PHYSICAL SCIENCES

Getting the picture of the sound

To find out what is lurking under water, it is usually necessary to use sonar. Acoustic waves can be transmitted through water for reflection by distant objects and return; the electromagnetic waves of radar would be quickly absorbed.

In the usual sonar system, however, the returned acoustic waves are transformed into electromagnetic ones by transducers in the receiving apparatus, and the information about underwater conditions is processed out of the electromagnetic waves. At the meeting in Ottawa this week of the Acoustical Society of America Wei Tsong Wu of the Department of Electrical Engineering and Computer Science at the Shanghai Jiao Tong University in China described a new system in which the information is processed from the acoustical waves directly. "...we begin with the acoustic wave signal and transform it to [an] image and then take image processing," he writes, "finally identification is carried out." The system provides a holographic image of the acoustic wavefront in an extremely sensitive way, avoiding as it does the energy loss and noise involved in the transduction process. "A very weak disturbance in the water, even if a slight variation of temperature in different regions of the water, will be distinctly found from the reconstructed image of the hologram," Wei writes. Also, the hologram, being two-dimensional, gives more information than the usual sonar display, which is one-dimensional.

Taking the shine off the sound

Musicians have always argued over the effect of the materials from which instruments are made on the sound of those instruments. A clarinet made of ebony sounds better than one made of metal. Brass instruments are customarily coated with a lacquer to protect the brass against corrosion. Brass players have always grumbled that the lacquer "darkened" (or "deadened" or "deafened") the tone of their instruments.

Now an experiment conducted by Robert W. Pyle of Bolt Beranek and Newman of Cambridge, Mass., reported at this week's meeting of the Acoustical Society of America in Ottawa, indicates that they are right. There is a measurable basis for the complaint.

Pyle worked with Walter Lawson of Boonsboro, Md., a maker of French horns, Robert Osmun of Belmont, Mass., a brass repairman, and Jean Rife of Brighton, Mass., a horn player. They tested French horns with lacquered and silver plated bells, then tested the same horns after the lacquer or the plate had been removed. Steady tones at three pitches and two dynamic levels were recorded for spectral analysis. Lacquer was found to diminish the output of the horn, more at high frequencies than at low frequencies. Silver plating had no measurable effect.

Aachion du lieber

An experiment by a group from the University of Aachen in West Germany now running at the Swiss Institute for Nuclear Research in Zurich (affectionately known as SIN) seems to show evidence for some new sort of extremely light, extremely penetrating subatomic particle. It is suspected that these may be axions, a variety of particle predicted a few years ago (SN: 4/15/78, p. 228).

Axions were predicted to save the current theory of particle physics, quantum chromodynamics, from a serious embarrassment. If they don't exist, serious symmetry breaks should appear in the behavior of the subatomic world, and theorists will have to rework the theory. It's not clear that the SIN particles are axions, and so to be safe CERN COURIER, in its May issue, calls them "aachions."

EARTH SCIENCES

Betwixt ocean and continent

Something has to give when an oceanic and a continental plate meet, but the question is how? Is the sediment that rides atop the oceanic plate scraped, like butter off a knife, onto the continental plate as the oceanic plate dives beneath it? Or is the oceanic plate swallowed whole, sediments and all? For a long time, these theories split the geologic camp, and deep sea drilling seemed only to confuse matters by providing evidence for both sides (SN: 7/28/79, p. 71; 8/25/79, p. 133).

Now the latest venture of the drilling ship *Glomar Challenger* has come up with evidence for a compromise between the two ideas. Leg 78A, led by Bernard Biju-Duval of the French Petroleum Institute and J. Casey Moore of the University of California at Santa Cruz, drilled at several sites east of the Lesser Antilles Islands where the Atlantic Ocean plate dives under the Caribbean plate. From the drill cores and from geophysical studies, such as seismic reflection profiles, the researchers found that the upper, less compacted sediments follow the butter-off-the-knife routine, and are skimmed off the Atlantic Ocean plate and mushed against the edge of the Caribbean plate. The lower part of the 1,500-foot-thick sediments, however, accompanies the Atlantic plate on its dive. What allows this to happen, the researchers say, is a "massive lubricated fault zone" between the two sediment sections. They describe the fault as a long horizontal crack that is lubricated by water under pressure between the weak upper sediments and the compacted lower sediments. The water apparently "floats" the upper sediments over those that travel with the Atlantic plate. In order detect the quakes that ought to occur along the fault, five seismometers were dropped to the seafloor and will be retrieved later.

Rules for U.S. seabed mining

Just in case the battle over the deep seabed mining provisions in the United Nations' proposed Law of the Sea treaty continued for another 10 years, the United States decided last year to pass its own seabed mining law. The treaty seems as far from ratification as ever (SN: 3/21/81, p. 185). Meanwhile, the National Oceanic and Atmospheric Administration has taken the first step toward implementing the U.S. law by publishing proposed regulations for mining.

The 1980 Deep Seabed Hard Mineral Resources Act directs NOAA to develop rules for U.S. seabed miners and encourages reciprocal agreements with other nations that have ocean mining legislation. If a LOS treaty is passed, only those parts of the U.S. law consistent with the treaty will remain in force. In the meantime, NOAA says, the law "will provide a more stable investment climate for the seabed mining industry and will encourage early exploitation of [seabed minerals]."

The recently published proposed rules pertain only to the exploration phase of mining. Regulations concerned with recovery of minerals will await the industry's progress. Specifically, the proposed rules deal with the application procedures for exploration licenses, environmental protection and resolution of overlapping site claims. The final regulations are due in September; the agency expects to receive the first applications for exploration licenses in October.

Climate forecast center established

A national center to experiment with ways to make reliable forecasts of seasonal temperature and precipitation has been established at the Scripps Institution of Oceanography's Climate Research Group. Funded by the National Climate Program Act, it will issue forecasts by three different methods each season in order to develop consistent and useful long-range forecasts.