

plots that had been mystifying.

Many theorists are working on the representation, especially attempting to make the theory unitary (as probability must be conserved). If one can add unitarity to the theory, it would mean that we live in a world composed of an infinite variety of resonances.

References

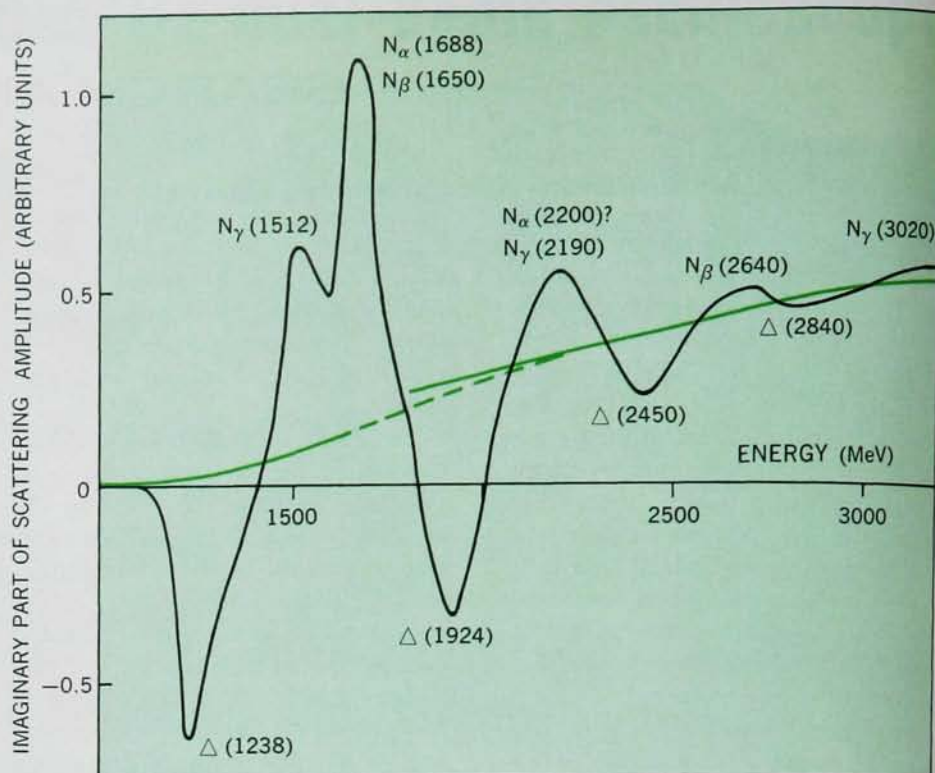
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Grids Instead of Walls for Electrodynastic Generators

A change in the design of pilot experiments at Gourdine Systems, Inc., makes the prospects for efficient generation of electricity by electrogasdynamics more promising.

The electrogasdynamic (EGD) power generator is like a Van de Graaff generator without the moving belt. Charged dust particles are carried to the high-potential terminal in a moving hot gas stream. The system is thus a high-potential, high-impedance output device, unlike those of the competing system, magnetohydrodynamics (MHD), which are low-impedance, high-current devices. One advantage over MHD is that no large magnet is necessary in EGD.

Early experiments with EGD generators showed that efficiency is lost when the charged particles precipitate onto the walls of the ceramic tubes instead of making their way to the high-voltage terminal. Meredith Gourdine, president of the company, and his research director, Ernst de Haas, recently demonstrated their new system. Instead of many separate parallel channels with solid ceramic walls they now use one large channel



SCATTERING AMPLITUDE for π - n scattering represented by two Regge fits (color) and by resonances. One can write the scattering amplitude either as a sum of a large number of resonances or with the Regge asymptotic formula. This duality concept is a key feature of the Veneziano representation.

-FIG. 2

with a grid system that essentially divides the single channel into many small parallel ones. The grids define the flow path and provide "walls" of greater than 90% transparency.

The first model built in this way provides 4 watts of power at 120 000 volts. de Haas believes that industrial models will go to 500 MW at 40% efficiency, with input gas temperatures of 1000°C.

Crab Pulsar Optically Identified; Other Pulsars Show Slowdown

Pulsar NP 0532, near the center of the Crab Nebula, pulses optically with the same period as its radio emissions, according to W. John Cocke, Michael J. Disney and Donald J. Taylor of the Steward Observatory (International Astronomical Union Circular No. 2128, 1969). The University of Arizona group, using a 36-inch reflector, discovered light flashing at the apparent radio period of 0.033095 sec from the region of a well known starlike object in the nebula.

Optical variation in NP 0532 was confirmed by Malcolm MacFarlane, Brian Warner and Ed Nather, using the 82-inch telescope at the McDonald Observatory, Texas, and by Stephen P.

Maran, Roger Lynds and Donald Trumbo of Kitt Peak National Observatory, using an 84-inch telescope. The Kitt Peak workers isolated the light flashes to the starlike object with a precision of better than 1 arc sec. Last spring the Kitt Peak group had found light variation from CP 1919 that had a period twice the radio period, but subsequent confirmation was later withdrawn. Unlike the weak light from CP 1919, which had to be integrated for hours, the Crab source could be seen by simply sweeping the equipment about 30 times a second for less than a minute.

The pulse shape as a function of time appears the same in both the optical and radio regions; this suggests the same mechanism that beams the radio emission also beams the optical flashes.

Slow down. NP 0532 was the first pulsar reported to be slowing down (*PHYSICS TODAY*, February, page 67). The rate at which its period is lengthening, 1 part in 2000 per year, implies that the lifetime of the physical characteristics that cause radio pulsations is approximately several thousand years.

Since then John G. Davies, G. C. Hunt and F. Graham Smith of Jodrell

Bank (*Nature* **221**, 27, 1969) found that over a nine-month interval CP 1919, CP 0834, CP 0950 and CP 1133 were slowing down (although the chance of a sinusoidal variation with a period much greater than a year is not ruled out entirely) with an apparent lifetime of about 10 million years.

In the same issue of *Nature* (**221**, 29, 1969), T. W. Cole of the Mullard Radio Astronomy Observatory, Cambridge, said in another report that CP 0834, CP 1919 and CP 1133 appear to be slowing down with lifetimes of the order of 10 million years, and CP 0808 shows a lifetime greater than 100 million years.

The most recent report of a lengthening pulsar period comes from an Australian group, headed by V. Radhakrishnan, who have reported that the pulsar in the Vela remnant, which has an 89-msec period, is lengthening at the rate of about 1 part in 20 000 per year.

— GBL

CERN Successfully Runs an Ultrasonic Bubble Chamber

An ultrasonically activated helium bubble chamber recently yielded its first photographs at CERN (*Nature* **220**, 1177, 1968). Although many laboratories have been working on the chambers, the CERN team, headed by Robin Brown, Hans Hilke and A. H. Rogers, is the first to show that they work and produce visible bubbles.

As in all chambers, momentarily lowering the pressure produces preferential boiling along particle tracks. Until now the necessary variations in pressure have been applied by huge expansion systems, which were in general slow to recycle (typically a few times per second at most).

In the CERN chamber the pressure variation is produced by two piezoelectric crystals, which set up a 110-kHz standing wave in liquid helium kept at 4.2 K. After 50 or 60 cycles bubbles grow to visible size. Such a chamber could presumably be almost continuously sensitive. Used along with an electronic counter system, the photographic flash might then be triggered only when interesting events occurred.

Near-Earth Study Program Proposed for 1968–1975

After the exploratory space surveys of the past ten years, it is time for co-ordinated satellite, space-probe and rocket sounding missions to attack

questions of fundamental physical mechanisms in the sun-earth system, according to a report issued by the Space Science Board of the National Academy of Sciences (*Physics of the Earth in Space: A Program of Research, 1968–1975*).

The report proposes specific missions for the period 1971–1976, putting high priority on co-ordinated spacecraft observations of the magnetosphere during the low solar activity expected in 1974–1975. Two new kinds of space vehicles are needed, the report says: clusters of simultaneously deployed small satellites to allow concurrent measurements at relatively short separations and special satellites capable of a variable orbit for sustained measurements

at lower altitudes than previously possible.

In surveying our knowledge of the sun-earth system, the report identifies many unanswered questions: How does the solar wind interact with the magnetosphere to form the boundary? How is solar-wind energy converted into electric currents, auroral light and radiation belts? What are the significant photochemical processes in the ionosphere? What causes geomagnetic storms, and how do they affect the magnetosphere and ionosphere? How do the density and temperature of the thermosphere vary with the magnetic activity? How does eddy diffusion affect gases in the atmosphere and transmit heat?

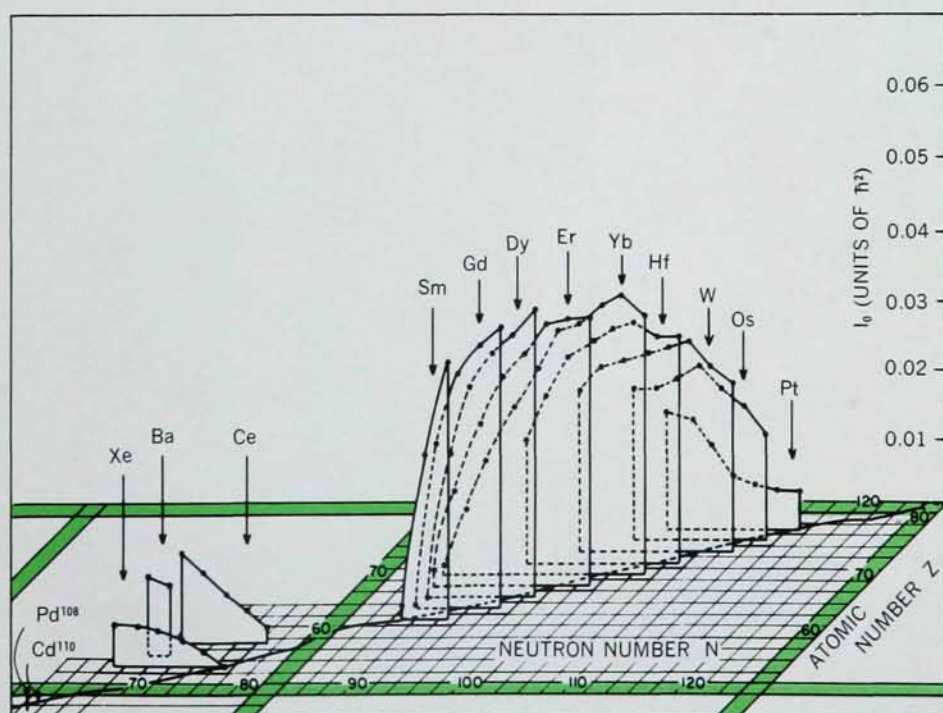
Variable Moment of Inertia For Even-Even Nuclei

By assuming that the nuclear moment of inertia is a function of nuclear spin, a Brookhaven group has developed a model for even-even nuclei that successfully predicts level spacings in ground-state bands, which are level sequences that have values of spin and parity $J^P = 2^+, 4^+, 6^+, \dots$. Such bands are found in both deformed and spherical nuclei.

To a first approximation well deformed nuclei have energy levels $E = (\hbar^2/2) [J(J+1)]/I$, which occupy a rotational band (I is characteristic nuclear moment of inertia). In spher-

ical nuclei ground-state-band levels are approximately equidistant, and are therefore usually thought to be members of a vibrational band. Energy-level patterns intermediate between the rotational and vibrational types are found, for example, in the regions of the osmium and xenon nuclei.

Recently M. A. J. Mariscotti, Gertrude Scharff-Goldhaber and Brian Buck (*Phys. Rev.* **20** Feb. 1969) showed that spherical nuclei can also be interpreted as rotational nuclei. Their model adds a new term to the rotational formula by assuming that I



VARIATION OF NUCLEAR MOMENT OF INERTIA I_0 as a function of neutron number and atomic number. I_0 reaches maximum midway between closed shells (color).