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A BIBLIOGRAPHY AND SUMMARY OF DATA FOR THE

(p,π) REACTION: $p + A \rightarrow \pi + (A+1)$

Harold W. Fearing
TRIUMF

MESON FACILITY OF:

UNIVERSITY OF ALBERTA
SIMON FRASER UNIVERSITY
UNIVERSITY OF VICTORIA
UNIVERSITY OF BRITISH COLUMBIA

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Harold W. Fearing*
TRIUMF

*Supported in part by NSERC of Canada

Postal address:

TRIUMF
4004 Wesbrook Mall
Vancouver, B.C.
Canada V6T 2A3

November 1980

INTRODUCTION

The exclusive pion production process on nuclei, $p + A \rightarrow (A+1) + \pi$, has generated a lot of interest over the past few years and equally resulted in a large number of papers, both theoretical and experimental. In the course of preparing a review article[1] on this subject it was necessary to compile an extensive bibliography of these papers. This bibliography contained a number of papers not referenced, and covered some areas not eventually included, in the review. Each entry also contained additional information, notably the title of the paper, which again could not be included in the review. For these reasons, and in view of the great interest in this field, it appeared useful to make the entire bibliography available separately as a laboratory report.

The list of references here thus contains all papers referred to in the review plus all those known to the author as of September, 1980 in the following areas. On the experimental side, all papers dealing with the reaction $A(p,\pi)A+1$ in the medium energy region ($E_p \leq 800$ MeV) are included with the exception of some very early ones, mainly dealing with $pp \rightarrow \pi d$, which are represented by later data surveys. The reversed reactions $A+1(\pi,p)A$ are included equally, except that reactions with stopped pions have been excluded. Theoretical papers dealing with (p,π) reactions in all of the various models have been included for $A \geq 2$, as have papers dealing with various related topics, eg. the question of the pion-nucleon vertex function. The specific reactions $pp \rightarrow \pi d$ and $NN \rightarrow NN\pi$ were not covered in the review and hence theoretical papers on these reactions are represented rather sketchily in the bibliography. It was intended however that most of the very recent articles (and a few older ones) be included so that the interested reader can trace for himself the earlier papers.

The references are listed alphabetically and chronologically by the first two letters of the first author's name plus the date of publication. A simplified subject index has been included, to provide at least some classification into subject areas.

Finally included at the end is a table, taken from the review,[1] listing target nuclei, energy, and angular range for all (p,π) and (π,p) data available, and indicating the appropriate reference from the bibliography.

The author would appreciate being informed of errors and omissions and of papers in the field published subsequent to September 1980, as it may be possible to provide an addendum to this listing at some time in the future.

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DATA SUMMARY

The following table summarizes the various (p,π) and (π,p) experimental data available and shows the approximate energy and angular range covered by each experiment. Detailed balance and isospin have been used to test all reactions such as (π,p) under the appropriate (p,π^+) or (p,π^-) heading.

REACTION	E_p^{LAB} (MeV)	APPROXIMATE RANGE OF θ_π^{cm}	REFERENCES
$^{9}Be(p,\pi^+)^{10}Be$	185	15 - 135	Da71,Da73a
	200	35 - 130	Au78,Ma80a
	225,250	45 - 135	Au80b
	410,605	5 - 70	Di80a, Br79
	800	10 - 40	Ho79c,Ho79d,Ho80a
$^{10}B(p,\pi^+)^{11}B$	145 - 200	0 - 155	Pi79,Pi78,Sc80
	154	35 - 125	Be80a
	154	16 - 55	Le74,Le75
	163 - 186	15 - 135	Ho77,Ho79a
	185	15 - 135	Da74a
	200	25	So80a
	320 - 605	5 - 60	Di80a, Br79
$^{11}B(p,\pi^+)^{13}B$	200	25	So80a
$^{11}C(p,\pi^+)^{12}C$	185,205	30 - 120	Do80
	230,330	10 - 120	An79,Ho80a,An80
	188	30 - 120	Am78
$^{12}C(p,\pi^+)^{13}C$	156 - 200	25 - 155	Be80a,So80b
	183	35 - 115	Do80
	185	15 - 135	Da71,Da73b
	200	35 - 135	Au78,Ma80a
	200	25 - 155	Ho80b
	200	45	Au80b, Lo80
	200	25	So80a
	245,330	10 - 120	An79,Ho80a,An80
	600	0	Do70b
	800	15 - 30	Ho80a
$^{13}C(p,\pi^+)^{14}C$	154	16 - 43	Le75
	185	15 - 135	Da73c,Da73d
	200	25	So80a
	200	25 - 155	Ho80b
	600	0	Do70b
$^{14}N(p,\pi^+)^{15}N$	154	15 - 33	Le75
	600	0	Do70b
$^{15}O(p,\pi^+)^{16}O$	203	30	Do80
	205	30 - 120	Ba77a,Ba76
$^{16}O(p,\pi^+)^{17}O$	154 - 174	25 - 155	Pi78,Sj80b,Sc80
	185	15 - 135	Da73c, Da74b
	800	15 - 30	Ho80a

REACTION	E_p^{LAB} (MeV)	APPROXIMATE RANGE OF Θ_π^{cm}	REFERENCES
$^1H(p,\pi^+)^2H$	325 - 675	5 - 175	Wi71
	332 - 1000	0 - 90	Ri70
	305 - 425	60 - 150	Jo78a, Wa79, Ma80a
	308 - 643	0 - 180	Ba70
	367 - 407	17 - 90	Pr78
	382	20 - 160	Ax76
	398 - 572	0 - 180	Ae76
	425	10 - 90	Do70a
	462 - 790	25 - 140	Al71
	470 - 590	0 - 90	Hu80
	515, 578	20 - 160	Ap80
	800	16 - 90	Na79
$^2H(p,\pi^+)^3H$	282 - 641	20 - 150	Ka78,Ka80b
	305 - 400	60 - 150	Ma80a, Jo79,
	325	0,150-180	Ch64
	340	30 - 150	Fr54
	377,462,576	70 - 125	Ca78,Fr74a
	400 - 470	135 - 170	Au80a
	400 - 580	110 - 180	Gr80b, Fr80
	410,605,809	10 - 90	As77
	450	135 - 145	Cr60
	470,590	40 - 160	Pe73,Do73
	470,500	10 - 160	Ab80
	560 - 750	130	Bo63
	591	40 - 130	Ha60
	600	0	Ga72
	760 - 1200	20 - 180	Ba73b
	800	10 - 90	Se78
$^3He(p,\pi^+)^4He$	200	25 - 85	Be80b
	230 - 550	20 - 150	Ka78,Ka80b
	415,716	10 - 100	Ta76
	600	0	Ga72
$^4He(p,\pi^+)^5He$	600	0	Ga72
$^5Li(p,\pi^+)^6Li$	255,375	20 - 120	Ka80a, Ka79
$^6Li(p,\pi^+)^7Li$	175	25 - 85	Be80b
	245,360	20 - 120	Ka80a, Ka79
	600	6 - 40	Ba77b, Br79

REACTION	E_p^{LAB} (MeV)	APPROXIMATE RANGE OF Θ_π^{cm}	REFERENCES
$^{25}Mg(p,\pi^+)^{26}Mg$	154	15 - 48	Le75
$^{26}Mg(p,\pi^+)^{27}Mg$	180	40 - 130	Ho78a
$^{28}Si(p,\pi^+)^{29}Si$	149 - 160	10 - 150	Be80a,Sj80b,Sc80
	154	15	Le75
	185	15 - 135	Da73c, Da74b
$^{40}Ca(p,\pi^+)^{41}Ca$	140 - 200	25 - 155	Pi79,Pi78,Sc80
	147	60 - 150	Be80a
	149 - 154	16 - 55	Le75,Le76a
	163,173,185	15 - 135	Ho77,Ho79a
	185	15 - 135	Da73c,Da74b
	800	15 - 30	Ho80a
$^{90}Zr(p,\pi^+)^{91}Zr$	144 - 160	25 - 155	Pi78,Be78,Sc80
	180	30 - 120	Ho77,Ho78b
$^{208}Pb(p,\pi^+)^{209}Pb$	149	90	Ba80b
	160	25 - 155	Be78,Sc80
	180	30 - 120	Ho77,Ho78b
$^{9}Be(p,\pi^-)^{10}C$	185	15 - 135	Da73a
	200	25 - 155	Sj80a
	225,250	45 - 135	Au80b,Lo80
	600	0	Ro72
	613	5 - 30	Co78,Br79
	800	10 - 30	Ho79c,Ho79d,Ho80a
$^{12}C(p,\pi^-)^{13}O$	200	25 - 155	Ho80b
	613	6 - 40	Co78, Br79
$^{13}C(p,\pi^-)^{14}O$	185	35 - 135	Da73c,Da73d
	200	25 - 155	Ho80b
	613	6	Co78, Br79
$^{26}Mg(p,\pi^-)^{27}Si$	160	25	Be80a,Be80b
	180	40 - 130	Ho77,Ho78a

SUBJECT INDEX

Experiment:

$pp \rightarrow \pi d$: Ae76, Al71, Ap80, Ax76, Ba70, Ch80c, Do70a, Ho80, Hu80, Ja80b, Jo78a, Kl80c, Ma80a, Na79, Pr76, Pr78, Ri70, Se78, Sp75, Wa79, We80, Wi70

$NN \rightarrow NN\pi$: Ha80, Hu78, Th77

$pd \rightarrow t\pi$: Ab80, As77, Au80a, Ba73b, Bo63, Ca78, Ch64, Cr60, Do73, Fr54, Fr74a, Fr80a, Ga72, Gr80b, Ha60, Is78, Jo79, Ka78, Ka80b, Ma80a, Pe73, Se78

$pd \rightarrow nd\pi$: Ho78c, Lo79

$A(p,\pi)A+1$, $A>2$

Uppsala: Da71, Da73a, Da73b, Da73c, Da73d, Da74a, Da74b, Ho78a, Ho78b, Ho79a, Ho79b

Indiana: Be78, Be79, Be80a, Be80b, Ho77, Ho80b, Ja80a, Ma79a, Ma79b, Ma79c, Pi78, Pi79, Sc80, Sj80a, Sj80b, So80a, So80b

TRIUMF: Au78, Au80b, Jo78a, Jo78b, Jo79, Lo80, Ma80a

Saclay/Orsay: Ba80, Ba76a, Ba77a, Ba77b, Bo79, Br79, Co78, Di80a, Le74, Le75, Le76a, Le76b, Ta76

LAMPF: Am74, Am78, An79, An80, Do80, Ho79c, Ho79d, Ho80a, Ka78, Ka79a, Ka80a, Ka80b, Ka80c

Misc.: Do70b, Ga72, He58, In71, Ro72

Analyzing Powers: Ab80, Ae76, Al71, Ap80, Au78, Au80a, Au80b, Be80a, Do70a, He58, Jo78b, Jo79, Lo80, Ma80a, Na79, Sj80a

Theory:

$pp \rightarrow \pi d$: Al78, Br77b, Ch80a, Ch80b, Gi80b, Go74, Go75, Gr76a, Gr76b, Gr79b, Ha79, Ka79b, Ka79c, Ka79d, Ka80d, Ka80e, Ka80f, Ka80g, Ke79a, La70, Ma55, Ma80b, Ma80c, Ma80d, Mi77, Ni77, Ni78a, Ni78b, Ni79, Ni80, Ri76, Ri77, Ri80, Sc68, Sh80, Sp75, We78b, Ya64

$NN \rightarrow NN\pi$: Av79, Ba71, Be80d, Bo74b, Bo76, Dr70, Du80, Gr78, Kl78, Kl80a, Kl80b, Mi77, Mi80, Si80, Th79, Um80, Ve79, We77

$pd \rightarrow t\pi$: Bh73, Bh76, Bh77b, Bl54, Fe74, Fe75a, Fe75b, Fe77, Fr80b, Gr79a, Gr79b, Hi77, Ja78, Pa68, Ru52

$A(p,\pi)A+1$

Born Approximation and DWBA Single Nucleon Models: Am72, Di76b, Ei73a, Ei73b, Ho74, Ho79a, Jo70, Ke73, Ke79b, Ki75, Ku77a, Ku77b, Ku79, Le66, Le76c, Mi74a, Mi74b, No76a, Re75, Re80, Ro73, Ts79a, Ts79b, Wh80

Other Single Nucleon and Related Models: Bh73, Bh77a, Bh77b, Di73a, Di73b, Di74a, Gi77a, Gi80a, Gr79a, Gr79c, Lo74

πNN Vertex Function: Ba69, Bo74a, Bo76, Bo77, Ch68, Di74b, Di79, Du77, Ei75, Ep78, Fr74b, Fr77, Gr80a, He78, Ho75, Le76c, Mi79, No76b, No79a, Nu76, Nu77a, Nu77b, Sh79, Wo80

Wave Function Orthogonality: Am77, Ce79b, Ei79, No78a, No78b

Relativistic Models and Effects: Ar79a, Ar79b, Br77a, Br78, Ce79a, Fr77, He78, Mi74c, Mi76a, Mi76b, Mi78, No79a, No79b, Wi73

Two Nucleon Microscopic Models: Di76a, Di77a, Gr74, Ko66, Re71

Impulse Approximation and DWIA Models: Al76, Ba73a, Bl54, Di80a, Fe74, Fe75a, Fe75b, Fe77, He52, In71, Lo74, Re72, Ru52

Other Phenomenological Two Nucleon and Related Models: Ba73a, Ch73, Co79, Di73a, Di73b, Di74a, Di80a, Gi79, Gi80a, Gr79a, Gr79c, Hi78, Ki80a, Ki80b, Re72

Analyzing Powers: Ku79, No75, No76c, We78a, We79, Yo78

Misc.: Ba76b, Em76, Ki76

Relation of (p,π) to (p,γ) and (p,d) Reactions: Am78, Bo79, Bo80, Ei73c, Fe80, Ja80a, Ka79e, Wi80

$(p,n\pi)$ Reactions: Du78, Gr80a, Sh79

Reviews and General Talks: As76, Be79, Be80a, Bh77b, Di76c, Di80b, Gi77b, Ho77, Ho79b, Ho80a, Jo78a, Jo78b, Jo79, Ko79a, Ko79b, Lo73, Me80, Ni80, No76a

Misc.: Al79, Bl77, Di76d, Di77b, La72, La79

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