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A revolutionary NASA space telescope—designed in part by Rochester researchers—indicates we really had no idea what was going on out there. By Adam Frank

EYE TEAM: Rochester astronomers Dan Watson, Bill Forrest, and Judith Pipher helped develop the detectors used in the Spitzer telescope's infrared "eyes."

One crisp summer day, a restless crowd weaved its way into a small conference room in Bausch & Lomb Hall. Outside, the sun sliced through a flawless azure sky. Inside, I squeezed in among the two dozen professors and students and waited for the presentation to begin. Then the lights dimmed, and any longing for the lovely day outside was displaced by the far more powerful allure of new worlds coming into view, worlds located many light-years away.

A computer projector snapped on and began displaying data from the Spitzer Space Telescope, a powerful companion to the famed Hubble Space Telescope. Spitzer was launched in 2003, and my colleagues and I were witnessing some of its earliest results: evidence of planets being born around nearby stars. The actual data did not look like much, mostly line graphs showing the intensity of radiation emitted by the stars at various wavelengths, but the meaning hidden behind those numbers had us talking all at once, lost in the fever of discovery.

Spitzer was designed to pick up infrared rays that, unlike visible light, can penetrate thick dust and probe the dense interstellar clouds where stars and planets form. After just a few months of operation, the telescope already exceeded its creators' optimistic expectations. Not only had it clearly identified evidence of newly formed planets, it had demonstrated that the planet-building process is far wilder, messier, and more varied than anyone expected.

Spitzer's Rochester Roots

The truth is that astronomers still do not know much about the origin of planets, but they are learning quickly. For a long time the only solar system they were able to study was our own, which formed a long 4.6 billion years ago. Over the past decade, the discovery of planets around other stars and the development of intricate computer simulations have suggested that our solar system is something of an oddball. Planet building seemed to favor giant worlds careering around their stars in extreme orbits; most of the worlds we have found seem unlikely to support life.

Spitzer's findings suggest that nature is far more interesting than that. Planets seem to form in all kinds of orbits and in all kinds of distances from their stars. They also form through processes that do not clearly fit into any of the standard theoretical models. In some cases, small, rocky bodies may aggregate gradually over hundreds of millions of years. In others, Jupiter-size objects may pull themselves together in just a few hundred years.

All this variety probably includes countless bizarre worlds, but also many that are similar to Earth. That is why the mood in that conference room was electric. Spitzer was unmasking the secrets of planet building—the process that created our own solar system and that may, at the moment, be creating new habitable worlds around other stars.

Astronomers deduced the basic recipe for making planets a long time ago, and it could hardly be simpler. Just take an interstellar molecular cloud—in essence, a big bag of cold