

Lab Studies and the Pyramid of Science

N.J. Woolf* LAPLACE team†

February 3, 2006

Abstract

Astrophysics, astrochemistry and astrobiology are the sciences we use to interpret observations of the universe beyond the Earth. They all deal with complex systems and complex interactions. Experience demonstrates that to understand a complex system, the necessary approach is modeling, and the fulcrum of modeling is the elimination of free parameters. With three parameters one could fit an elephant, and so to avoid the garbage-in-garbage-out situation, parameters must be defined so far as possible from laboratory studies, and these must be supplemented by copious empirical data and theoretical analyses. I will use the study of organic molecules in space as an example to demonstrate this. Despite the successes of quantum mechanics, precision determination of physical quantities must still come from the lab. The lab is the home of science, and science cannot make sense without it. And so, though occasionally and rarely, a simple observation made with a sensitive instrument will pin down the characteristics of a new phenomenon, the ultra sensitive instrument is just one tool in the toolkit of science, and it needs to be balanced by appropriate resources being spent on other tools - such as laboratory astrophysics. The current imbalance between national resources going towards extremely expensive sensitive telescopes and their auxiliary equipment and the lack of resources going to the bases of science, lab studies, education and theory, is turning the pyramid of science upside down and trying to balance it on a point! Such a use of resources sacrifices science for grandiosity.

*Steward Observatory, University of Arizona, Tucson AZ 85721

†NASA Astrobiology Institute