X-Ray Emission from Crab Nebula			
Group	*Energy range (keV)*	*% of source luminosity*	*Date of observation*
NRL	0.8–4	5	13 Mar. 1969
Columbia	5–20	6.5 ± 5	7 Mar. 1969
Rice	>30	7 ± 2	4 June 1967
MIT	1.5–10	9	27 Apr. 1969
Goddard	2–10	15 ± 3	16 Mar. 1968

ular rather than stellar. Their result cast doubt for a while that the Crab contained a neutron star. However, the NRL group notes in their latest report, their earlier observation could not have detected a 5% stellar contribution.

The new NRL experiment also showed that NP 0532 was emitting two pulses, a main one and an interpulse occurring 12 millisec later, similar to the behavior already found both in the optical and radio regions.

Meanwhile a Columbia group (Roger Angel, Robert Novick, Paul van den Bout, Martin Weisskopf and Richard Wolff) was analyzing Crab x-ray data from a flight launched six days earlier than the NRL rocket. The Columbia group was searching for x-ray polarization from the nebula. The Crab is known to emit strongly polarized radiation in the visible and radio regions; if x-ray polarization were found, too, it would be strong evidence that the Crab x-ray emission results from synchrotron radiation. When the Columbia experimenters heard of the NRL result, they examined their data for pulsing and found (International Astronomical Union circular no. 2142) pulsing with a peak value $(6.5 \pm 2.7)\%$ of the average source luminosity. Further analysis suggests a value of $(6.5 \pm 5)\%$.

A group at Rice University (Robert Haymes, G. J. Fishman and F. R. Harnden Jr), analyzing balloon-flight data from 4 June 1967, also confirmed the pulsing (circular no. 2143). Comparing the 1967 x-ray period with 1969 optical data, the Rice group calculated linear slowdown rate over a 575-day interval as 36.51 ± 0.02 nanosec/day.

A collaboration (Hale Bradt, Saul Rappaport and W. Mayer of MIT, Ed Nather, Brian Warner and Malcolm MacFarlane of McDonald Observatory, Texas, and Jerome Kristian of Mt Palomar) looked at the pulsar with a rocket-launched x-ray detector, the 200-inch Palomar telescope and the 36-inch McDonald telescope (*Nature*, 24 May). They confirmed the earlier observations and demonstrated that the pulsar blinks at both x-ray and optical wavelengths simultaneously, within 1 millisec.

Analyzing 1968 rocket data, a team from Goddard Space Flight Center (Elihu Boldt, Upendra Desai, Stephen Holt, Peter Serlemitsos and Robert Silverberg) confirmed pulsing. Their luminosity value is substantially higher than the other observations.

Crystal Acts Like a Two-Dimensional Antiferromagnet

A single crystal of K_2NiF_4 acts like a two-dimensional antiferromagnet above a critical temperature T_n = 97.1 K, according to a recent experiment at Brookhaven. At the critical temperature the crystal undergoes an extremely sharp phase transition to long-range order in three dimensions. Then below that temperature the magnetization varies as $(T - T_n)^\beta$ where $\beta = 0.15$, again suggesting that the magnetic behavior is two dimensional.

Robert Birgeneau (Bell Labs and Brookhaven), Howard Guggenheim (Bell) and Gen Shirane (Brookhaven) reported their results in *Phys. Rev. Letters* **22**, 720 (1969). The group believes that theirs is the first observation of two-dimensional scattering in a magnetic system.

The experimenters expected that K_2NiF_4 would show such behavior, Birgeneau told us, because its structure favors strong interactions within crystal planes and no interactions between nearest-neighbor planes. Nearest-neighbor nickel ions that are within the plane possess molecular orbitals that point directly at each other, thus producing a huge exchange interaction. Also, the crystal was known to be antiferromagnetic, its spins lining up antiparallel.

To do the experiment, the group bombarded the single crystal with monochromatic neutrons from the Brookhaven High-Flux Reactor, and they observed scattering as a function of angle as the temperature was lowered. As the temperature neared the critical point, the spins in a given plane lined up head to tail over very long crystalline distance: Spins were almost perfectly correlated over lengths up to 500 nanometers. These enormous spin globules showed no awareness of the spins in another plane until the critical point was reached.

The data show that within the plane in two dimensions, you have normal critical scattering peaks. On the other hand, if you scan through the crystal planes, the scattering cross section is essentially independent of momentum in the direction perpendicular to the plane. So you observe, instead, a "critical ridge."

As the critical point is approached, the correlation length grows, Birgeneau said. Once the crystal has nearly perfect long-range order, with globules containing more than a million spins, the net coupling between the crystal planes apparently commences to matter. Just at the critical point, when the system is about to become completely ordered, it simultaneously orders in three dimensions.

Below the critical point, the K_2NiF_4 system again acts two dimensionally. Many critical-point experiments on three-dimensional systems have shown magnetization to vary as $(T - T_c)^\beta$ with $\beta = 0.33$ to 0.4. In 1944 Lars Onsager, using the two-dimensional Ising model, had predicted $\beta = 1/8$. The Brookhaven result is $\beta = 0.15$, which is about 1/7. This equation fits the data over the complete temperature range the group studied, from 97.0 to 5.0 K. —GBL

Berkeley Group Reports Discovery of Element 104

A Berkeley group says it has positively identified two isotopes of element 104, ${}_{104}X^{257}$ and ${}_{104}X^{259}$. Speaking at the American Chemical Society's Mendeleev Centennial Symposium, Albert Ghiorso said that they also think they have found ${}_{104}X^{258}$, but are not yet sure. The group was unable to observe ${}_{104}X^{260}$, which Georgi N. Flerov and his collaborators at the Joint Institute for Nuclear Research, Dubna had reported in 1964 (and named kurchatovium).

In the Berkeley experiments, ${}_{98}Cf^{249}$ was bombarded with carbon ions from the HILAC device. The experimenters, to identify isotopes 257 and 259, first directly observed their alpha decay to nobelium, measuring the alpha-decay energy. Then they measured the de-