RESEARCH FACILITIES AND PROGRAMS

Spectroscopy at NYU

Research on atomic hyperfine structure and isotope shifts has begun at the Bronx campus of New York University in a new laboratory containing a high-resolution optical spectrograph of 10-meter focal length. Henry H. Stroke, associate professor of physics, built the laboratory for a systematic study of heavy radioactive isotopes. The National Science Foundation gave \$178 100 for construction and four years of research.

To gain the necessary resolution, the instrument has a 25.4-cm plane-blazed diffraction grating in a Czerny-Turner mount. The whole thing is housed in a light-tight room-within-a-room where temperature is controlled to within 0.1°F. It rests on two vibration-insulated piers that go down to bedrock and hold it stable to a maximum movement of 0.1 micron.

For experiments, discharge lamps are prepared from samples of radioactive material produced in a cyclotron or reactor. Some of the samples, with half-lives of a few hours, have been made at Harvard and brought to NYU by automobile to be refined, distilled and made into lamps, all before they decayed.

Stroke is beginning his work with high-resolution studies of visible and near-ultraviolet spectra of atoms with radioactive nuclei. He is investigating nuclear-charge distribution by isotope-shift measurements. At the same time he is attempting to correlate deformations (from vibrations) with the orbits into which neutrons go.

The laboratory also has a 10-kg magnet (and some smaller magnets) for optical level-crossing studies and Helmholtz coils for research on the atomic-radiation process itself. Meteorolgists and oceanographers plan to use the spectrograph for geophysical problems (including high-resolution studies of sunlight that they will "pipe" into the laboratory), and other physicists want to do solid-state and astrophysical research.

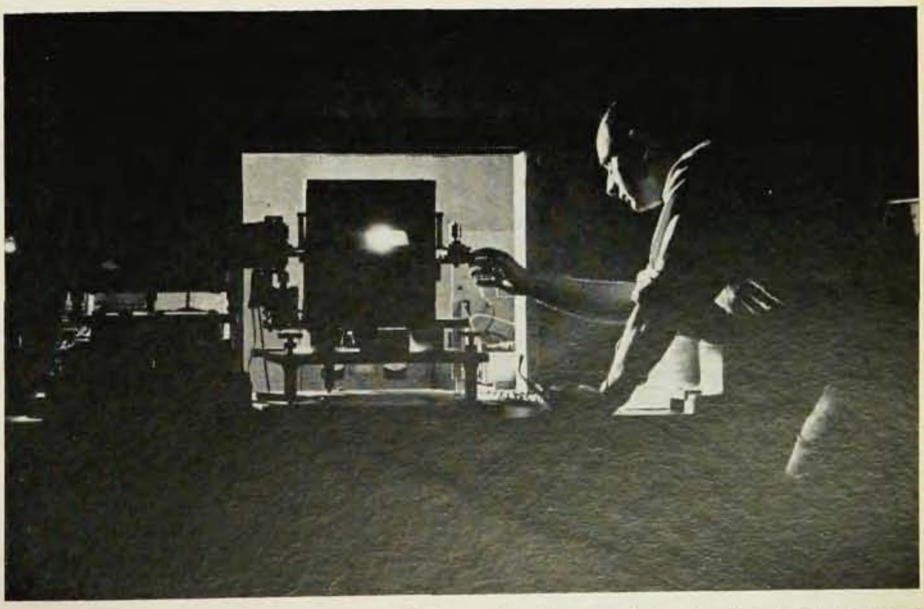
Supernovas may fluoresce

Philip Morrison and Leo Sartori have presented a theory involving fluorescence of interstellar gas clouds to explain the observed spectra of Type I supernovas. According to their argument [Phys. Rev. Letters, **16**, 414 (1966)], most of the supernova light comes from a gas cloud surrounding the exploding center, which is excited by ultraviolet radiation from the explosion.

The objects in question show a sudden, sharp flash; their photographic light curves (log of luminosity from 380 to 520 millimicrons) rise in a few days to an average maximum greater than 10^9 times solar luminosity. Afterward they dim rapidly for 20 or 30 days, then go into an almost exponential decline with a half-life of 40 to 80 days. The decline can continue in this fashion for nearly two years. During the early period the color reddens rapidly, but after about 40 days it becomes bluish and after about 100 days stays approximately constant.

The spectrum consists mainly of broad bands about 10 to 20 millimicrons wide, the brightest of which peaks near 460 millimicrons and contains nearly half the total intensity in the photographic region. This peak and three others in the blue (490, 480, and 430 millimicrons) show a gradual redshift leading to an overall displacement of about 10 millimicrons in each case. Red features of the spectra behave erratically.

The authors assume that the bulk of the direct energy release is a sudden burst lasting at most a few days. At first the radiation is concentrated in the ultraviolet or beyond, but it shifts to lower frequencies as time goes on. Thus the visible power increases even while the total emission goes down. After maximum the direct emission decreases so rapidly that it soon becomes negligible. Thus the light observed after ten or 20 days is fluorescence—that is, visible light emitted by interstellar gas that has been excited by the original ultraviolet emission. As time goes on the fluorescence emanates from regions farther and farther from the center so that the observed near-exponential decline in brightness with time represents the essentially ex-



SPECTROSCOPY LAB at New York University (Bronx campus). Henry H. Stroke, who designed the instrument, is shown adjusting a mirror in the focal plane of the 10-meter-focal-length, high-resolution optical spectrograph.