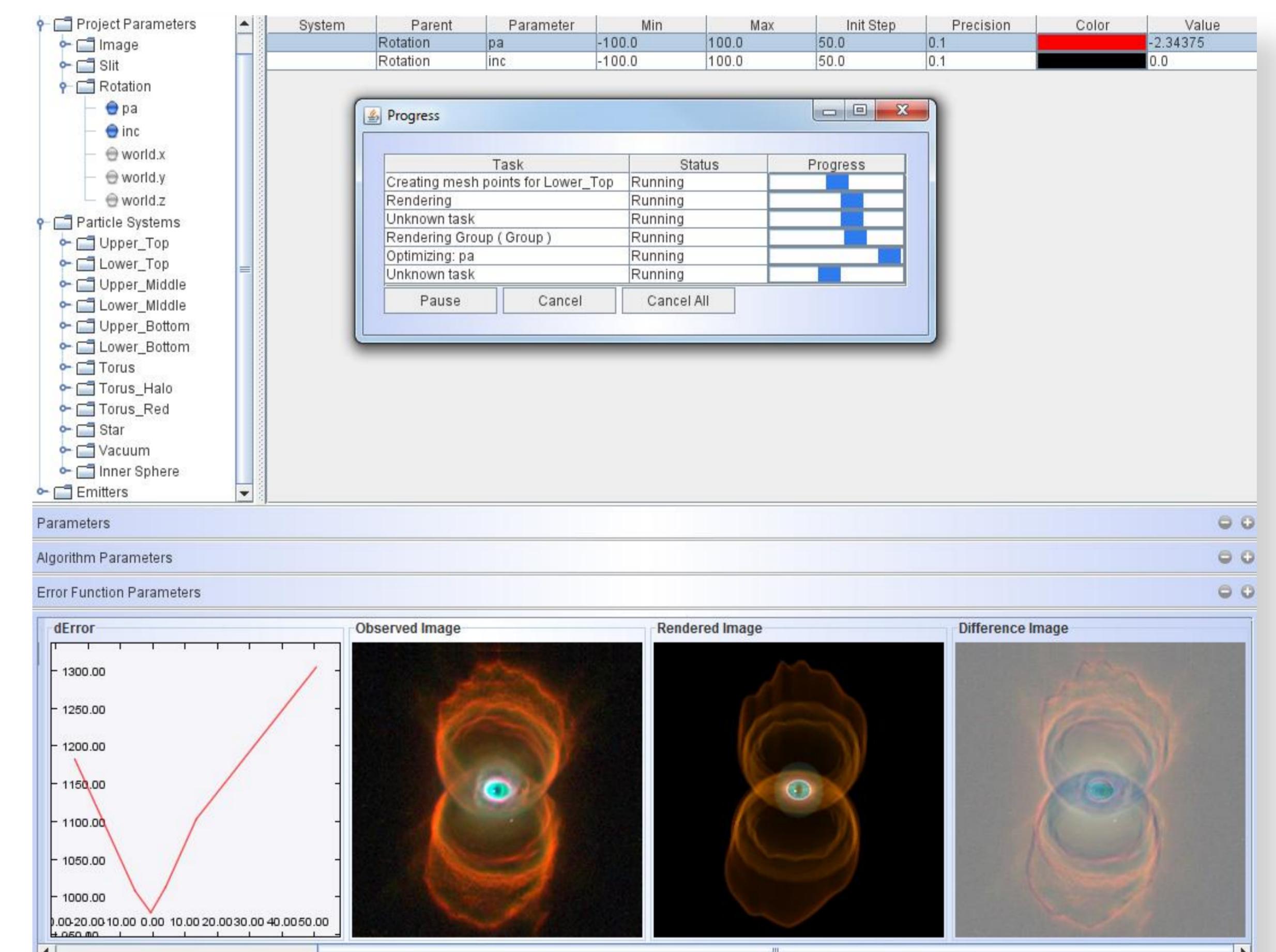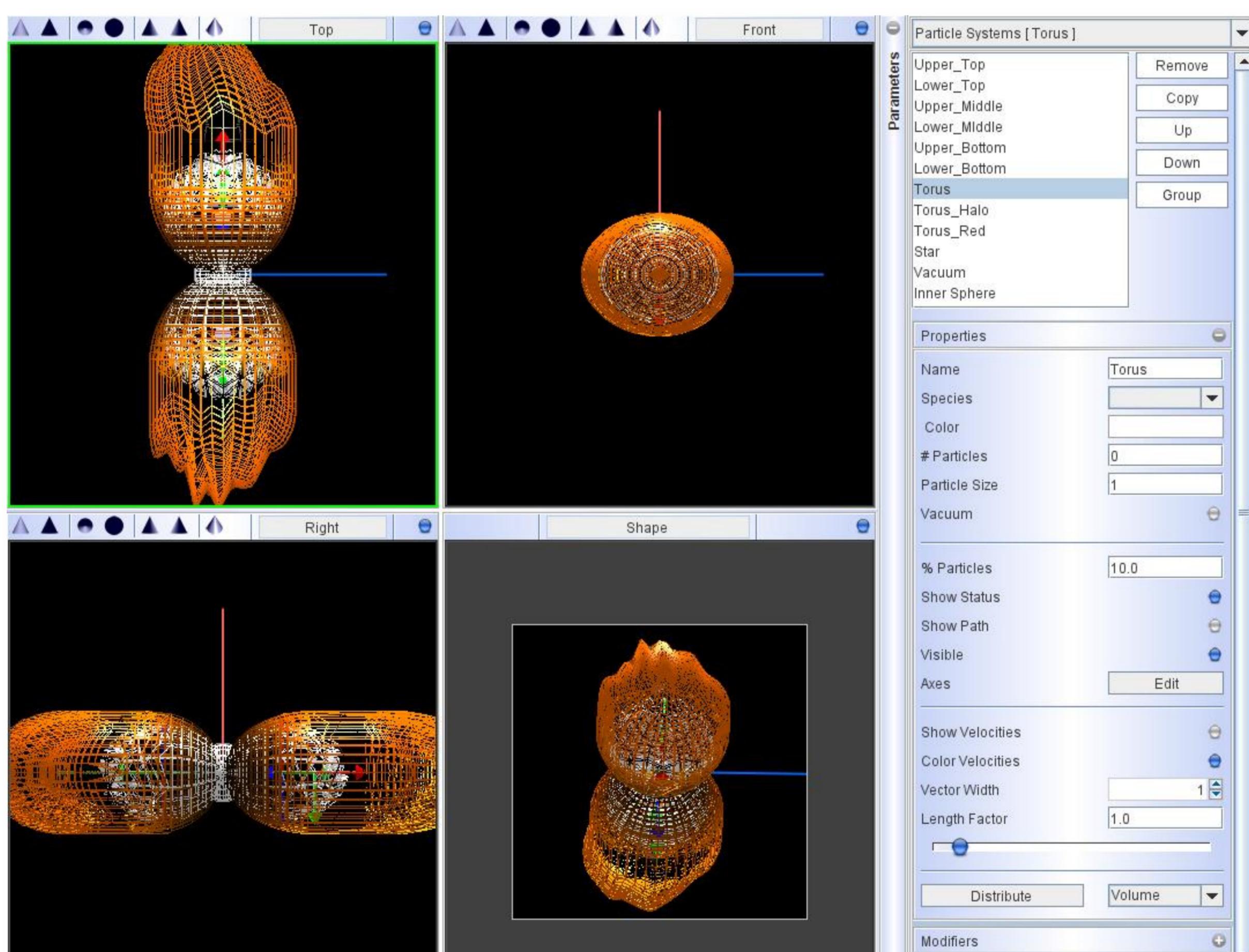
3D modeling with *Shape*

- Specialized 3D mesh-based modeling system for astrophysics (Steffen & López, 2006; Steffen, et al. 2010)

- User driven manual model adjustment to data starting from model hypothesis

- Depth information from observed spectral velocity data

- Assumed velocity law allows mapping of velocity to depth

- Iterative modeling: model hypothesis – compare with data – adjust model – compare with data …

- **Final step: fine tuning with automatic optimization**

Optimizable parameters

- Orientation

- Large- and small-scale geometry (via modifiers like advanced shear, twist, squeeze, scale, etc)

- Large- and small-scale structure (density & velocity field with analytical or piecewise linear 3D functions)

References

- Steffen & López, 2006, Revista Mexicana de Astronomía y Astrofísica, 42, 99'105

- Steffen, W., Koning, N., Wenger, S., Morisset, C., Magnor, M., 2010, *IEEE Transactions on Visualization and Computer Graphics, in press*

TECHNISCHE UNIVERSITÄT
CAROLO-WILHELMINA
ZU BRAUNSCHWEIG

instituto de astronomía
unam

S4L
Space Astronomy Laboratory