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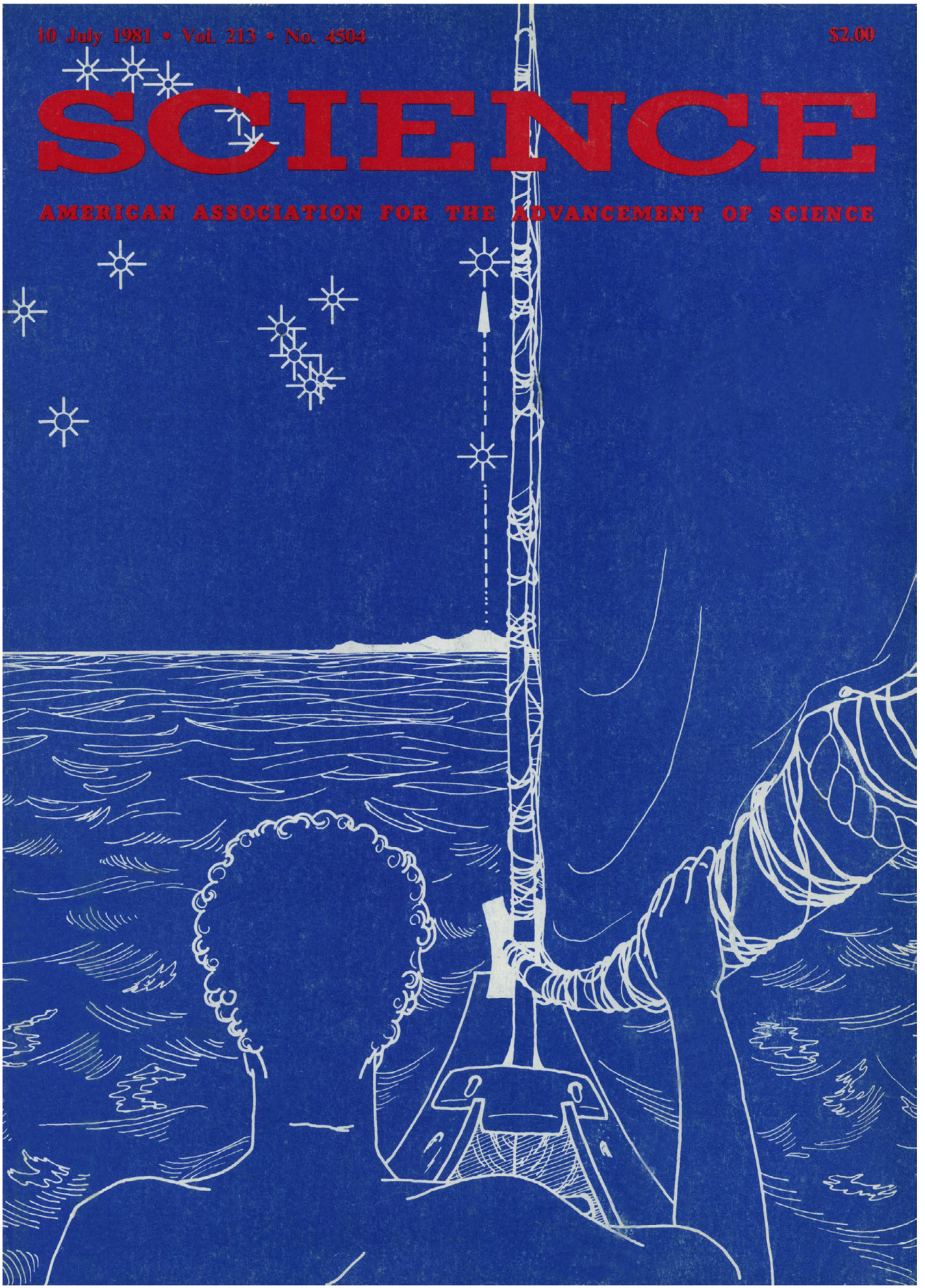

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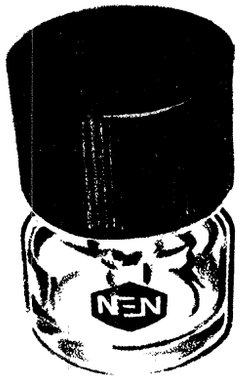

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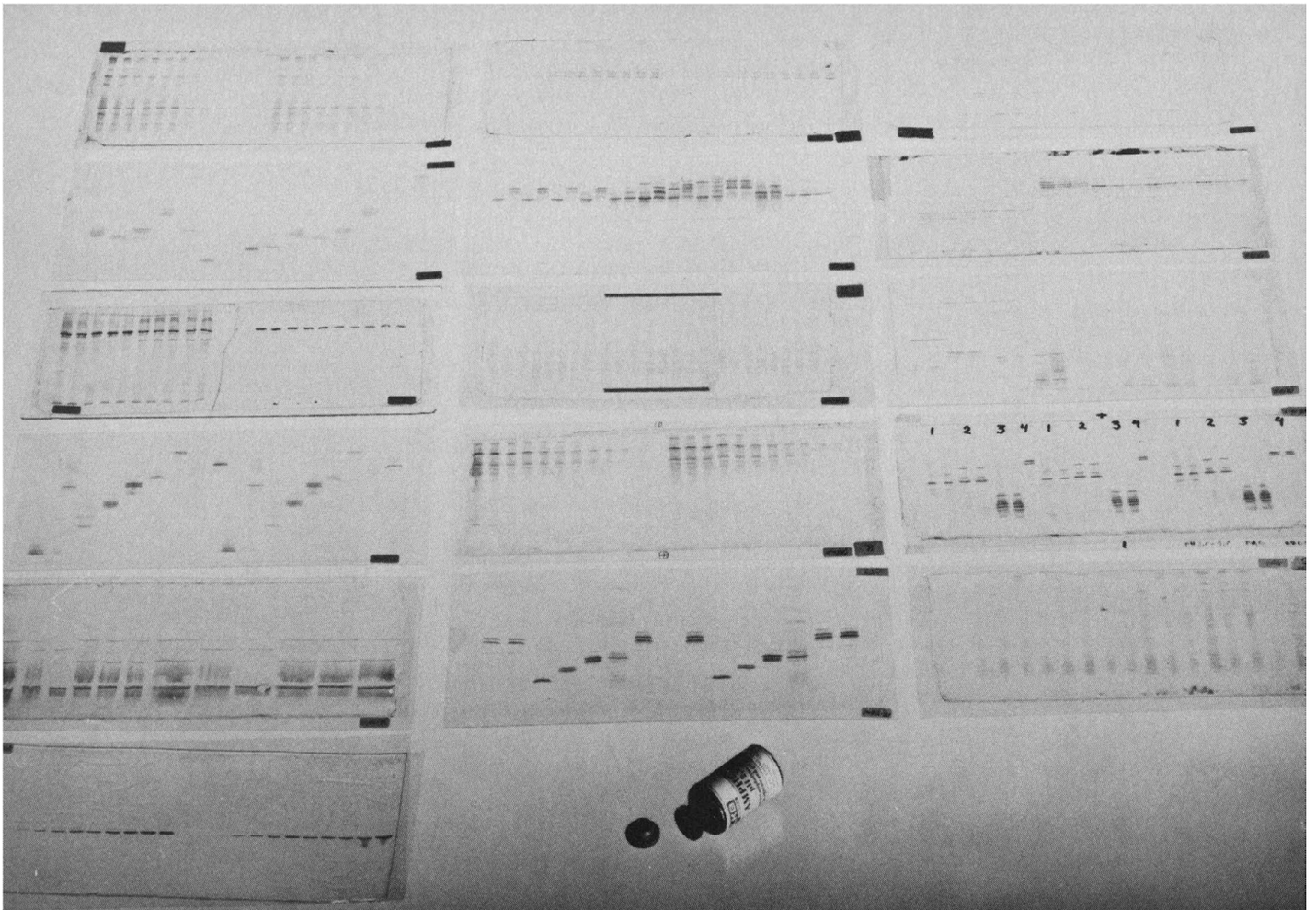
The role of environment in the development of astronomical systems is illustrated by the hypothetical navigator in tropical latitudes who finds his island destination by mnemonic association with a particular linear constellation composed of member stars that rise or set vertically with respect to the direction of that island in the horizon plane. The two members of the chain, connected by a dashed line in the illustration, can be recognized by astronomers in north temperate latitudes as part of a different star pattern—the well-known constellation of Orion. See page 161. [Sketch by Julia Meyerson, Colgate University, Hamilton, New York 13346]



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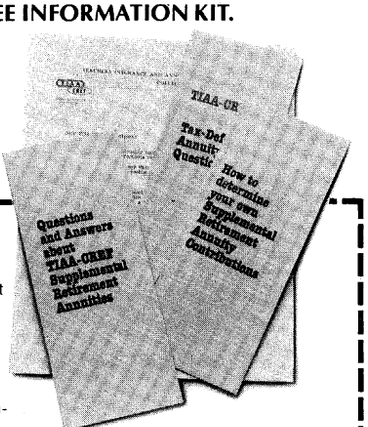

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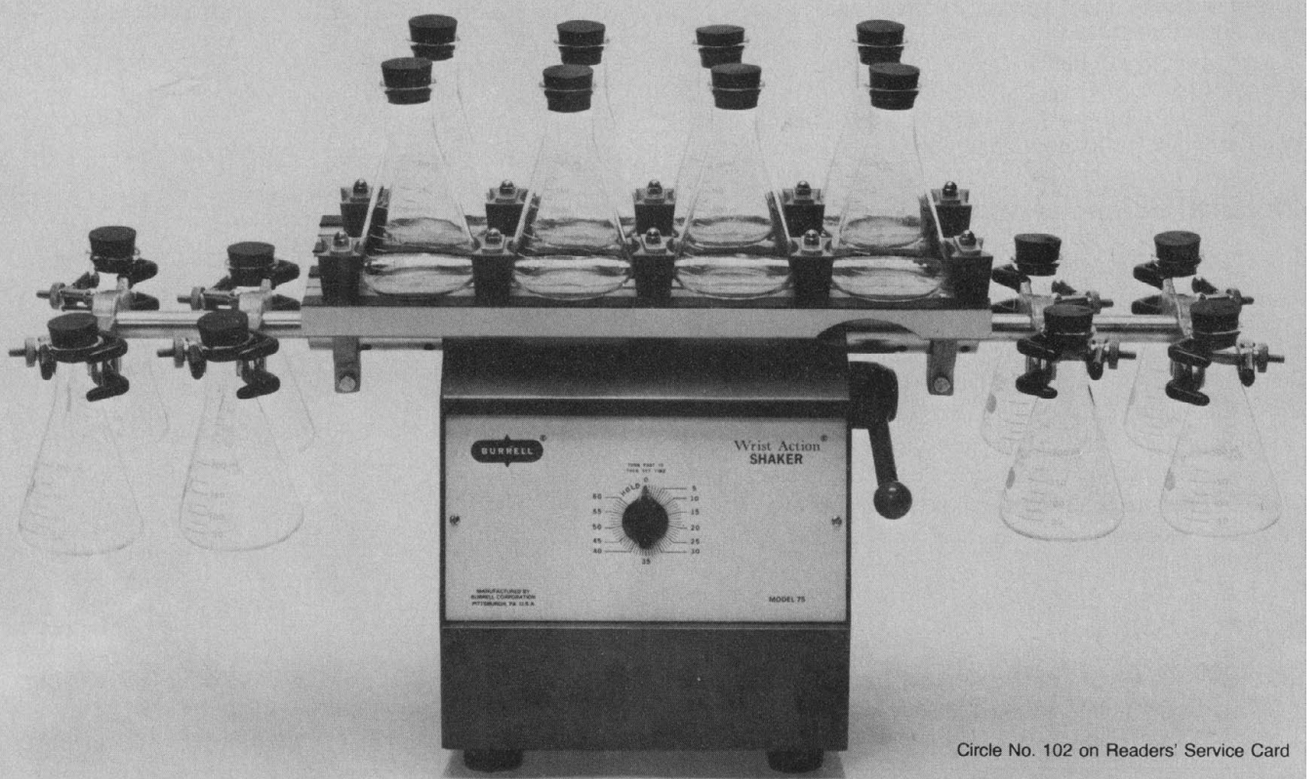

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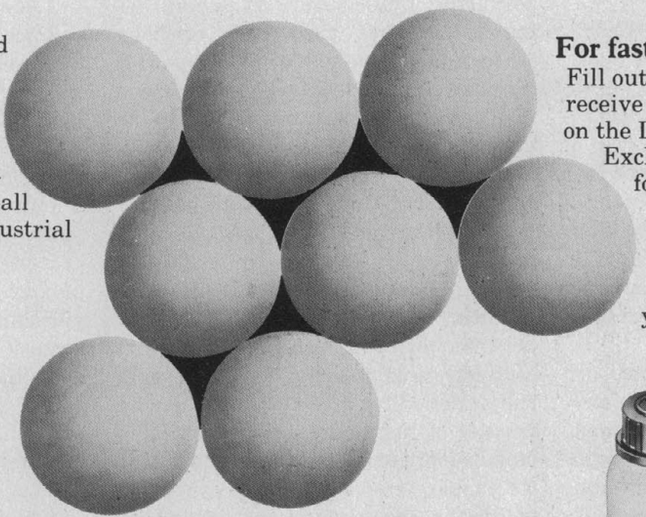

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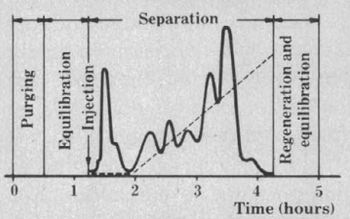

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10 July 1981, Volume 213, Number 4504 **SCIENCE**

The Fate of the Seed Corn

In American Indian culture one of the surest indications of impending disaster was the tribe's decision that, in order to survive, it was necessary to eat the seed corn—in the full knowledge that this doomed the crop of the following year.

We face a similar situation in U.S. education in mathematics, physical science, and engineering. To remain competitive in the international marketplace, U.S. industries have recognized that they must attract the brightest, most dedicated young people available, and beginning industrial salaries have risen rapidly to bring this about. Colleges and universities can no longer compete, and there is a growing question about our ability, in the 1980's, to supply young people in these areas for *either* industry *or* education.

At comparable career levels, industrial salaries have always been somewhat higher than academic ones; but academic positions remained in high demand because of what some viewed as important nonmonetary rewards. The situation has changed dramatically. While new Ph.D.'s in academic positions are typically offered annual salaries in the $15,000 to $20,000 range, the corresponding salaries in high-technology industry are in the $30,000 to $40,000 range. With this factor of 2, universities can no longer afford to hire their most able graduates—the teaching faculty of tomorrow.

But this is not all; unable to find enough qualified people in the universities and colleges, industry has recognized that high school science teachers also represent a pool of highly talented, underpaid, and often underappreciated people. During the past year alone, the membership of the Association of High School Science Teachers decreased by 10 percent; most of the 1000 teachers who left were hired by industry. We in the United States are dependent on secondary school teachers to attract young people into scientific and technological careers; so this reduction in the number of teachers is compounded. We are indeed eating the seed corn!

But let me hasten to add that I believe the industrial salary levels are fully justified. Our traditional positive balance of trade in high technology rested on the facts that we had superior products and superior salesmanship. The latter we can no longer claim in the face of aggressive competition from abroad and the former superiority is increasingly in jeopardy. As a nation, we need a continuing flow of the best young scientists, engineers, and mathematicians into industry.

Why then do secondary schools, colleges, and universities not more nearly match the industrial salaries? Unfortunately, at a time when the cost of a year of college has broken through the $10,000 barrier, educational institutions, as distinct from industry, simply cannot pass through such cost increases to their ultimate consumers; failing this, they cannot raise their salary scales sufficiently and remain solvent.

In its 1979 report to the Department of Commerce, the Advisory Committee on Industrial Innovation noted that "there has been an ever widening gap between the university and industrial communities and, as a result, the key national source of new technological knowledge is not being adequately tapped for its innovative potential by the private sector." In the short term, industry has responded by sharply increasing its hiring of scientific and technological personnel; in the long term, it may well be destroying our national capability to supply such personnel.

In its own self-interest, industry must reexamine its long-term needs and responsibilities for educated personnel. Mechanisms for direct industrial support of university research activity are already being explored on many campuses. Even more important, however, will be the development of mechanisms for direct industrial support or augmentation of faculty salaries to the level where these are again competitive. This is not a simple matter and large measures of goodwill, compromise, and recognition of mutual need will be required on both sides. But the time to begin is now, while some seed corn still remains.—D. ALLAN BROMLEY, *Henry Ford II Professor, Yale University, New Haven, Connecticut 06511*

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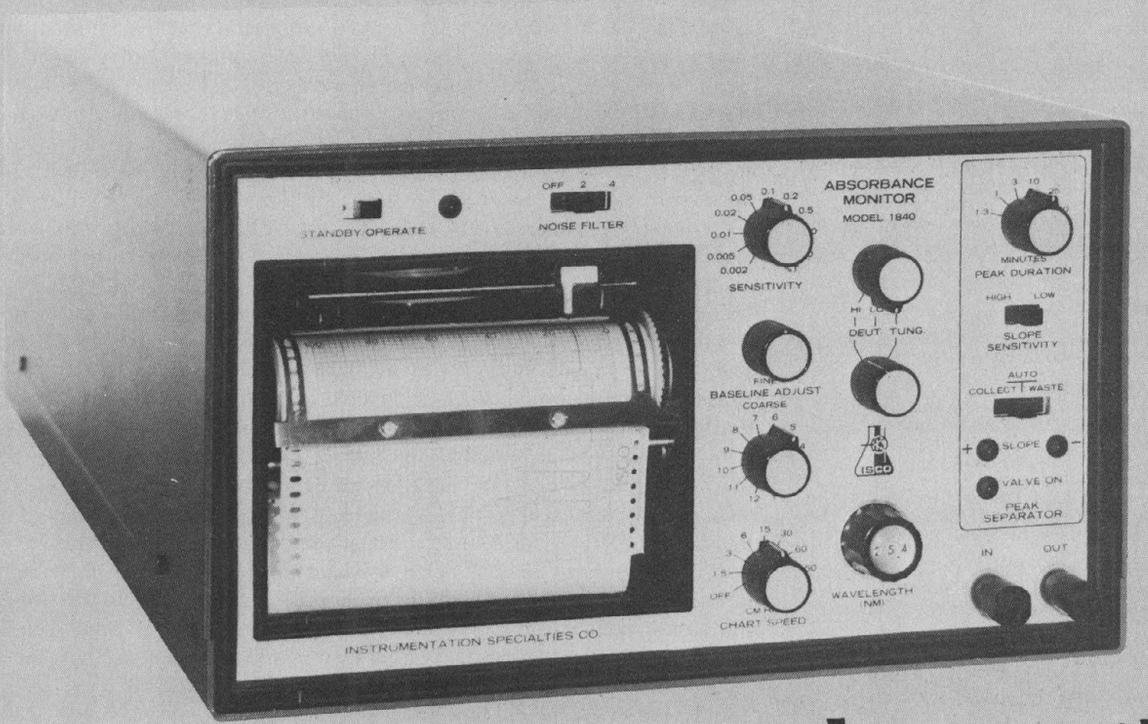

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Although it is too late to submit suggestions for symposia for this Annual Meeting, contributed papers can be sent in up to 4 September 1981. Instructions for abstracts are given below and a sample is shown.

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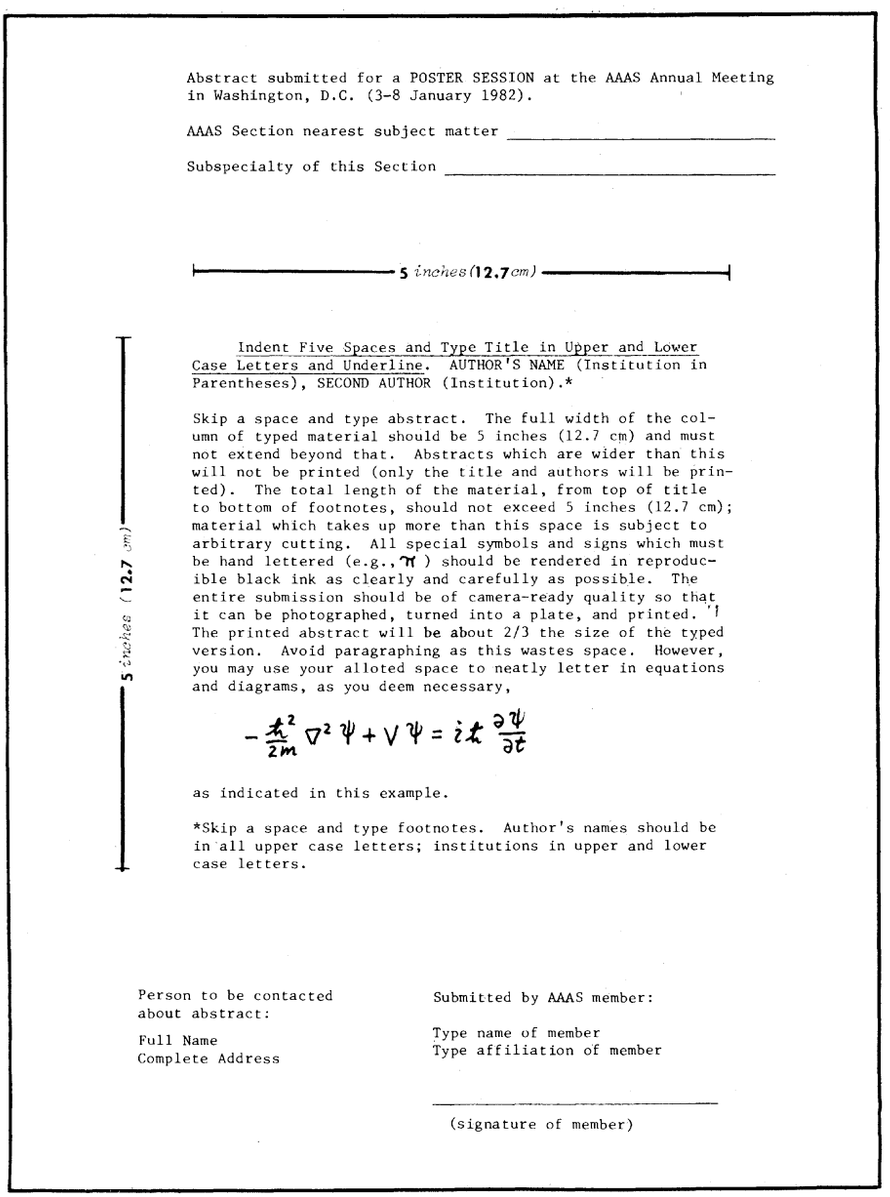

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