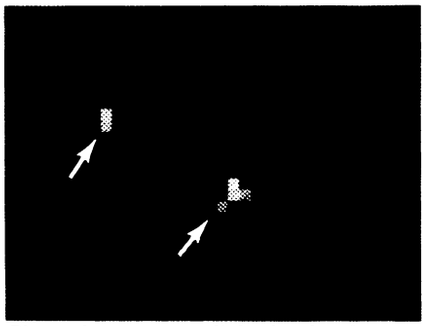
than a point-like source indicative of a quasar, reports Keith Matthews of the California Institute of Technology in Pasadena. Although the finding doesn't rule out a quasar, it supports previous observations that a burst of star formation contributes to the luminosity of the galaxy, known as FSC10214+4724, Matthews says. He adds that wing-like structures near the galaxy's edge may indicate a stream of stars and gas torn off by a collision with one or more other galaxies.



Keck Obs./Matthews, James Larkin

Photo shows quasar light that has been gravitationally bent, or lensed, into two images (arrows) by a foreground galaxy. Other images indicate that the galaxy may be the second known example of a dusty gravitational lens.

Nelson says the Keck Telescope will have its five detectors in place by the end of the year. Visible-light studies will begin this summer. — *R. Cowen*

Freedom's redesigns reach the White House

You say you want to buy a space station but you're short on cash this budget year. Well, take a look at this little number right here — we call it the Big Can. Drive it into orbit for $11.9 billion. . . .

Last week, still struggling to sell its beleaguered orbiting laboratory to Congress and President Clinton, NASA offered three cost-cutting alternatives to Space Station Freedom, projected to cost $18 billion over the next four years.

In February, Clinton asked NASA to halve the price of completing the Earth-orbiting craft. At the same time, the redesign had to preserve the station's scientific capabilities and still honor prior commitments to international partners (SN: 4/3/93, p.218). The 50-member NASA team found it could not meet these goals within the cost limit set by the White House — $9 billion or less spread over five NASA budgets, 1994 through 1998.

The least expensive of the three space station designs, option C, would blast off in a single package. Informally dubbed the Big Can, this $11.9 billion, 92-foot-long cylinder would be launched with external fuel tank, main engines, and solid boosters cannibalized from a space shuttle. Option B, a scaled-down version of Freedom, would cost $13.3 billion in the next five fiscal years to build and loft into orbit. Option A, a mixture of components designed for Space Station Freedom and flight-ready parts from other sources, would cost $12.9 to $13.2 billion. The redesigned station would operate for 10 to 15 years.

On June 7, NASA Administrator Daniel Goldin sent the new design options to a special advisory panel appointed in April by Vice President Albert Gore to undertake an independent assessment of the space station program. The panel submitted its report to the White House late last week, assessing the three options in terms of cost, inherent risk to crews, and technical feasibility.

The panel rejected option B as too risky, explaining that astronauts would have to spend too much time on spacewalks assembling and maintaining the station. Instead, the advisory panel recommended options A and C as technically simpler and less dangerous to construct.

One likely problem: Rep. George E. Brown Jr. (D-Calif.), chairman of the key authorizing committee for space projects in the House, favors option B as the only design likely to muster lasting support in Congress.

President Clinton will decide shortly which design option he will ask Congress to adopt in the 1994 budget. — *D. Pendick*

Cooling the vision of Earth's hot core

Heat trapped deep within Earth during its formation provides the energy that ultimately moves continents, powers volcanoes, and triggers earthquakes. So to understand better the planet's workings and its 4.6-billion-year geologic evolution, geophysicists want to know how much heat is stored inside Earth's iron-rich core.

New experiments now suggest a cooler core than previously thought.

To determine Earth's reserve of internal heat, scientists must know the melting temperature of iron at the boundary between the solid inner core and the molten outer core. Since that boundary lies 5,100 kilometers below Earth's surface at a pressure of 3.3 million atmospheres, it cannot be reached directly, nor can such high pressures be created in a laboratory.

Previously, the pressure limit at which scientists could hold iron was just 1 million atmospheres. Now, geophysicist Reinhard Boehler of the Max Planck Institute for Chemistry in Mainz, Germany, has pushed that to 2 million atmospheres. And he has extrapolated his data to 3.3 million atmospheres, calculating a temperature of 4,800 kelvins at the inner core-outer core boundary — a much lower figure than prior estimates of up to 8,000 kelvins.

Boehler reports his findings in the June 10 NATURE.

"We have reached the upper limit of pressure and temperature that can be achieved using this equipment," says Boehler, who used a diamond anvil that squeezes tiny iron samples between two diamond crystals.

While Boehler cranked up the pressure exerted by the diamonds, he heated the iron sample with a laser. Heating iron shifts its color from red to blue. Boehler determined the iron's melting temperature under different pressures by monitoring the sample's changing spectra.

He also estimated the heat loss at the boundary between the liquid outer core and the overlying solid mantle — an area of dramatic physical changes resulting in large part from the huge drop in temperature between the two regions, the geophysicist says. The temperature drops from 4,000 kelvins at the edge of the outer core to 2,700 kelvins at the bottom of the mantle, he calculates.

This transfer of heat can cause huge plumes, or currents, of solid rock to inch slowly upward, ultimately driving the motion of crustal plates. Yet as large as the temperature gap is between core and mantle, it is still much less than predicted by previous experiments.

This unexpectedly low temperature and Boehler's newer research on mantle rocks radically alter the picture of the lower mantle. In unpublished work on perovskite, the mineral that makes up most of the lower mantle, he finds evidence that perovskite's melting temperature is 7,000 to 8,000 kelvins — much higher than previously calculated.

Putting the two findings together, Boehler proposes that the lower mantle will prove to be a rigid area with limited flow and little chance of chemical reactions between mantle and core. "All predictions of flow in the lower mantle have to be reworked," Boehler contends.

Geophysicist Raymond Jeanloz of the University of California, Berkeley, says that only four or five scientific groups worldwide are carrying out work similar to Boehler's and emphasizes the need for cross-checks. Jeanloz has carried out high-pressure diamond anvil experiments, with different results. He anticipates that further experiments will resolve those differences in numbers and illuminate the true dynamics of Earth's inaccessible core.

— *B. Wuethrich*

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