

cores of galaxies, where black holes and quasars may lurk.

The telescope has also begun a search for youngsters in the cosmos—baby planets and infant galaxies. It lacks the resolution to image directly the dusty disks around stars, widely regarded as the spawning grounds for planets. But it can identify excess infrared emissions, a likely signature of dust disks, around stars that lie within 100 light-years of Earth. Therefore, ISO may identify places likely to harbor planetary systems.

The observatory also seeks primeval galaxies—distant, young galaxies caught in the act of making their first generation of stars (SN: 2/24/96, p. 120). These stars radiate mostly in the ultraviolet, but the expansion of the universe shifts their light to much longer wavelengths, so they appear bright in the infrared.

The astronomers plan to characterize nearby galaxies in great detail at shorter infrared wavelengths. They can then investigate more distant galaxies by looking for the same features redshifted to longer infrared wavelengths.

"We're creating a template of galaxies in the nearby universe so we can know what to expect when we look deeper, at more distant galaxies," says ISO project scientist Martin Kessler of the European Space Agency in Villafranca. Noting that astronomers aren't sure what galaxies

look like in the far infrared, the longest infrared wavelengths, Kessler says the ISO observations highlight "the unexplored nature of this part of the electromagnetic spectrum."

Observations such as these are all but impossible from the ground. Several gases in Earth's atmosphere—mainly water vapor and carbon dioxide—provide a double whammy in the infrared. These molecules absorb most infrared light, allowing only a few narrow bands of radiation to reach the ground. In addition, the molecules themselves radiate copious amounts of infrared light, overwhelming the faint emissions from stars and galaxies.

"It's as though you were trying to do astronomy in a snowstorm," notes Harwit.

Short-duration airplane and balloon surveys have flown above much of this atmospheric fog. Many studies have relied on the Kuiper Airborne Observatory, an infrared telescope that flew high in the atmosphere in a converted C-141 airplane. Even so, infrared emissions from the equipment itself as well as the atmosphere have interfered with observations.

Leaving the atmosphere far behind, ISO outperforms its only predecessor in space, the Infrared Astronomical Satellite. During its 1983 survey, the earlier satellite observed infrared emissions in

only four broad bands, none of them at wavelengths longer than 120 micrometers. In contrast, ISO's suite of instruments—a sensitive camera, two spectrometers to analyze the components of infrared light, and a photometer to measure brightness—cover a wavelength range spanning the middle and far infrared, from 3 to 240 micrometers.

"One can now make observations across the entire infrared spectral band—perhaps that's the most important attribute of the mission," says Harwit. "Now we have this absolutely clear view of the universe at all infrared wavelengths."

Even in the chilly environs of space, most infrared telescopes would generate infrared emissions some 10,000 times as strong as the radiation they are designed to detect. That's why scientists built ISO as a cryogenic telescope, using a huge tank of superfluid helium to cool it down to 2° above absolute zero. The mission ends when the helium runs out, about 20 months from now.

By that time, if all goes according to plan, astronauts will have outfitted the Hubble Space Telescope with an infrared camera, and NASA may be 2 years away from launching a major infrared observatory known as SOFIA (Stratospheric Observatory for Infrared Astronomy). Astronomers hope that as part of its legacy, ISO will have unveiled a variety of cool bodies for these telescopes to examine further. □

Environment

Cooking—and wheezing—with gas

If preparing dinner leaves you a trifle short of breath, perhaps you should evaluate the range of cooking preparations involved. British researchers find that women who cook with gas are at least twice as likely to experience wheezing, shortness of breath, and other symptoms of asthma as those who prepare meals using electric cooktops and ovens. This association held even when the cooks regularly used exhaust fans.

Deborah Jarvis and her coworkers at St. Thomas' Hospital in London surveyed respiratory symptoms for a year among 659 women and 500 men, aged 20 to 44, living in one of three provincial towns in eastern England. In addition to describing the heating appliances in their homes, most participants also provided blood samples and submitted to tests of lung function.

The questionnaire and tests link gas cooking not only to asthma but also to slightly diminished lung function, the researchers reported in the Feb. 17 *LANCET*. Moreover, these effects showed up only in women—probably because they spend more time in the kitchen than men do. Small impairments in lung function also showed up among those participants who heated rooms or water with an open gas fire, again only among women. Though smokers were no more likely to develop symptoms than nonsmokers, those who did experience problems tended to develop more serious ones.

Other studies have implicated the pollutants from indoor gas appliances in the frequency and severity of asthmatic episodes in children. That link tended to be weaker, however, perhaps because children spend less time close to a gas range's flames, suggest Michael Brauer and Susan M. Kennedy of the University of British Columbia in Vancouver in a commentary accompanying the *LANCET* article. Jarvis and her team

calculate that switching to electric ranges might cut wheezing and breathlessness among young women by up to 48 percent.

New construction: What a waste

As anyone who's hosted a major building project knows, those ugly dumpsters fill up fast—with scraps of framing lumber, drywall, and roofing shingles; bedsheet-size panels of plastic and paper; and nail-studded pallets to keep supplies flat and off the ground. Now, researchers at Cornell University have audited recyclable materials in construction waste from two houses. The 4,656 pounds of scraps tallied during the building of one four-bedroom vinyl-sided house included 1,788 lbs. of drywall, 1,338 lbs. of wood scraps (46 lbs. as sawdust), 346 lbs. of asphalt roofing, 273 lbs. of cardboard, 211 lbs. of plastic, 133 lbs. of brick pieces, and 31 lbs. of paper.

The big surprise, to environmental analyst and former building contractor Mark Pierce, was the uniform ratio of waste types among the two houses he examined and those in other studies. "Cardboard, wood, and gypsum [drywall] account for between 74 and 77 percent of all the wastes produced in a residential construction site, regardless of the size of the house or style."

While makers of particleboard and some other materials are periodically "starved" for the raw materials shed as waste during construction, he noted, "we had a real hard time finding [conservation and recycling] alternatives that would be cost-effective" for a builder putting up houses 60 miles north of New York City. Unless landfills increase their fees, Pierce found, it will remain slightly less expensive to dump most construction materials than to salvage them.