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ABSTRACT

At the beginning of the academic year 1972-73 the graduate physics student population was 11,804. The 173 doctorate granting institutions and the 137 master's granting institutions reported enrollments of 10,227 and 1,577 graduate physics students, respectively. The data for this Graduate Student Survey comes from individual graduate students whose names and addresses were supplied by physics department chairman. Of the 10,784 student names and addresses received from the chairman, 6,770 students returned usable questionnaires. The tables, bar graph, and flow diagrams included in this report present data concerning percentage of degree recipients; characteristic of the graduate physics student population, 1972-73; characteristics of minority group respondents; characteristics of new physics doctorate recipients, 1969-73; 1972-73 sources of graduate support by years of graduate study; employment opportunities for 1972-73 graduate physics degree recipients by subfield; and background characteristics of 1972-73 physics doctorate recipients. (MJM)

1972-1973 GRADUATE STUDENT SURVEY

AMERICAN INSTITUTE OF PHYSICS / 335 EAST 45 STREET, NEW YORK, N.Y. 10017 / 212-685-1940

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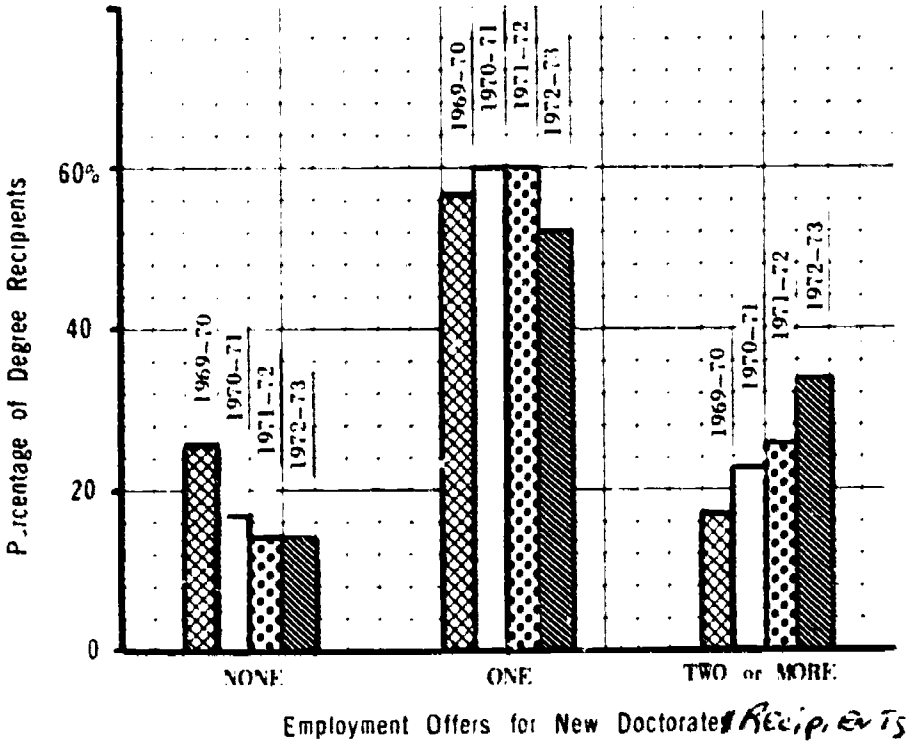
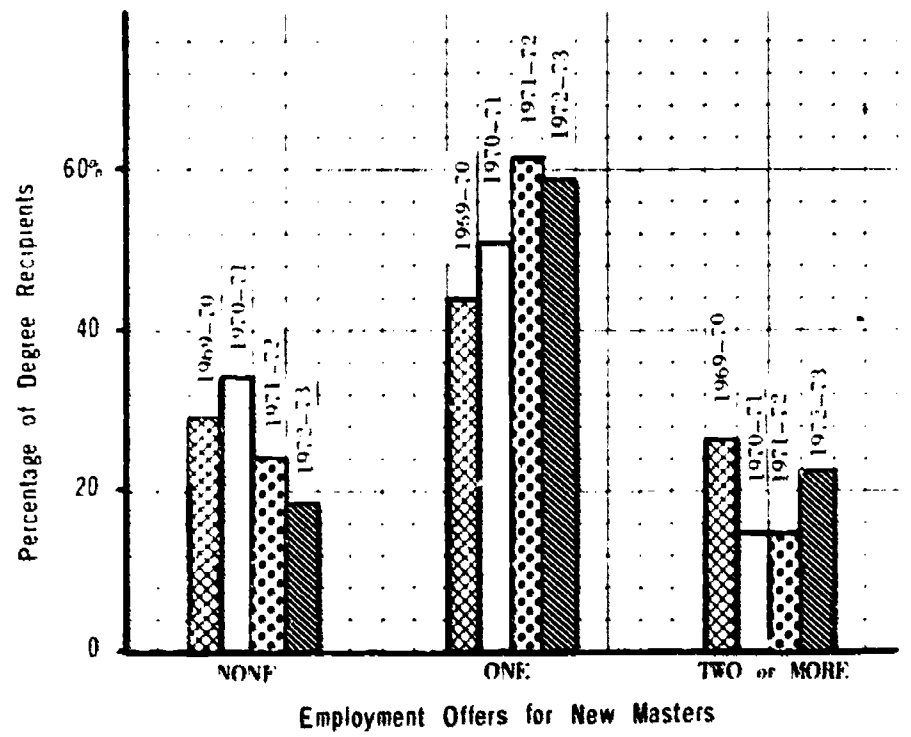
Fig. 1 EMPLOYMENT OFFERS FOR NEW GRADUATES 1969 - 1973





At the beginning of the academic year 1972-73 the graduate physics student population was 11,804. The 173 doctorate granting institutions and the 137 master's granting institutions reported enrollments of 10,227 and 1,577 graduate physics students respectively. The data for this Graduate Student Survey comes from individual graduate students whose names and addresses were supplied by department chairmen. Of the 10,784 student names and addresses received from chairmen, 6,770 students returned usable questionnaires and 821 were returned by the Post Office. The tables, bar graph and flow diagrams included in this report represent those data for which we get the largest number of requests.

Figure I shows how the employment market has changed for new graduate degree recipients over the past four years. Multiple employment offers for doctorate holders increased steadily while the percentage of those without offers declined. For the master's degree holders the pattern is somewhat more complex. While single employment offers were increasing the multiple employment offers did not begin to increase until the current year. For both groups the employment market appears to be improving, but more strikingly for doctorate holders than for terminal masters.

Table I compares seven characteristics of the total graduate student population with those of three subgroups — the first-year graduate students, and two groups of graduate degree recipients.

Table I Characteristics of the graduate physics student population, 1972-73

		Graduate students	First-year grad. students	Degree recipients	
				Term. MS	Doctorate
Total number*		11,804	2904	1050	1445
Number of respondents		6,770	1449	473	965
Sex	Female	7%	9%	8%	3%
	Male	93	91	92	97
Citizenship	US	79%	86%	90%	78%
	Foreign	21	14	10	22
Type of H.S. physics	PSSC **	28%	35%	27%	19%
	Project physics	2	3	3	3
	Other	64	54	61	72
	None	6	8	9	6
Type of bachelor's institution	PhD-granting	53%	51%	42%	56%
	MS-granting	13	17	23	9
	BS-granting	18	22	29	18
	Foreign	16	10	6	17
Type of grad. institution	PhD-granting	87%	75%	69%	100%
	MS-granting	13	25	31	0
Student status	Full-time	84%	86%	75%	86%
	Part-time	16	14	25	14
Sources of support	Teach. ass'tship	32%	46%	36%	14%
	Res. ass'tship	34	11	12	57
	Fellowship	12	11	8	11
	Employment	12	18	22	13
	Family, savings, etc	3	7	6	2
	Other	7	7	16	3

* These totals were reported by physics department chairmen as part of the Survey of Enrollments and Degrees.

** The Physical Science Study Committee(PSSC) course material became available for general use in 1960. Since the late 1960's the percentage of graduate physics students who took PSSC in high school has increased steadily.

The distribution of minorities among physicists is currently a topic of considerable interest. For the first time in 1972 we asked minority students to identify themselves on the graduate student questionnaire and in 1973 the same question yielded the information shown in Table II. Orientals form by far the largest group among the minority groups, but only 13% of them are U.S. citizens; an even smaller percentage of the Asian Indians are U.S. citizens. Although the numbers are small, women comprise a considerably larger fraction of four out of the five minority groups than they do of the total graduate physics student population. Each number shown in table II represents a lower limit because there are minorities not only among the nonrespondents, but also among respondents who chose not to identify themselves as members of a minority. In case of black degree recipients it is possible to compare their response to the Graduate Student Survey with the data we received from department chairmen as part of our annual Survey of Enrollments and Degrees. The chairmen reported 14 black doctorate recipients and 18 black terminal masters. The Graduate Student Survey respondents included 11 doctoral and 7 terminal master's degree recipients who identified themselves as blacks.

Table II Characteristics of minority-group respondents

		Black	Spanish speaking	American Indian	Asian Indian	Oriental
Total number		106	123	10	281	687
Sex	Female	10	8	2	39	89
	Male	96	115	8	242	598
Citizenship	US	85	39	10	2	89
	Foreign	21	84	0	279	598
Full-time equivalent years of graduate study	1 year	31	23	4	26	113
	2	29	37	1	49	167
	3	20	23		52	120
	4	12	17	3	55	120
	5	8	15	2	44	81
	6	3	7		23	48
	≥7	3	1		32	38
Student status	Full-time	79	110	8	259	634
	Part-time	19	10	2	15	36
	no response	8	3		7	17
Major subfields	Astrophysics	5	4		6	23
	Atomic & molec.	7	5		18	58
	Elem. particles	14	17	2		80
	Nuclear	10	14	2	86	76
	Physics education	5	4	2	1	1
	Solid state	28	30	1	116	243
	other subfields	37	49	3	54	206
Graduate degree recipients	Terminal master's	7	14	1	3	30
	Doctorate	11	18	3	41	97

Table III singles out the physics doctorate recipients of four consecutive years and shows that both women and foreign citizens are forming an increasing fraction of the graduating classes.

Table III Characteristics of new physics doctorate recipients, 1969-73

Academic year	Citizenship U.S.	Foreign	Sex Male	Female	Number
1969-70	83%	17%	97.4%	2.6%	1545
1970-71	83	17	97.5	2.5	1530
1971-72	82	18	97.9	2.1	1438
1972-73	78	22	96.7	3.3	1345

Tables IV and V divide the graduate student population into the following two groups: doctoral and terminal master's students. Each group is then distributed according to the level of graduate study in 1972-73.

Table IV Subfield specializations of 1972-73 graduate students by years of graduate study.

Physics subfield	Terminal master's degree students 1st yr.	2nd yr.	Total	Doctoral students Full-time equivalent years of graduate study 1st yr.	2nd yr.	3rd yr.	4th yr.	5th yr.	6th yr.	7th yr.	≥8th yr.	Total
Astrophysics	4%	3%	4%	6%	7%	7%	7%	7%	5%	5%	12%	7%
Atmospheric physics	2	2	2	2	2	3	1	2	2	2	3	2
Atomic & molecular	5	6	5	5	7	8	9	9	10	9	15	8
Biophysics	4	3	3	2	6	4	3	4	2	3	2	4
Electronic & Eng. physics	6	6	6	2	1	1	1	1	1	0	1	1
Elem. particles	2	1	1	13	13	11	14	18	15	11	14	14
Fusion, plasmas	1	2	2	5	4	5	5	4	3	4	2	4
Nuclear	7	10	9	9	9	12	13	12	14	15	14	12
Optics	6	9	7	3	3	3	3	3	3	3	1	3
Relativity	1	1	1	4	4	4	2	2	1	1	1	3
Solid state	17	16	16	20	27	25	31	26	34	34	24	27
Physics, general	20	19	19	14	6	5	1	0	0	1	0	4
Physics, education	13	12	13	4	1	1	-	-	-	-	-	1
Other subfields	12	10	12	11	10	11	10	11	10	12	10	10
Total number reporting subfields	100% 496	100% 446	100% 942	100% 900	100% 1023	100% 1074	100% 958	100% 721	100% 514	100% 321	100% 159	100% 5670 respondents

Note: Table includes all graduate students who answered both the subfield question and that on years of graduate study.

Table IV shows that the subfield distributions are considerably different for the two types of students. For example, general physics, physics education, electronics and engineering physics attract primarily terminal master's students, whereas elementary particles is a leading subfield only for doctoral candidates.

Table V indicates the variations in sources of support for different types and levels of students. Doctoral students in their first, second, and even third year of graduate study are heavily supported by teaching assistantships; from the fourth year on, support comes primarily from research assistantships. Terminal masters on the other hand are supported by either teaching assistantships or employment with very little dependence on research funding.

Table V 1972-73 Sources of graduate student support by years of graduate study

Source of support	Terminal master's degree students			Doctoral students Full-time equivalent years of grad. study								
	1st	2nd	Total	1st	2nd	3rd	4th	5th	6th	7th	≥8th	Total
Teaching assistantship	37%	37%	37%	50%	42%	32%	19%	19%	21%	18%	16%	32%
Research assistantship	5	13	10	11	25	36	53	58	53	56	56	38
Fellowship	4	8	6	9	12	16	14	10	7	7	5	13
Employment	35	22	27	16	11	8	8	7	14	14	17	10
Family, savings	7	6	7	6	3	2	1	2	3	4	6	3
Other sources	12	14	13	8	7	6	5	4	2	1	0	4
Total number reporting source of support	100% 483	100% 450	100% 933	100% 1058	100% 1045	100% 988	100% 966	100% 695	100% 490	100% 312	100% 151	100% 5705

Table VI shows the distribution of degree recipients in each subfield along with the number of employment offers each group received. Solid state remains the largest single subfield for both types of degree holders. Those terminal masters who specialized in physics education appear to encounter the most positive situation while the biophysicists and fusion physicists among the PhD's seem to be in greatest demand. It should be emphasized that these reports of employment offers were made in the summer of 1973 when at least some of the degree recipients had only started to explore the employment market.

Table VI Employment opportunities* for 1972-73 graduate physics-degree recipients by subfield

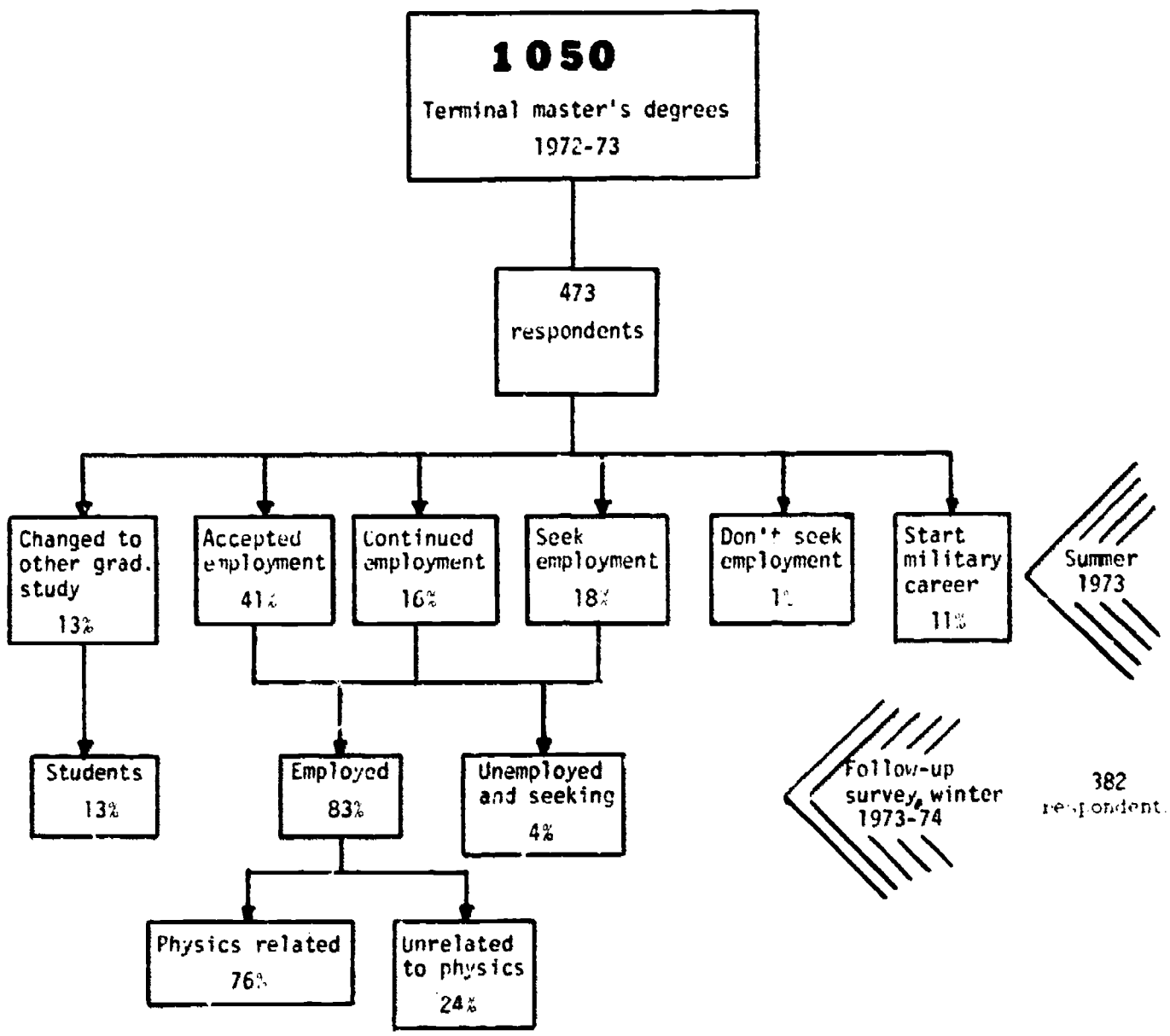
Physics subfield	Percentage of degree recipients within each specialty							
	Terminal master's				Doctorate			
		Received				Received		
	Total in subfield	0 offer	1 offer	≥ 2 offers	Total in subfield	0 offer	1 offer	≥ 2 offers
Astrophysics	3.1%	-	-	-	5.4%	9%	57%	34%
Atomic & molecular	6.3	13%	58%	29%	8.7	12	52	36
Biophysics	2.9	-	-	-	2.5	11	37	52
Electronics & Eng. phys.	6.3	13	71	16	-	-	-	-
Elem. particles	-	-	-	-	15.5	14	45	41
Fusion, plasmas	-	-	-	-	3.4	7	55	38
Nuclear	10.1	8	67	25	14.7	13	42	45
Optics	8.7	13	64	23	1.8	13	47	40
Solid state	15.9	25	48	27	30.7	16	53	31
Thermal, cryogenics	-	-	-	-	3.3	13	67	20
Phys. education	12.3	8	57	35	-	-	-	-
General physics	19.1	22	66	12	-	-	-	-
Other subfields	15.3	-	-	-	14.0	-	-	-
Total degree recipients No. of respondents	100.0% 380	18%	59%	23%	100.0% 804	14%	52%	34%

- Fewer than 10 respondents
* Survey conducted during the summer of 1973.

When a respondent to the Graduate Student Survey indicated on his questionnaire that he received either a terminal master's degree or a doctorate in 1972-73 we included him in a follow-up Employment Survey conducted in December 1973. The only group not contacted in the follow-up Employment Survey consisted of graduates who returned to foreign countries and addresses were unknown. All other respondents to the Graduate Student Survey received a follow-up questionnaire which enquired not only about their employment status at that time(winter 1973-74), but also examined work activities and their relationship to the subfield studied in graduate school. The results of this follow-up survey of new masters and new doctorate holders are shown as part of three flow diagrams, figures I' IV and V.

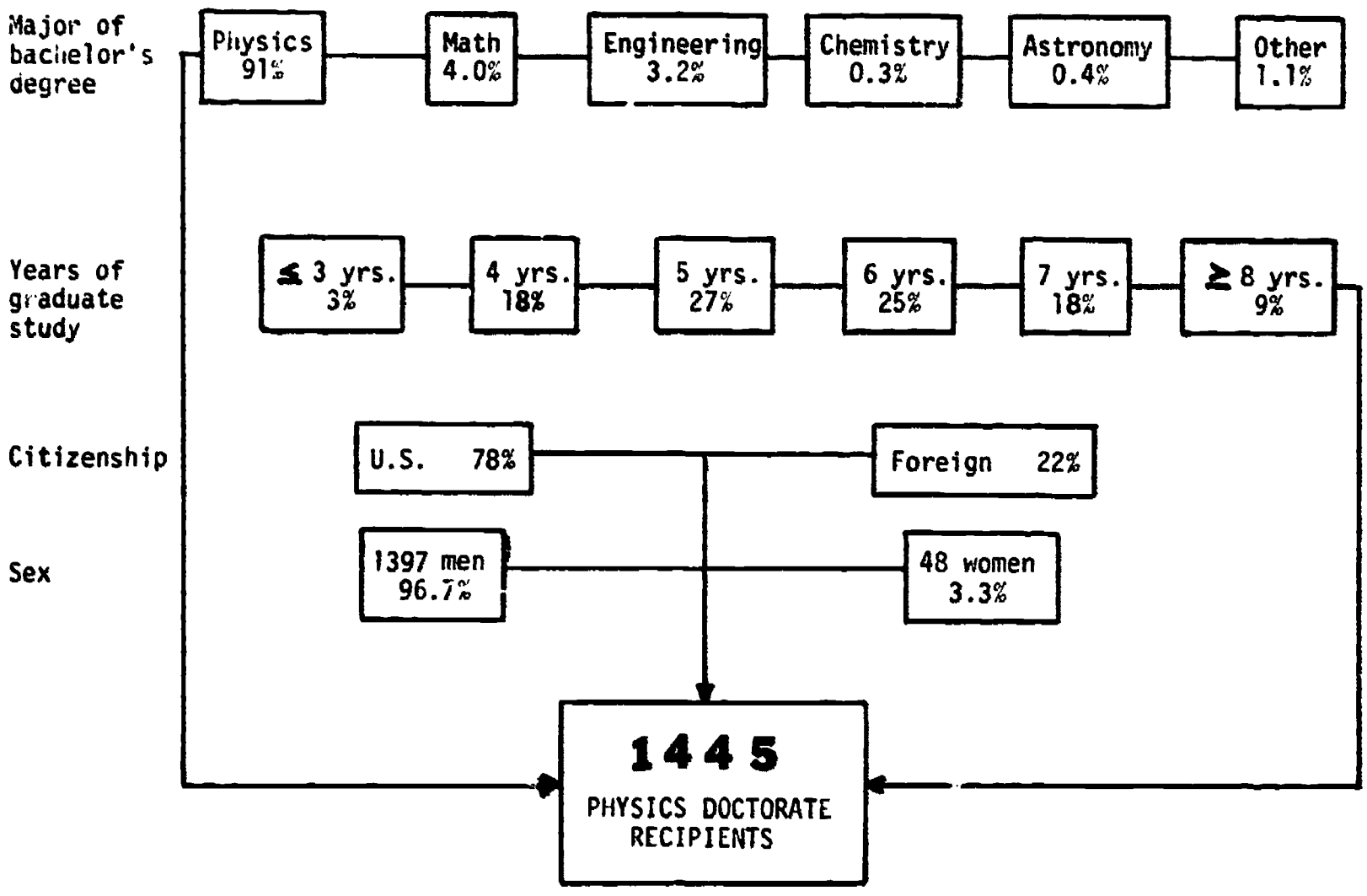
Almost one fifth of the new masters were seeking employment at or shortly after graduation — during the summer 1973. Approximately half a year later, only 4% of the respondents indicated that they were seeking employment. A large percentage of the remainder were employed in physics-related subfields.

Fig. II Employment opportunities for new physics master's degree recipients, 1972-73



1050 terminal master's degrees granted 1972-73, Survey of Physics Enrollments and Degrees; 473/1050 = 45% response of the terminal master's degree recipients to the Graduate Student Survey 1972-73.

Fig. III Background characteristics of 1972-73 physics doctorate recipients



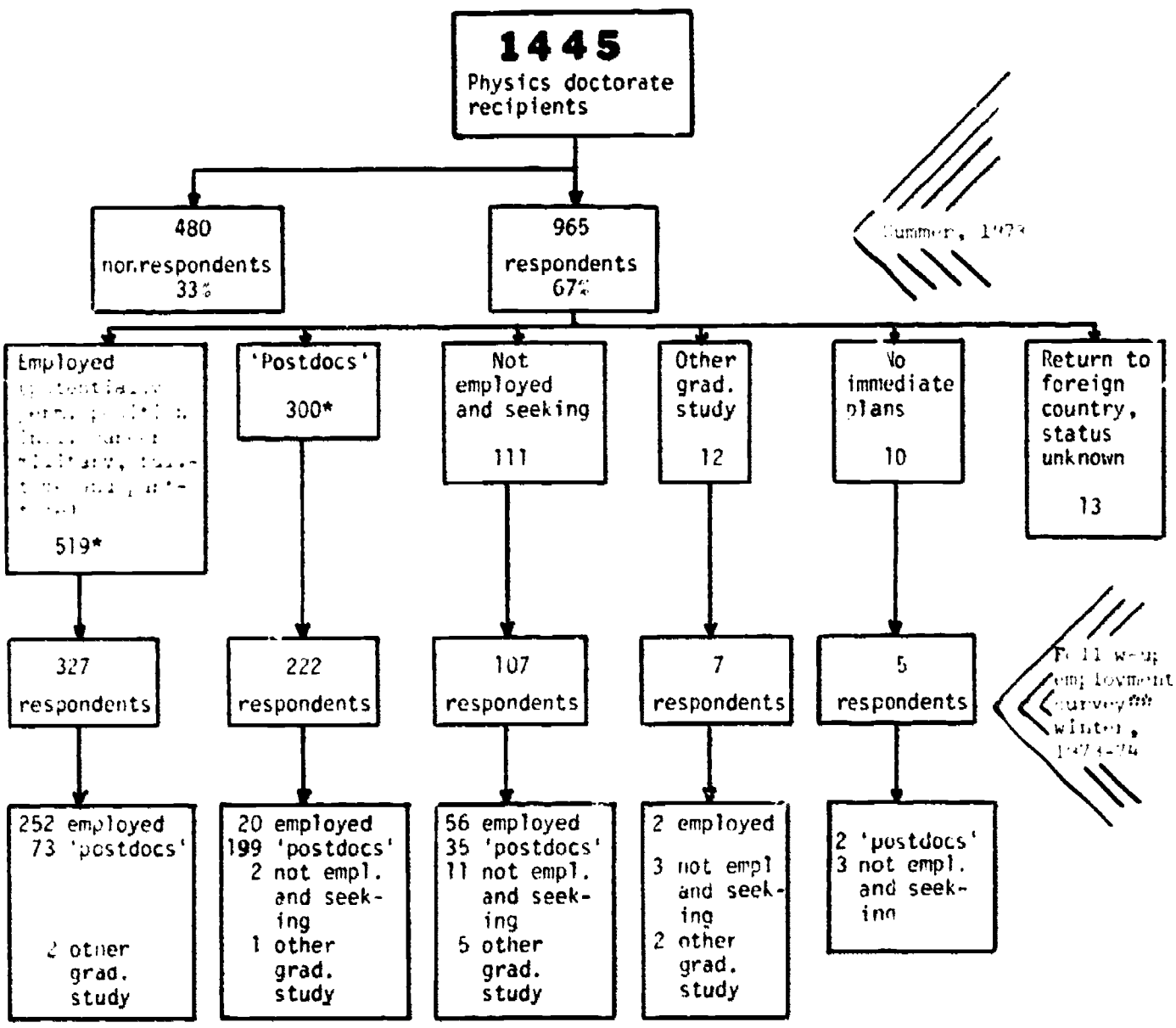
Note: All percentages shown in this figure, with the exception of sex, are based on the 965 individual responses to the Graduate Student Survey. The 1445 total and the breakdown by sex come from the Survey of Enrollments and Degrees.

Figure IV shows that 12% of the doctorate recipients were unemployed shortly after graduation, yet by December 1973 this percentage had declined to less than 3%. It should be noted that, contrary to expectation, the highest response came from the unemployed group. Thus we do not feel that the unemployment percentage is underestimated.

In the Graduate Student Survey nearly one third of all graduates had accepted postdoctoral positions. In the follow-up survey almost half of the respondents held such positions. In addition to respondents from the original post-doctoral group, 33% of the previously unemployed respondents, and 22% of the respondents who had previously held 'potentially permanent positions' were now holding postdoctoral positions.

Also in figure IV it should be noted that six out of the ten new physics doctorate holders who report "other graduate study" in the follow-up survey, enrolled in medical schools.

Fig. IV Flow diagram — Postdegree employment status of 1972-73 physics doctorate recipients

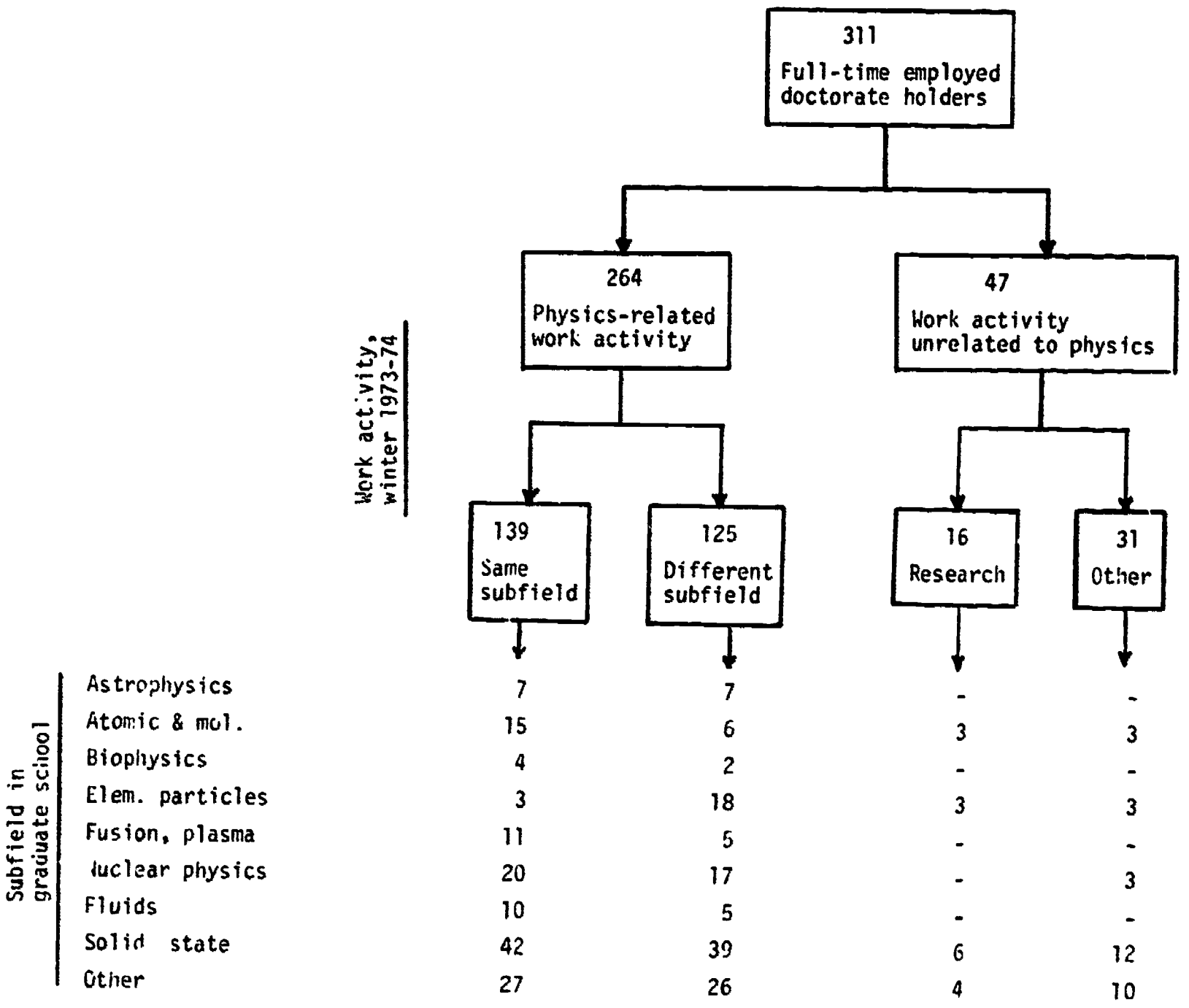


* These totals included 24 foreign doctorate recipients whose initial post-degree employment was with a foreign employer.

** 668 respondents to the follow-up employment survey.

The follow-up survey also indicates that less than half of the full-time employed doctorate holders (excluding 'postdocs') were employed in their doctoral study subfield in the winter of 1973-74. This was most striking for new doctorate holders in elementary particles.

Fig. V Relationship between subfield of 1972-73 doctorate recipients and their full-time employment, winter 1973-74



Tables VII and VIII relate the work activities of new graduates to the major subfields studied in graduate school. The "research" category in table VIII includes most of the 'postdocs'.

Table VII Work activity and physics subfield for new master's degree recipients 1972-73

Physics subfield		Teaching	R&D	Engineering	Computer science	Nonphysics profession	Other	Total
All subfields	N	103	71	55	23	20	21	293
	%	35%	24%	19%	8%	7%	7%	100%
Atomic & molecular		4	5	3	2	4	2	20
Engineering phys.		2	10	4	-	1	3	20
Nuclear		4	9	13	1	1	3	31
Optics		3	12	4	3	3	7	32
Physics education		44	-	2	-	-	-	46
Solid state		12	11	10	7	2	-	42
General physics		26	6	8	4	3	4	51
All other subfields		8	18	11	6	6	2	51

Note: 293 masters answered the question on work activity and the one on subfield in graduate school.

Table VIII Work activity and physics subfield for new doctorate recipients 1972-73

Physics subfield		Teach.	Res.	T&R	R&D	Mgt.	Nonphys. prof.	Other	Total
All subfields	N	65	339	109	104	8	25	14	664
	%	10%	51%	16%	16%	1%	4%	2%	100%
Astrophysics		3	22	7	7	-	1	-	40
Atomic & molecular		7	28	7	6	1	3	2	54
Elem. particles		5	64	21	10	1	6	-	107
Fusion, plasmas		1	15	5	4	-	-	-	25
Nuclear		10	49	15	18	1	3	1	97
Solid state		22	90	36	35	1	8	7	199
All other subfields		17	71	18	24	4	4	4	142

Note: 664 doctorate recipients answered the question on work activity and the one on subfield in graduate school.

Table IX describes the initial work activity and type of employer of doctorate recipients — both U.S. citizens and non citizens. Not shown as part of table IX are two smaller groups: 25 U.S. citizens and 37 foreign citizens whose first employer is foreign.

Table IX Initial employment of doctorate recipients 1972-73

	Work activity		Type of U.S. employer								
			Univ.	4-yr. coll.	2-yr. coll. or sec. sch.	Ind.	Gov't	Fed. fund. res. cent.	Nonpr. org.	Other	Total
U.S. citizens	Teaching		22	29	8	-	1	-	-	-	60 11%
	Research		158	4	-	20	38	32	8	-	260 48
	Teach. & res.		67	14	-	-	1	-	-	-	82 15
	Res. & dev.		11	-	-	50	26	6	4	1	98 18
	Engineering		3	-	-	6	1	1	-	-	11 2
	Computer sci.		2	-	1	6	4	1	-	-	14 3
	Management		1	-	-	4	2	-	-	-	7 1
	Nonphys. prof.		-	-	-	2	2	1	2	1	8 2
	Other		-	-	-	-	-	-	1	1	2 -
	Total	N	264	47	9	88	75	41	15	3	542
		%	49%	9%	2%	16%	14%	7%	3%	-	100%
Foreign citizens	Teaching		1	3	3	-	-	-	-	-	7 9%
	Research		45	-	-	2	2	2	1	-	52 70
	Teach. & res.		6	1	-	-	-	-	-	-	7 9
	Res. & dev.		1	-	-	7	-	-	-	1	9 12
	Total	N	53	4	3	9	2	2	1	1	75
		%	71%	5%	4%	12%	3%	3%	1%	1%	100%

Table X Median monthly salaries for new graduate physics degree recipients 1973

Type of employer	Terminal master's recipients		Doctorate recipients		
	Percentage accepting positions	Monthly starting salary	Percentage accepting positions	Postdoctoral fellowships	Monthly starting salary
Secondary school	22%	$ 810	1%		
4-year college	2	*	8		$ 950
University	8	800	32% 21	$ 860	1010
Industry	36	1070	14		1450
Government	22	1080	3 9	1110	1170
Nonprofit org.	2 }	1000	2		*
Fed. funded res. center	3 }		7		1225
Other	5	*	3		*
All employers	100%	$ 980	100%		$1140[1]

* Fewer than 20 graduates reported salary.

[1] Does not include salaries of 'postdocs'

Note: Where two median salaries are shown for the employer, two corresponding percentages are given for first time recipients with accepted positions.

The salaries shown in table X by type of employer represent only a small increase over those reported in 1972.