Landolt-Börnstein

Numerical Data and Functional Relationships
in Science and Technology

Zahlenwerte und Funktionen
aus Naturwissenschaften und Technik

New Series / Neue Serie

Group I

Volume 9

Elastic and Charge Exchange Scattering of Elementary Particles

Supplement to Volume I/7 and Extension to High Energies

Subvolume b: Pion Nucleon Scattering
Part 1: Tables of Data

Springer-Verlag Berlin · Heidelberg · New York

LANDOLT-BÖRNSTEIN

Numerical Data and Functional Relationships in Science and Technology

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Editor in Chief: K.-H. Hellwege

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Volume 9

Elastic and Charge Exchange Scattering of Elementary Particles

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Part 1: Tables of Data

G. Höhler

Editor: H. Schopper

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Conversion of units

Most of the equations contain only the physical quantities mass, energy, momentum, length and time (no electrical or magnetic quantities). In this case, the equations can be written in terms of only one natural unit, preferably an energy. If the rest mass μ of a particle is chosen, the units are shown in the first line of the following table; if 1 GeV is used as basic unit, the corresponding units are shown in the second line.

Basic unit	Energy	Mass	Momentum	Length	Time
μc^2	μc^2	μ	μc	$\lambda\!\!\!^{-} = \frac{\hbar}{\mu c}$	$\frac{\lambda\!\!\!^{-}}{c} = \frac{\hbar}{\mu c^2}$
1 GeV	GeV	GeV/c^2	GeV/c	0.197 fm	$0.657 \cdot 10^{-24}$ s

Both these systems of units go usually under the expression $\hbar = c = 1$. In this volume the charged pion mass is used for μ (natural units, "n.u."). As an example the equation $E^2 = (pc)^2 + m^2c^4$ can be written as

$$(E/\mu c^2)^2 = (p/\mu c)^2 + (m/\mu)^2 \text{ or } (E/\text{GeV})^2 = (p/\text{GeV}/c)^2 + (mc^2/\text{GeV})^2$$

In the literature and also in this volume there is an inconsistency concerning the treatment of c in the dimension. In some cases, $c = 1$ is understood (for instance resonance masses are usually given in GeV) but in others, c is written in the dimension (momenta are given in GeV/c).

Length		fm	n.u.	GeV^{-1}	mb·GeV
$1\ \text{fm} = 10^{-13}$ cm	=	–	0.7073	5.068	1.9733
1 n.u. $= 1\mu^{-1}$	=	1.414	–	7.165	2.7898
$1\ \text{GeV}^{-1}$	=	0.1973	0.1396	–	0.3894
1 mb·GeV	=	0.5068	0.3585	2.568	–
Area		**mb**	**n.u.**	GeV^{-2}	$\text{mb}^{1/2}\,\text{GeV}^{-1}$
$1\ \text{mb} = 10^{-27}\ \text{cm}^2$	=	–	0.05003	2.568	1.6025
1 n.u. $= 1\mu^{-2}$	=	19.99	–	51.34	32.03
$1\ \text{GeV}^{-2}$	=	0.3894	0.01948	–	0.6240
$1\ \text{mb}^{1/2}\,\text{GeV}^{-1}$	=	0.6240	0.03122	1.6025	–

Units for amplitudes

Invariant amplitudes A, C and spin non-flip and flip amplitudes G, H:

$$A[\text{GeV}^{-1}] = \frac{A[\mu^{-1}]}{0.1396} = \frac{A[\text{fm}]}{0.1973} = \frac{A[\text{mb}\cdot\text{GeV}]}{0.3894} = \frac{A[\text{mb}^{1/2}]}{0.6240}.$$

Invariant amplitude B and helicity amplitudes F_{++}, G_{++}:

$$B[\text{GeV}^{-2}] = \frac{B[\text{mb}]}{0.3894} = \frac{B[\text{mb}^{1/2}\text{GeV}^{-1}]}{0.6240} = 51.33\,B[\mu^{-2}].$$

Units for cross sections

$$\frac{d\sigma}{dt}\left[\frac{mb}{GeV^2}\right]=0.3894\frac{d\sigma}{dt}[GeV^{-4}]=1026.0\frac{d\sigma}{dt}[n.u.];$$

$$\frac{d\sigma}{d\Omega}\left[\frac{mb}{sr}\right]=0.3894\frac{d\sigma}{d\Omega}[GeV^{-2}]=19.99\frac{d\sigma}{d\Omega}[n.u.]=\frac{q^2[GeV^2]}{\pi}\frac{d\sigma}{dt}\left[\frac{mb}{GeV^2}\right]$$

$$1\,mb=10^3\,\mu b=10^6\,nb=10^{-27}\,cm^2.$$

Masses and derived quantities

Pion: $\mu=\mu_\pm=0.13957\,GeV$, $\mu_0=0.13496\,GeV$.
Nucleon: $m=m_p=0.93828\,GeV$, $m_n=0.93957\,GeV$.

$$1/\mu=7.1649\,GeV^{-1},\quad 1/\mu^2=51.336\,GeV^{-2},\quad m/\mu=6.7227,\quad m^2=45.195\,\mu^2.$$

Compton wavelength: $\lambda\!\!\!^{-}_\pi=\hbar c/\mu c^2=1.4138\,fm$, $\lambda\!\!\!^{-2}_\pi=19.989\,mb$, $\lambda\!\!\!^{-}_\pi/c=4.716\cdot10^{-24}\,s$.
We have always used the proton mass and the charged pion mass in kinematical calculations.

Pion-Nucleon coupling constant and other parameters

The pseudoscalar and pseudovector coupling constants g and f are related by $g^2/4\pi=(2m/\mu)^2f^2$. Taking $f^2=0.079$, we have $g^2/4\pi=14.28$, $g=13.40$, $g^2/m=26.70\,\mu^{-1}=191.3\,GeV^{-1}$, $g^2/2m^2=1.99\,\mu^{-2}$.
Pion decay constant: $f_\pi=(0.945\pm0.001)\mu=132\,MeV$. Axial vector coupling constant: $g_A=1.26\pm0.01$.

Notation

THETA3	Pion scattering angle in the lab. system, θ_3
COSTH3*	Cosine of pion scattering angle in the c.m. system, $\cos\theta_3^*$
DSIG/DOM	Differential cross section in the lab. system, $d\sigma/d\Omega$
DSIG/DOM*	Differential cross section in the c.m. system, $d\sigma/d\Omega^*$
DSIG/DT	Invariant differential cross section, $d\sigma/dt$ (units: mb/(GeV/c)^2)
S, T, U	Mandelstam variables, s, t, u; $s+t+u=2m^2+2\mu^2$
T1, P1	Kinetic energy and momentum of the incoming pion in the lab. system, T_1, P_1
E*, P1*	Total energy and momentum in the c.m. system, E^*, P_1; $s=E^{*2}$
P	Polarization parameter, P
R, A	Spin-rotation parameters, R, A

The kinematical formulas are listed in Vol. I/9b 2, Sect. A.1 .

内部交流

F 164 / 28 （德·英 2 - 1 / 9 - 1Ib1）
自然科学与技术中的数据和函数关系 新辑 第I类
《核物理学与粒子物理学》 第9卷《基本粒子的弹性与电荷交换散射》 b分册《点核散射》
第1部分《数据表》

B000420

Vorwort

Band I/9b ist als integrale Ergänzung des Bandes I/9 anzusehen, indem hier die noch ausstehenden neuesten Daten über die Pion-Nukleon-Streuung nachgeliefert werden. Andererseits muß er aber auch als ein in sich abgeschlossenes Werk betrachtet werden, da er nicht nur die neueste, sondern wohl auch die vollständigste Zusammenstellung unserer Kenntnisse über die Pion-Nukleon-Streuung darstellt. Die Rechtfertigung, diesem Gebiet einen eigenen Band zu widmen, kommt vor allem daher, daß die Pion-Nukleon-Streuung wegen ihrer einfachen Spin-Struktur (Pion hat spin 0) einer der übersichtlichsten fundamentalen Streuprozesse ist, der einer theoretischen Interpretation besonders zugänglich ist. Das Interesse, diesen Prozeß zu untersuchen, war daher immer groß, und entsprechend umfangreich ist sowohl die experimentelle wie auch die theoretische Literatur. Dies machte es nötig, den Band I/9b in zwei Teilbände zu zerlegen.

Die allgemeinen Ausführungen im Vorwort zu Band I/9a gelten auch für diesen Teilband. Gegenüber dem Band I/7 enthält Band I/9b insbesondere die Daten bei hohen Energien, die durch die neuen Beschleuniger bei CERN und am Fermi National Accelerator Laboratory verfügbar wurden. Für die Pion-Nukleon-Streuung wurden aber im Laufe der letzten Jahre auch viele neue Daten bei niedrigeren Energien erhalten (insbesondere Messungen der Polarisationsparameter). Diese experimentellen Daten sind im Teilband I/9b1 (Tabellen der Daten) enthalten. Durch die neuen Daten wurde es möglich, die aus den Meßdaten abgeleiteten Streuamplituden zuverlässiger zu bestimmen. Da diese Amplituden gemittelte Werte der Experimente darstellen, ist es in vielen Fällen zweckmäßig, sie den ursprünglichen Meßdaten vorzuziehen. Daher wurden sie in Teilband I/9b2 (Analysen und Streuamplituden) zusammengestellt. Die Ableitung der Streuamplituden ist allerdings nicht ganz einfach und besitzt eine lange Geschichte. Die Darstellung der damit zusammenhängenden Probleme in diesem Band dürfte eine gewisse Einmaligkeit an Übersichtlichkeit und Vollständigkeit besitzen.

Generell ist ein beträchtlicher Teil des Bandes einer Darstellung des theoretischen Hintergrundes der Pion-Nukleon-Streuung gewidmet, und die ausführliche Zusammenstellung aller relevanten Formeln (insbesondere im Anhang) sollten eine rasche Klärung spezieller Fragen und den Vergleich verschiedener Veröffentlichungen erheblich erleichtern. Wegen des großen Umfangs dieses Gebietes wurde besonderer Wert darauf gelegt, in speziellen Listen sowohl für die Experimente als auch für die Veröffentlichungen dem Benutzer das rasche Auffinden der gewünschten Informationen zu ermöglichen.

Die Voraussetzung für eine so umfassende und präzise Darstellung des sehr komplexen Gebietes war die Kompetenz und Sorgfalt des Autors, der sich mehrere Jahrzehnte diesem Problemkreis gewidmet hat und wohl als einer seiner besten Kenner gilt. Ihm gebührt besonderer Dank für diese Mühe. Bei der Fertigstellung des Bandes waren wiederum eine Reihe von technischen und administrativen Schwierigkeiten zu lösen. Daß sie erfolgreich überwunden werden konnten, ist dem Gesamtherausgeber, der Redaktion, insbesondere Herrn Dr. W. Polzin und dem Verlag zu danken. Dieser Band wurde, wie alle Bände des Landolt-Börnstein, ohne finanzielle Unterstützung von anderer Seite veröffentlicht.

Genf, November 1981 **Der Herausgeber**

Preface

Volume I/9b should be considered as an integral supplement of vol. I/9, supplying the still missing most recent data on pion-nucleon scattering. On the other hand, it should also be looked upon as a publication complete in itself, since it presents not only a recent but also an extensive survey of our knowledge on pion-nucleon scattering. The justification to dedicate a volume soleley to this field stems mainly from the fact that, because of its simple spin structure (pion spin zero), pion-nucleon scattering is one of the simplest fundamental processes which is particularly accessible to theoretical interpretation. Hence the interest to investigate this process has always been great and the literature, both experimental and theoretical, is therefore very extensive. This made it necessary to split volume I/9b into two subvolumes.

The general remarks made in the preface of volume I/9a are valid also for this sub-volume. With respect to volume I/7, this volume I/9b contains the data at high energies which became available at the new accelerators at CERN and at the Fermi National Accelerator Laboratory. But also many new data were obtained during the last few years for pion-nucleon scattering at low energies (in particular measurements of polarization parameters). These experimental data are contained in subvolume I/9b1 (Tables of data). The new data made it possible to determine the scattering amplitudes deduced from the measurements more reliably. Since these scattering amplitudes represent smoothed values of the experimental data it will be more useful in many cases to give them preference over the initial measurements. Hence they are presented in subvolume I/9b2 (Analyses, Tables of amplitudes). The determination of the scattering amplitudes is not so simple and has a long history. The survey of the corresponding problems in this volume may have a certain uniqueness of clarity and completeness.

In general, an important part of this volume is dedicated to a review of the theoretical background of the pion-nucleon scattering process and the extensive compilation of all relevant formulae (in particular in the appendix) should facilitate considerably a rapid clarification of special questions and a comparison of different publications. Because of the wide extent of this field special importance was given to survey indexes both for the experiments and for publications to enable users to find rapidly the wanted information.

The basis for such a comprehensive and precise review of a complex field was the competence and carefulness of the author who dedicated himself for several decades to this field of problems and who no doubt is one of its best experts. Special thanks are due to him for his endeavours. In producing this volume, again a series of technical and administrative difficulties had to be solved. Thanks are due to the editor in chief, the editorial office, especially Dr. W. Polzin, and to the publishers for solving all those problems successfully. This volume like all other volumes of Landolt-Börnstein has been published without financial support from any outside source.

Geneva, November 1981 **The Editor**

Contents

Pion nucleon scattering

Subvolume b1: Tables of data

Subvolume b2: Analyses, tables of amplitudes

Note: Please delete asterisk and footnote on p. 31 of subvolume I/9b 1 and place them on p. 148 instead.

0 Introduction

The first part of Vol. I/9b is a continuation of G. Giacomelli's article in Vol. I/7 of this series. It contains tables of the new pion-nucleon scattering data measured since 1972, and a list of the new literature. We have added two indices, which facilitate the use of the tables, and a list of other compilations of pion-nucleon scattering data and of related subjects.

The index "List of Experiments" is a time-ordered list of all publications on pion-nucleon scattering experiments found in our search. It gives information on the reaction, the kinematic region, whether a table of the data has been included in the present volume or in Vol. I/7 and whether different publications belong to the same experiment. In some cases it is not immediately clear that a paper contains the final version of an experiment, of which a preliminary version has been published or presented at a conference many years ago. The "List of Experiments" is compact and easy to survey, because abbreviations are used for the entries.

The "Survey Index" for differential cross sections and polarization parameters is a condensed graphical representation of the points in a kinematical plane (laboratory momentum vs. scattering angle) where experimental data exist. This index is helpful for readers who want to find out quickly, which of the data sets of the main tables can be used for instance for a study of the energy dependence at a fixed scattering angle or at fixed momentum transfer. Another application is to find energies where both cross-section and polarization data are available. It would be rather cumbersome to do this with the main table alone.

The second part (Vol. I/9b2) contains a chapter on "Results of Phenomenological Analyses", of which only a few aspects were covered briefly in Vol. I/7. The reason for the extension of the original concept was mentioned by the editor in the preface of Vol. I/9a. Most of the users of experimental information on the pion-nucleon system are interested in the scattering amplitudes. Even if someone needs cross sections or polarization parameters, he will in general prefer to use values derived from phase shift or amplitude analysis, which have been obtained after a careful study of the experimental discrepancies between different data sets and normalization problems.

Although the determination of scattering amplitudes from data is a rather difficult procedure, which cannot be carried out without some theoretical input, we think that, nowadays, the reliability is good enough to justify the presentation of tables. The main features of the amplitudes at low and intermediate energies were determined about 10 years ago and have been confirmed in subsequent investigations. In order to show the remaining uncertainties, we shall present a comparison between the results of two recent phase shift analyses which are based on considerably different methods. They are the only new analyses which cover a large momentum range and include data from all three reactions.

In addition to the tables and figures, we have included summaries of the present status of phase shift analysis and of the most important applications of the amplitudes, mentioning books, review articles and original papers, in which a full presentation of these topics is given. This "guide to the literature" will be helpful to those who have not followed the progress in this field during the last two decades, but need information on the pion-nucleon system, for instance for applications in nuclear physics or for a comparison with predictions from quark models. Special attention has been paid to the analysis of high energy data.

The Appendix of Vol. I/9b2 contains a "Collection of Pion-Nucleon Scattering Formulas" which is a coherent presentation of formulas related to topics treated in this volume. It is true that most of these formulas can be found in various books and review articles, but each of these covers only part of our topics. Combining formulas taken from different sources is usually tedious and time-consuming, because many different notations and conventions exist.

Acknowledgements

The content of this volume is based on the πN data compiled for phase shift and amplitude analysis by the Karlsruhe group. I would like to express my gratitude to all physicists, who sent us tables of data and comments, and to my colleagues at Karlsruhe, who contributed to the present version of the data tape. The compilation would not exist without the continuous effort of H. M. Staudenmaier. Significant improvements are due to M. Hutt. Many errors have been detected by R. Koch and E. Pietarinen, who used the tape for phase shift analysis. An earlier version was completed in 1975 in collaboration with K. H. Augenstein. My son Reinhard wrote some of the computer programs for the tables of this volume.

1 Tables of data

1.1 General remarks

In the earlier version of this article, which was completed in 1972, Giacomelli presented a selection of about 14000 pion-nucleon scattering data, rejecting about 3000 data which have poor accuracy or were known to be faulty. The present version includes about 20000 data which have become available since that time.

As pointed out by Giacomelli, compiling data collections is difficult, because there is no standard method for presenting and publishing experimental results*).

i) Errors are quoted in different ways. In the column "ERROR" of our tables we have listed the values given by the authors. In general it is the statistical error, but sometimes part of the systematic error has been included. If a total systematic error (or normalization error) has been quoted by the authors, it is mentioned in the headline of the data set or in the table caption. Otherwise the entry is omitted, assuming that the authors had a good reason not to combine the different contributions in a total systematic error.

ii) It happens that results are presented at conferences or in preprints, but not published within a reasonable time. Presumably, this is frequently due to the fact that the authors have problems with the data or with their analysis. Sometimes, however, the reason for the delay is simply the high priority for the work on the next experiment and the data are as good as published ones.

iii) We have made no attempt to include experimental results, if the authors published only graphs and did not distribute tables, because it is clear that these data are very preliminary.

It happens that the numbers in our tables do not agree exactly with those in the original papers. However, the differences are small in comparison with the errors. The reason is that we wanted to have the same format within each column of the table, even if this leads to additional figures which are not significant. Further tiny differences are due to the fact that we have used the most recent values for the charged pion mass and proton mass in our kinematical calculations.

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*) In many cases, the publication of the experimental results presents only figures but does not include a table. Sometimes, it is easy to get the table from the authors but, according to my experience, it can also be very difficult. Therefore, it would be a great help, if the libraries of the accelerator centers collected and distributed tables of all experimental results obtained at their laboratory. This collection should also include comments on these experiments, pointing out for instance errors in published tables or difficulties with the data or the analysis, which were noticed after the publication.

1.2 Survey indices

1.2.1 List of experiments

For the period 1968–Oct. 81 we have listed all published papers found in our survey of the journals, indicating the relation between different publications which belong to the same experiment. Preprints and unpublished reports are mentioned only, if a publication is not yet available. Before 1968, the list is restricted to papers containing the final versions of the experiments. Further papers can be found in Vol. I/7, Sect. 3.4. In order to present a list which is reasonably short and easy to survey, we have given only the name of the first author, using abbreviations for the journals. See Sect. 1.7 for complete references.

```
LEGEND:

1ST COLUMN: NAME OF THE DATA SET. THE NAME CONSISTS OF THE LAST TWO
    DIGITS OF THE YEAR AND THE FIRST SIX LETTERS OF THE NAME OF THE FIRST
    AUTHOR. THE LAST LETTER HAS BEEN MODIFIED,IF NECESSARY FOR UNIQUENESS.

2ND COLUMN: LABEL FOR THE DATA SET:
    +,-,0:        INDEX FOR PI+P,PI-P ELASTIC AND FOR CHARGE-EXCHANGE SCATTERING
    T+,T-:        TOTAL CROSS SECTIONS
    D+,D-,DO:     DIFFERENTIAL CROSS SECTIONS
    DOL:          THE AUTHORS GIVE ONLY LEGENDRE COEFFICIENTS (CHARGE-EXCHANGE)
    TO:           INTEGRATED CHARGE-EXCHANGE DIFFERENTIAL CROSS SECTIONS
    P+,P-,PO:     POLARIZATION PARAMETERS
    R+,R-,A+,A-:  SPIN ROTATION PARAMETERS

3RD COLUMN: APPROXIMATE PION LABORATORY MOMENTUM RANGE

4TH COLUMN: ANGULAR RANGE OF THE DATA(C.M.SCATTERING ANGLE)
    C: COULOMB INTERFERENCE REGION
    F: NEAR FORWARD SCATTERING
    B: NEAR BACKWARD SCATTERING
    M: INTERMEDIATE ANGLES
    FB:ALL ANGLES

5TH COLUMN: FULL NAME OF THE FIRST AUTHOR AND REFERENCE.
    ABBREVIATIONS FOR THE NAMES OF JOURNALS:
    NP:           NUCLEAR PHYSICS
    PL:           PHYSICS LETTERS
    PR:           PHYSICAL REVIEW
    PRL:          PHYSICAL REVIEW LETTERS
    SJNP:         SOVIET JOURNAL OF NUCLEAR PHYSICS.TRANSLATION OF YADERN.FIZ.
    SOV.PHYS.:    TRANSLATION OF JETP (USSR)

6TH COLUMN:
    LB I/9B:   THE DATA ARE LISTED IN THIS VOLUME.
    LB I/7:    AT LEAST PART OF THE DATA ARE LISTED IN VOLUME I/7.
    NO TABLE:  THE DATA HAVE NOT BEEN INCLUDED,BECAUSE A TABLE OF THE
               FINAL RESULTS IS NOT AVAILABLE TO US.
    2ND PUBL:  THE SAME DATA OR ANOTHER VERSION HAS BEEN PUBLISHED
               ELSEWHERE.
    LOW ACC:   THE DATA ARE NOT INCLUDED,BECAUSE THE ACCURACY IS CONSIDERABLY
               LOWER THAN THAT OF OTHER DATA AT NEARBY MOMENTA AND ANGLES.
    NOT INCL.:THE DATA WERE PUBLISHED BEFORE 1973,BUT NOT INCLUDED IN LB I/7.


PREVIEW OF FORTHCOMING DATA:
============================

LAB.                LAB.MOM.          SPOKESMAN                  STATUS
                    GEV/C
CERN        D+      80.          C    EKELOEF T.                 ANALYSIS
CERN        D-      150.-345.    C    GRAFSTROEM P.              ANALYSIS
CERN        D+      100.-300.    C    GRAFSTROEM P.              ANALYSIS
CERN        P-P+D+  50.-200.     F,B  FIDECARO G.                ANALYSIS
CERN        D-      20.-90.      FM   GRACCO V.                  DATA TAKING
CERN        DO      UP TO 300.   FM   PROKOSHKIN YU.D.           PREPARATION
LAMPF       DO      .20-.69      FB   NEFKENS B.,FITZGERALD D.   PREPARATION
RUTHERFORD  D+      1.3-2.55     MB   CANDLIN D.                 ANALYSIS

SEE ALSO THE DATA WITH THE REMARK "NO TABLE" IN THE FOLLOWING LIST.
```

PUBLICATIONS AND PREPRINTS*

REFERENCE		P1 GEV/C	ANG. RANGE	LITERATURE	
80 ADACHI	PO	2.8-4.2	FM	ADACHI T. THESIS,KYOTO UNIV.	LB I/9B
80 ALMAS	D-D+	20.,30.	M	ALMAS R. PL 93B,199	LB I/9B
80 AVVAKU	PO	40.	F	AVVAKUMOV I.A. SERPUCHOV PREPRINT 80-94	
80 AZHINE	D+	32.	F	AZHINENKO I.V. YAD.FIZ.31,648	NO TABLE
80 BAILLO	D-	5.7-13.	MB	BAILLON P. PL 94B,533	NO TABLE
80 BARREL	T-	2.-14.		BARRELET E. PL 94B,541	NO TABLE
80 BEKREN	P-	.57-.69	MB	BEKRENEV V.S. YAD.FIZ.31,173	LB I/9B
80 BURQ	D-	345.	C	BURQ J.P. CERN EP 80-117	NO TABLE
80 CROUCH	DOL	1.3-3.8	FB	CROUCH H.R. PR D21,3023	LB I/9B
80 EATON	PO	.35-.41	MB	EATON G. (SIN) PRIV.COMM.	LB I/9B
80 FAJARD	D-D+	70.-200.	CF	FAJARDO A. FERMILAB-PUB-80/27 AND THESIS	LB I/9B
80 FRASCA	D+	.23-.40	R	FRASCARIA R. PL 91B,345	NO TABLE
80 FUKUSH	P-	2.2-3.5	B	FUKUSHIMA M. NP B167,307	LB I/9B
80 JENKIN	D-D+	2.0$\pm$9.	M	JENKINS K.A. PR D21,2445,SEE 78JENKIN	2ND PUBL
80 KLINE	P-P+	100.	F	KLINE R.V. PR D22,553 SEE 77AUER	2ND PUBL
80 SCHIZ	D-D+	200.	F	SCHIZ,A. FERMILAB-PUB-79/81	LB I/9B
80 TERADA	D-	2.-3.5	FB	TERADA S. NP B175,1	LB I/9B
79 ABLEEV	D-	40.	C	ABLEEV V.G. YAD.FIZ.28,1529	LB I/9B
79 ALDER	P-	.19,.35	M	ALDER J. SUBMITTED TO VANCOUVER CONF.	LB I/9B
79 APEL	DO	15.-40.	F	APEL W.D. NP B154,189,SEE ALSO 77APEL	LB I/9B
79 APEL	DO			AND AUGENSTEIN K.H.,THESIS,KARLSRUHE(1978)	
79 AULD	D+	.13	FB	AULD E.G. CAN.J.PHYS.57,73	LB I/9B
79 BAKER	D-D+	30.-90.	B	BAKER W.F. PRL 43,1635	LB I/9B
79 CARROL	T-T+	200.-370.		CARROL A.S. PL 80B,423	LB I/9B
79 FRANK	D-D+	.10-.18	MB	FRANK J.S. PROC.HOUSTON CONF.	NO TABLE
79 FUJISA	P+	6.,12.	F	FUJISAKI,M. NP B151,206 AND B155,544 (E)	LB I/9B
79 GORDEE	D-D+	.55-.77	MB	GORDEEV B.A. YAD.FIZ.29,657	LB I/9B
79 KARAMI	D-	1.0-1.2	M	KARAMI H. NP B154,503	LB I/9B
79 MINOWA	PO	1.9-3.0	FB	MINOWA M.,THESIS,KYOTO	LB I/9B
79 SADLER	D-D+	.38-.62	FB	SADLER M.E. PROC.HOUSTON CONF.	NO TABLE
79 SARMA	D-	.66-.72	M	SARMA,H.N.K. NP B161,1	LB I/9B
79 SUZUKI	DO	1.9-3.0	FB	SUZUKI Y.,THESIS,KYOTO	LB I/9B
78 ALDER	P-	.41	M	ALDER,J.C. LETT.AL NUOVO CIM. 23,381	LB I/9B
78 BROWN	PO	0.6-2.0	FB	BROWN R.M. NP B144,287	LB I/9B
78 BURQ	D-	30.-140.	C	BURQ J.P. PL 77B,438 AND CERN REPORT	LB I/9B
78 JENKIN	D-D+	2.0-9.	M	JENKINS K.A. PRL 40,425 SEE 80 JENKIN	LB I/9B
78 KRAVTS	DO	.52-.77	F	KRAVTSOV A.V. NP B140,279(EXTR.TO 0 DEG.)	LB I/9B
78 NEFKEN	D-D+	.38-.45	M	NEFKEN B.M.K. LOS ANGELES PREPRINT	LOW ACC
78 PEDRON	T-T+	.16-.49		PEDRONI E. NP A300,321	LB I/9B
78 SCHARR	D-	4.	B	SCHARRE D.L. PR D17,2853	LB I/9B
78 SHARFM	D-	6.	B	SHARFMAN N. PRL 40,681	NO TABLE
77 APEL	DO	40.	F	APEL W.D. PL 72B,132,JETP LETT. 26,205	2ND PUBL
77 APEL	DO			SEE 79APEL	
77 APOKIN	D+T+	42.,52.	C	APOKIN V.D. SJNP 25,51	LB I/9B
77 AUER	P-P+	100.	F	AUER P. PRL 39,313,SEE ALSO 80KLINE	LB I/9B
77 AYRES	D-D+	50.-175.	F	AYRES,D.S. PR D15,3105	LB I/9B
77 BABAEV	D-	25.,38.	B	BABAEV A. PL 67B,351,JETP LETT. 25,367	LB I/9B
77 BARREL	P-	1.2-1.4	M	BARRELET E. PRL 15,2435	LB I/9B
77 BRUNET	D-D+	39.,44.	F	BRUNETON C. NP B124,391	LB I/9B
77 DEREVS	P+	45.	F	DEREVSHCHIKOV A.A. SJNP 25,198,S.76GAIDOT	2ND PUBL
77 DUBAL	P+	.41,.43	M	DUBAL L. HELV.PHYS.ACTA 50,815	LB I/9B
77 JACHOL	D-	9.,12.	B	JACHOLSKOWSKI A. NP B126,1	LB I/9B
77 JENEFS	DO	.23-.36	MB	JENEFSKY R.F. NP A290,407	LB I/9B
77 LJUNG	D-	205.	F	LJUNG D. PR D15,3163	LOW ACC
77 OTT	D+	1.2-2.0	MB	OTT R.J. PR D16,2699	LB I/9B
77 REY	D+	4.4-6.	F	REY C.A. PR D15,59 (SLOPES AT 0 DEG.)	NO TABLE
77 RUSS	D-	8.0,16.	F	RUSS J.S. PR D15,3139	LB I/9B
77 STEIN	D+	6.	B	STEIN N.A. PRL 39,378	LB I/9B
77 VAVRA	D-	1.2-3.	MB	VAVRA K. PR D16,2687	LB I/9B
76 AKERLO	D-D+	50.-200.	F	AKERLOF C.W. PRL 35,1406,PR D14,2864	LB I/9B
76 ALITTI	D-	3.9	FB	ALITTI J. NC 33A,160	LB I/9B
76 AMSLER	P+	.19-.3	MB	AMSLER C. LETT.AL NUOVO CIM. 15,209	LB I/9B
76 ANTIPO	D+	29.,43.	F	ANTIPOV M.YU. IHEP 76-95,SERPUCHOV	LB I/9B
76 APOKIN	D-T-	33.-60.	C	APOKIN V.D. NP B106,413 ,SJNP 24,49	LB I/9B
76 AUER	P-	2.9-3.2	MB	AUER P. PRL 37,83,NP B113,279	LB I/9B
76 BAILLO	D-D+	0.6-2.	C	BAILLON P. NP B105,365,SEE 74BAILLO	2ND PUBL
76 BARDSL	D-D+	0.4-2.1	FB	BARDSLEY D.J. PROC.OXFORD CONF.	NO TABLE
76 BARNES	DO	20.-200	F	BARNES A.V. PRL 37,76	LB I/9B

* See p. 9 for more recent papers.

76	BAYER	DO	.24-.39	F	BAYER W. NUCL.INST.AND METHODS 134,449	LB I/9B
76	BERTIN	D+	.08-.2	M	BERTIN P.Y. NP B106,341	LB I/9B
76	BIRSA	P-	3.5	B	BIRSA R. NP B117,77	LB I/9B
76	BROWN	DO	0.6-2.7	FB	BROWN R.M. NP B117,12 AND B137,542 (E)	LB I/9B
76	BRUNET	R+	45.	F	BRUNETON C. SJNP 24,397,SEE 76PIERRA	LB I/9B
76	BRUNE1	R-	40.	F	BRUNETON C. SJNP 23,409,SEE 75PIERRA	2ND PUBL
76	BRUNE2	P-	40.	F	BRUNETON C. SJNP 23,405,SEE 75GAIDOT	2ND PUBL
76	BURAN	D-	6.2	MB	BURAN T. NP B111,1	LB I/9B
76	CARROL	T-T+	23.-280.		CARROL A.S. PL 61B,303	LB I/9B
76	FIREST	D-T-	360.	F	FIRESTONE A. PR D14,2902	NO TABLE
76	GAIDOT	P+	45.	F	GAIDOT A. PL 61B,103,SEE 77DEREVS	LB I/9B
76	GORDEE	D-D+	0.4-.6	MB	GORDEEV V.A. SJNP 24,599	LB I/9B
76	HOFFMA	D-	3.0-5.1	B	HOFFMAN D.W. OXFORD CONF. EXT.OF 75HOFFMA	LB I/9B
76	KISTIA	DOL	1.3-3.8	FB	KISTIAKOWSKY V. TBILISI CONF.,SEE 80CROUCH	2ND PUBL
76	PIERRA	R+	45.	F	PIERRARD J. PL 61B,107,SEE 76BRUNET	2ND PUBL
75	AMSLER	P+	.35	MB	AMSLER C. PL 57B,289	LB I/9B
75	APOKIN	D-	40.,50.	C	APOKIN V.D. SJNP 21,640,PL 56B,391	LB I/9B
75	AYRES	D-D+	50.-175.	F	AYRES D.S. PRL 35,1195,SEE 77AYRES	2ND PUBL
75	BAGLIN	D+	10.	FB	BAGLIN C. NP B98,365 (EXT.OF 73BAGLIN)	LB I/9B
75	BARBER	D-	1.0-1.4	FB	BARBER P.C. NP B84,109	LB I/9B
75	BEKREN	P-P+	.57	M	BEKRENEV V.S. JETP LETT.21,282	LB I/9
75	BLAISI	D-	17.	F	BLAISING J.J. PL 58B,121	LOW ACC
75	BRANDE	D-D+	10.	F	BRANDENBURG G. PL 58B,367 AND PL 59B,313	LB I/9B
75	COMISO	DO	.24-0.4	M	COMISO J.C. PR D12,738	LB I/9B
75	DEBENH	D-DO	0.6-1.	B	DEBENHAM N.C. PR D12,2545	LB I/9B
75	GAIDOT	P-	40.	F	GAIDOT A. PL 57B,389	LB I/9B
75	HOFFMA	D-	3.0,5.1	B	HOFFMAN D.W. PRL 35,138	LB I/9B
75	LENNOX	D+	2.0-6.	B	LENNOX A.J. PR D11,1777	LB I/9B
75	MARTIN	P+	0.6-2.6	MB	MARTIN J.F. NP B89,253	LB I/9B
75	MARZO	DO	2.6-8.	B	DE MARZO C. PL 56B,487	LB I/9B
75	MICHAE	D+	3.7,7.	MB	MICHAEL W. PRL 35,193	NO TABLE
75	PIERRA	R-	40.	F	PIERRARD J. PL 57B,393	LB I/9B
74	ABE	D+	1.5-2.	M	ABE K. PR D10,3556	LB I/9B
74	AMBATS	D-D+	3.0-6.	F	AMBATS I. PR D9,1179	LB I/9B
74	ANTIPO	D-	25.,40.	F	ANTIPOV Y.M. SJNP 18,182	LB I/9B
74	BAILLO	D-D+	0.6-2.	C	BAILLON P. PL 50B,387, CERN 75-10	LB I/9B
74	BAKER	D+	2.0-6.0	B	BAKER W.F. PRL 32,251,SEE 75LENNOX	2ND PUBL
74	BASHIA	D+	3.2-10.	B	BASHIAN A. PR D9,3193	LB I/9B
74	BERTHO	D+	1.2	FB	BERTHON A. NP B81,431	LB I/9B
74	BOLOTO	DO	20.-50.	F	BOLOTOV V.N. NP B73,365,SJNP 18,538	LB I/9B
74	BROCKE	DO	5.9	M	BROCKETT W.S. PL 51B,390	LB I/9B
74	CHEZE	DO	.47-.5	B	CHEZE J.B. NP B72,365	LB I/9B
74	DEREVG	D-	50.	F	DEREVSHCHIKOV A. A. PL 48B,367	LB I/9B
74	DEREVM	D-	35.-55.	F	DEREVSHCHIKOV A.A. NP B80,442	LB I/9B
74	DOLBEA	D-	0.9-1.2	FB	DOLBEAU J. NP B78,233	LB I/9B
74	FELTES	DO	1.8,2.	MB	FELTESSE J. CEA-N-1838,THESIS(PARIS)	LB I/9B
74	JENEFS	DO	.12-.2	B	JENEFSKY R. HELV.PHYS.ACTA 47,80	2ND PUBL
74	JENEFS				SEE 77JENEFS	
74	RICHAR	D-	0.6-1.2	B	RICHARDS T.J. PR D10,45	LB I/9B
74	SHANNO	PO	1.0-1.8	FB	SHANNON S.R.PRL 33,237,LBL2607(BERKELEY)	LB I/9
74	STIER	DO	8.	F	STIER U. THESIS KARLSRUHE 1974	LB I/9B
74	VOROBE	D-	1.9,6.1	C	VOROBEV G.G. SJNP 19,433	NO TABLE
73	ANTIPO	D-	25.,40.	F	ANTIPOV Y.M. NP B57,333,SEE 74ANTIPO	2ND PUBL
73	BAGLIN	D+	10.	FB	BAGLIN C. PL B47,85,SEE 75BAGLIN	2ND PUBL
73	BOGERT	D-T-	205.	F	BOGERT D. PRL 31,1271	LOW ACC
73	BONAMY	PO	5.,8.	F	BONAMY P. NP B52,392	LB I/9B
73	BRADAM	P+	2.-4.	B	BRADAMANTE F. NP B56,356	LB I/9B
73	BRUNET	P-	40.	F	BRUNETON C.PL B44,471 REPL. BY 75GAIDOT	2ND PUBL
73	BUSHNI	T-T+	10.-60.		BUSHNIN YU.P. SJNP 16,674	LB I/9B
73	BUSSEY	D+D-	.18-.41	FB	BUSSEY P.J. NP B58,363	LB I/9B
73	CORNIL	D-	14.,23	F	CORNILLON P. PRL 30,403	LB I/9B
73	DENISO	T-	6.7-65.		DENISOV S.P. NP B65,1	LB I/9B
73	DICK	P-	6.	B	DICK L. NP B64,45	LB I/9B
73	DUCLOS	DO	0.1	B	DUCLOS J. PL 43B,245	LB I/9B
73	DZIERB	D-	14.	F	DZIERBA A.R. PR D7,725	LB I/9B
73	EIDE	D+D-	5.	FB	EIDE A. NP B60,173	LB I/9B
73	GORN	P+P-	0.3-.53	MB	GORN W. LBL 1320, BERKELEY	LB I/9B
73	HILL	PO	3.5,5.0	F	HILL D. PRL 30,239	LB I/9B
73	KARTAM	D-	4.5	FM	KARTAMYSHEV A.A. PL 44B,310	LOW ACC
73	MALOS	D+	0.8-1.	FB	MALOS J. AND HUGHES,THESIS(BRISTOL)	LB I/9B
73	NELSON	DO	1.0-2.	FB	NELSON J.E. PL 47B,281	LB I/9B
73	RUBINS	D+	14.	F	RUBINSTEIN R. PRL 30,1010	LB I/9B
73	SCHEID	P+P-	2.5-5.	FB	SCHEID J.A. PR D8,1263	LB I/9B

72	ABILLO	D-	0.9-1.6	F	ABILLON J.M. NP B46,630	LB I/7
72	ALBROW	D-P-	.86-2.7	FB	ALBROW M.G. NP B37,594	LB I/7
72	AMBATS	D+D-	3.0-6.	F	AMBATS I. PRL 29,1415, SEE 74AMBATS	2ND PUBL
72	BABAEV	D+	23.,40.	B	BABAEV A. PL 38B,342 (PI-N DATA)	LB I/9B
72	BERARD	DO	.3-.5	FB	BERARDO F.A. PR D6 756	NOT INCL
72	BOLOTO	DO	20.-50.	F	BOLOTOV V.N. PL B38,133,SEE 74BOLOTO	2ND PUBL
72	BORGHI	P+P-	10.-17.5	F	BORGHINI H. CERN REPORT (JAN.1972,CORR.)	LB I/9B
72	BOWLER	D+	0.6-0.8	FB	BOWLER M.G. NP B37,133	LB I/7
72	BRABSO	D-	3.,4.	B	BRABSON A. PL B42,283	LB I/7
72	CHABAU	D-D+	5.	FB	CHABAUD V.PL B38,441,REPLACED BY 73EIDE	2ND PUBL
72	DAVIDS	T-T+	0.4-0.87		DAVIDSON D. PR D6,1199	LB I/7
72	DELESQ	R+R-A-	6.0,16.	F	DELESQUEN A. PL 40B,277	LB I/7
72	DICK	P+	6.	B	DICK L. NP B43,522	LB I/7
72	GORIN	T-	15.-65.		GORIN Y.P. SJNP 15,530,SEE 73DENISO	2ND PUBL
72	GORIN1	T+	15.-60.		GORIN Y.P. SJNP 14,560,SEE 71DENISO	2ND PUBL
72	HAGOPI	D-	2.3	FB	HAGOPIAN S. PR D5,2684	LB I/9B
72	KISTIA	DO	1.8-6.	B	KISTIAKOWSKY V. PR D6,1882	LB I/9B
72	MEANLY	D-	2.1-6.0	B	MEANLY E.S. PR D6,740	LB I/7
72	OTT	D-	1.3-3.	B	OTT J. PL 42B,133,SEE 77VAVRA	2ND PUBL
72	REHAK	DO	3.8-12.	F	REHAK P. THESIS,PISA	LB I/9B
72	ROTHSC	D+D-	0.6-1.	B	ROTHSCHILD R.E. PR D5,499	LB I/9B
71	AKERLO	D+D-	5.0	MB	AKERLOF C.W. PRL 27,219	LB I/7
71	ALBROW	D+P+	0.8-2.7	FB	ALBROW M.G. NP B25,9	LB I/7
71	APLIN	D-	1.2-3.0	FB	APLIN P.S. NP B32,253	LB I/7
71	AOI	P+	6.	B	AOI H. PL 35B,90, SEE 72DICK	2ND PUBL
71	BAKER	D-D+	5.2-7.	B	BAKER W.F. NP B25,385	LB I/9B
71	BASTIE	D+	3.9	FB	BASTIEN P.L. PR D3,2047	NOT INCL
71	BORGHI	P-P+	10.-17.5	F	BORGHINI H. PL 36B,493,SEE 72BORGHI	LB I/7
71	BROCKE	DO	3.7-4.	M	BROCKETT W.S. PRL 26,527	LB I/9B
71	BRODY	D-	.55-1.	FB	BRODY H. PR D3,2619	LB I/7
71	BUGG	TO	.18-.38		BUGG D.V. NP B26,588	LB I/7
71	BURLES	P+	1.6-2.3	FB	BURLESON G. PRL 26,338	LB I/9B
71	CARTER	T+T-	0.2-0.4		CARTER A.A. NP B26,445	LB I/7
71	CRABB	D-	0.6-1.3	B	CRABB D.G. PRL 27,216, SEE 74RICHAR	2ND PUBL
71	DENISO	T+	15.-60.		DENISOV S.P. PL 36B,415	LB I/7
71	DENISV	T-	21.-65.		DENISOV S.P. PL 36B,528	LB I/7
71	GUISAN	DO	7.8	F	GUISAN O. NP B32,681 (CH2-TARGET)	NOT INCL
71	HARVEY	DO	3.6	F	HARVEY E.H.,MINNESOTA PREPRINT	NOT INCL
71	HAUSER	DO	.15-.6	B	HAUSER M.G. PL 35B,252	NOT INCL
71	HILL	P-	1.6-2.2	FB	HILL D. PRL 27,1241,1550(E)	LB I/9B
71	KALMUS	D+	1.3-1.8	FB	KALMUS G.E. PR D4,676	LB I/7
71	KISTIA	DO	1.8-6.	B	KISTIAKOWSKI V. PRL 26,1498,SEE 72KISTIA	2ND PUBL
71	MACNAU	D+	3.6	FB	MACNAUGTON J. NP B33,101	LB I/9B
71	SCHNEI	DO	4.0-11.	B	SCHNEIDER,J.THESIS,PARIS,SEE 69SCHNEI	LB I/7
71	SIDWEL	D+	2.2-5.	B	SIDWELL R.A. PR D3,1523	LB I/7
70	ABILLO	D-	0.9-1.6	B	ABILLON J.M. PL 32B,712	NOT INCL
70	ALLABY	T-	20.-65.		ALLABY J.C. SJNP 12,295	LB I/7
70	ANGELO	D+	2.3	F	ANGELOV N. SJNP 11,345	NOT INCL
70	BAKER	D+	0.8-1.	FB	BAKER A.L. NP B18,29	NOT INCL
70	BATON	D-	2.8	FB	BATON J.P. NP B21,551	LB I/7
70	BIZARD	T-	0.7-1.		BIZARD G. PL 31B,481	NOT INCL
70	BONAMY	PODO	5.9-11.	F	BONAMY P. NP B16,335	LB I/7
70	BORGHI	P+P-	6.0	F	BORGHINI M. PL 31B,405	LB I/7
70	BORIGH	DO	5.9-14.	B	BORIGHT J.P. PL 33B,615,PRL 24,964	LB I/7
70	BRABSO	D-D+	3.-5.	FM	BRABSON A. PRL 25,553 DATA IN	LB I/9B
70	BRABSO				PAIK H.W. INDIANA UNIV.REP.C00-2009-31	LB I/9B
70	CHASE	DO	2.0-6.0	B	CHASE R.C. PR D2,2588	NOT INCL
70	CRITTE	D-	2.3-3.	B	CRITTENDEN R.R. PR D1,3050	NOT INCL
70	FELLIN	D-	1.7-5.	F	FELLINGER M. PR D2,1777	LB I/7
70	GIORDE	T-	5.0		GIORDENESCU N. DUBNA PI-5460	NOT INCL
70	HILL1	PO	0.4	F	HILL R.E. PR D2,1199	LB I/7
70	HILL	D-P-	1.7-2.5	FM	HILL R.E. PR D1,729	LB I/9B
70	HILL	D+P+	1.0	F	HILL R.E. PR D1,729	NOT INCL
70	RUST	D+	5.0	F	RUST D.R. PRL 24,1361	LB I/7
70	SCHOTA	D+T+	5.0	F	SCHOTANUS D. NP B22,45	NOT INCL
70	SHERDE	P+	2.5-3.	B	SHERDEN D.J. PRL 25,898, SEE 73SCHEID	2ND PUBL
69	ALLABY	T-	20.-65.		ALLABY J.V. PL 30B,500, SEE 70ALLABY	2ND PUBL
69	ANTOPO	D+	1.5-3.8	B	ANTOPOLSKI V.D. SJNP 9,466 (PI-N)	NOT INCL
69	BAKER	D+D-	2.8-3.5	B	BAKER W.F. NP B9,249	LB I/7
69	BOOTH	D+	2.7	B	BOOTH N.E. EFI 69-34 (CHICAGO)	NOT INCL
69	BOWEN	D-	1.0	M	BOWEN T. PR 178,2082	NOT INCL
69	BRADAM	D-	0.9	FM	BRADAMANTE I. LETT.AL NUOVO CIM. 1,177	LB I/7
69	BRODY	D-	0.5-1.	FB	BRODY A. PRL 22,1401,SEE BRODY 71	2ND PUBL
69	BULOS	DOL	0.6-1.2	FB	BULOS F. PR 187,1827	NOT INCL
69	BUSZA	D-D+	1.7-2.5	FB	BUSZA W. PR 180,1339	LB I/7

69 CARROL	DO	1.7-2.4	F	CARROL A.S. PR 177,2047	LB I/7
69 CHANDL	D+	2.1-5.	B	CHANDLER J.P. PRL 23,186 SEE 71SIDWEL	2ND PUBL
69 CHASE	DO	2.-6.	B	CHASE R.C. PRL 22,1137,SEE 70CHASE	2ND PUBL
69 DELER	D+	0.9-1.	FB	DELER B. CEA-R-3579 (SACLAY)	NOT INCL
69 DERRE	D-	0.5-0.6	FB	DERRE J. THESIS (ORSAY)	LB I/7
69 FELLIN	D-	2.5-3.	M	FELLINGER M. PRL 23,600	LB I/7
69 FOLEY	D+D-	8.-26.	C	FOLEY K.J. PR 181,1775	LB I/7
69 KISTIA	DO	5.8	B	KISTIAKOWSKY V. PRL 22,618,SEE 72KISTIA	2ND PUBL
69 MATULE	DO	4.	F	MATULENKO J. ACTA.PHYS.POL.35,625	NOT INCL
69 OWEN	D-D+	5.8-17.	FB	OWEN D.P. PR 181,1794	NOT INCL
69 SCHNEI	DO	4.0-11.	B	SCHNEIDER J. PRL 23,1068,SEE 71SCHNEI	2ND PUBL
69 TULI	D-	2.	FB	TULI S.K. NP B12,79	NOT INCL
68 ADERHO	D+	8.0	F	ADERHOLZ M. NP B8,45	NOT INCL
68 ALLEN	D-	1.7	FB	ALLEN D.D. NC 58A,701,SEE 66ALLEN	2ND PUBL
68 ANDERS	D-	8.0-16.	B	ANDERSON E.W. PRL 20,1529	LB I/7
68 ANTHON	D-	2.5-5.	B	ANTHONY R. PRL 21,1605,SEE 72MEANLY	2ND PUBL
68 ANTOPO	DO	1.5-3.8	B	ANTOPOLSKI V.D. PL B28,223,SJNP 9,598(69)	NOT INCL
68 ARENDS	P-	.34-.5	B	ARENS J.F. PR 167,1261	LB I/7
68 ASHMOR	D-	6.,8.	M	ASHMORE A. PRL 21,387,SEE 69OWEN	2ND PUBL
68 BAKER	D+	5.0-7.	B	BAKER W.F. PL 28B,291,SEE 71BAKER	2ND PUBL
68 BANAIG	D-D+	2.8-3.	MB	BANAIGS J. NP B8,31	LB I/7
68 BERTAN	D-	0.7-0.8	FB	BERTANZA L.,CERN PREPRINT 8990	NOT INCL
68 BIZARD	P-P+	.89-1.	MB	BIZARD G. NP B5,515	NOT INCL
68 CARROL	D-D+	1.5-3.	B	CARROL A.S. PRL 20,607	LB I/7
68 CARTER	T-T+	0.5-2.7		CARTER A.A. PR 168,1457	LB I/7
68 COX	P-	.64-2.	FB	COX J. PR 184,1453	LB I/7
68 CROUCH	DOL	1.4-4.		CROUCH H.R. PRL 21,845	NOT INCL
68 CROWE	D-D+	.14	FB	CROWE K.M. UCRL-18473 (BERKELEY)	NOT INCL
68 DEBAIS	D+	.85	FB	DEBAISIEUX J. NP B5,147	NOT INCL
68 DROBNI	PO	2.-5.	F	DROBNIS D.D. PRL 20,274	LB I/7
68 DUKE	P-	0.9-1.6	FB	DUKE P.J. PR 166,1448	LB I/7
68 ESTERL	P-P+	5.1	F	ESTERLING R.J. PRL 21,1410,SEE 73SCHEID	2ND PUBL
68 HYMAN	DO	0.7-0.8	B	HYMAN E. PR 165,1437	NOT INCL
68 OREAR	D-	9.8-13.6	M	OREAR J. PL B28,61,SEE 69OWEN	2ND PUBL
68 OREAR1	D-D+	6.-17.	B	OREAR J. PRL 21,389,SEE 69OWEN	2ND PUBL
68 REYNOL	D-	2.2	FB	REYNOLDS B.G. PR 173,1403	LB I/7
68 RISK	DO	0.5-2.1	F	RISK W.S. PR 167,1249	LB I/7
68 WAHLIG	DO	2.4-10.	F	WAHLIG M.A. PR 168,1515	LB I/7
68 WALLE	D-	.84	FB	VAN DER WALLE R.T. NC A53,745	NOT INCL
68 WALOSC	D-	0.3	B	WALOSCHEK P. PRIV.COMM.	NOT INCL
68 YAMAMO	D+	2.8	FB	YAMAMOTO S.S. PR 173,1302	NOT INCL
68 YVERT	DO	2.5-5.9	F	YVERT M. THESIS(PARIS)	LB I/7
67 BANNER	D-D+	.53,.61	FB	BANNER M. NC A50,431	LB I/7
67 BARMIN	DO	2,8	FB	BARMIN V.V. SJNP 4,592	LB I/7
67 BORGHI	P-P+	6.0-12.	F	BORGHINI M. PL 24B,77	LB I/7
67 CHIU	DO	.6 -1.4	FB	CHIU C.B., PR 156,1415	LB I/7
67 COFFIN	D-D+	2.3-6.	FB	COFFIN C.T. PR 159,1169	LB I/7
67 DOBROW	D+	2.6-4.7	B	DOBROWOLSKI T. PL B24,203	LB I/7
67 EDWARD	D+	.2	FB	EDWARDS D.N. PROC.PHYS.SOC 92,602	LB I/7
67 FRANK	DOL	.2		FRANK S.G. PROC.PHYS.SOC.92,609	LB I/7
67 EISNER	D-	4.2	FB	EISNER R.L. PR 164,1699	LB I/7
67 FEMINO	D-	.8	FB	FEMINO S. NC 52A,892	NOT INCL
67 FOLEY	T-T+	8.-22.		FOLEY K.J. PRL 19,330	LB I/7
67 FOLEY1	D-D+	8.-26.	C	FOLEY K.J. PRL 19,193,SEE 69FOLEY	NOT INCL
67 HANSRO	P-	.6-3.3	BM	HANSROUL M. UCRL-17263 (THESIS,BERKELEY)	LB I/7
67 JOHNSO	P+	.74-3.7	FB	JOHNSON C.H. UCRL-17683 (THESIS,BERKELEY)	LB I/7
67 KORMAN	D-	1.6-5.3	B	KORMANYOS S.W. PR 164,1661	LB I/7
67 METZGE	D+	1.0	FB	METZGER W.J. PR 164,1680	LB I/7
66 ALLEN	D-	1.7	FB	ALLEN D.D. PL 21,468	NOT INCL
66 ALFF-S	D+	2.3,2.9	MB	ALFF-STEINBERGER, PR 145,1072	NOT INCL
66 BACKEN	DO	10.	F	BACKENSTOSS G. NC 42,814	NOT INCL
66 BERTAN	D-	.90	FB	BERTANZA L. NC 44,712	LB I/7
66 BRODY	D-D+	4.2-7.	B	BRODY H. PRL 16,828	NOT INCL
66 CITRON	T-T+	2.-7.		CITRON A. PR 144,1101	LB I/7
66 DICKIN	P-	.49	M	DICKINSON D.F. PL 20,549	LB I/7
66 DONALD	D-	.1	BM	DONALD R.A. PROC.PHYS.SOC.87,445	LB I/7
66 DUKE	D-D+	.9-1.6	FB	DUKE PR 149,1077	LB I/7
66 JACOBS	D-	2.-3.2	FB	JACOBS L.D. UCRL-16877 (BERKELEY)	NOT INCL
66 OLIVER	D-	.8	FB	OLIVER J.D. PR.147,932	NOT INCL
66 OREAR	D-D+	4.-12.	FB	OREAR J. PR 152,1162	NOT INCL
66 POIRIE	D-D+	.57	FB	POIRIER C.F. PR 143,1092 AND 148,1311	NOT INCL
66 SONDER	DO	3.-18.	F	SONDEREGGER P. PL 20,75	LB I/7
66 TROKA	D+	.36	FB	TROKA W. PR 144,1115	LB I/7
66 VASILE	P-	.42	BM	VASILEVSKII I.M. PL 23,174	LB I/7

65	BAREYR	P-P+	.53-.62	BM	BAREYRE P. PRL 14,198	LB I/7
65	BURNST	D-	.68	FB	BURNSTEIN R.A. PR 137B,1044	NOT INCL
65	CUNDY	D-	.10	BM	CUNDY D.C. PROC.PHY.SOC 85,257	NOT INCL
65	DEBAIS	D+	.63	FB	DEBAISEUX J. NP 63,273	NOT INCL
65	FOCARD	P-	8.5	F	FOCARDI S. NC 39,289	NOT INCL
65	FOLEY	D-	15.-25.	F	FOLEY K.J. PRL 15,45	LB I/7
65	FOLEY1	D-D+	8.-24.	C	FOLEY K.J. PRL 14,862, SEE 69FOLEY	2ND PUBL
65	GALBRA	T-T+	6.-22.		GALBRAITH W. PR B138,913	LB I/7
65	HARTIN	D-D+	8.5-18.	F	HARTING D. NC 38,60	LB I/7
65	JAMES	D+	1.8,2.	FB	JAMES F.E. PL 19,72	NOT INCL
65	KURZ	DO	.49	M	SEE 65LIND	2ND PUBL
65	LIND	DO	.43-.49	BM	LIND D.L. PR B138,1509	LB I/7
65	MANNEL	DO	6.0-16.	F	MANNELLI I. PRL 14,408	NOT INCL
65	ODGEN	D-D+	.42-.77	FB	ODGEN P.M. PR B137,1115	LB I/7
65	PERL	D-	3.6	FB	PERL M.L. PR B138,707	NOT INCL
65	SAVIN	D+	3.2	B	SAVIN I.A. PL 17,68	NOT INCL
65	STIRLI	DO	6.-18.	F	STIRLING A.V. PRL 14,763,	LB I/7
64	ADERHO	D-D+	4.0	FB	ADERHOLZ M. NC 31,729 AND PL 10,248	NOT INCL
64	AMBLAR	T-T+	0.8-1.8		AMBLARD B. PL 10,138	LB I/7
64	BARMIN	DO	1.5	FB	BARMIN V.V. SOV.PHYS. 19,102	LB I/7
64	BIGI	DO	1.1	FB	BIGI A. NC 34,878	NOT INCL
64	BORGEA	DO	.8-1.9	F	BORGEAUD P. PL 10,134	NOT INCL
64	DAUDIN	D+	1.6	FB	DAUDIN A. NC 33,1300	NOT INCL
64	EANDI	P-P+	.65-1.4	BM	EANDI R.D. PR B136,536,1187	LB I/7
64	FAISSN	DO	4.0	MF	FAISSNER H. PL 11,178	LB I/7
64	HELLAN	D-D+	.65-1.7	BM	HELLAND J.A. PR B134,1062 AND B134,1079	LB I/7
64	MULLER	DO	.72,1.	FB	MULLER A. PL 10,349	NOT INCL
64	SAXER	D-	2.-5.	C	SAXER H.I. MIC 03106-19-T (MICHIGAN)	NOT INCL
64	VITTIT	D-	.73	FB	VITTITOE C.N. PR B135,232	LB I/7
63	ALITTI	D-	1.6	FB	ALITTI J. NC 29,515	LB I/7
63	BRANDT	D-	10.	F	BRANDT S. PRL 10,413	LB I/7
63	CHAMBE	P+	.36	MB	CHAMBERLAIN O. PL 7,293	LB I/7
63	COOK	D+	1.5,2.5	FB	COOK V. PR 130,762	NOT INCL
63	CRITTE	D-	.90	FB	CRITTENDEN R.R. SIENNA CONF.	NOT INCL
63	DAMOUT	D-D+	2.0	FB	DAMOUTH D.E. PRL 11,287	NOT INCL
63	DIDDEN	T-T+	1.6-5.9		DIDDENS A.N. PRL 10,262	LB I/7
63	FOLEY	D-D+	7.-20.	F	FOLEY K.J. PRL 11,425	LB I/7
63	KELLMA	D-	.25,.38	FB	KELLMANN S. PR 129,365	LB I/7
63	KNAPP	D-D+	.1	MB	KNAPP D.E. PR 131,1822	LB I/7
63	NEWCOM	D+	.73	FB	NEWCOMB P.C.A. PR 132,1283	NOT INCL
63	PERL	D-D+	2.9-5.	FB	PERL M.L. PR 132,1252	NOT INCL
63	PICKUP	D-	1.0-1.2	FB	PICKUP E. PR 132,1819	NOT INCL
63	RUGGE	D-	.43	FB	RUGGE H.R. PR 129,2300	LB I/7
63	VIK	D-P-	.43	FB	VIK O.T. PR 129,2311	LB I/7
62	AINUTD	D-	7.3	F	AINUTDINOV M.S. SOV.PHYS.15,1038	NOT INCL
62	BARLOU	D+	.73-1.2	FB	BARLOUTAUD R. PL 1,207 AND NC 26,1409	NOT INCL
62	BEALL	P-	.62-1.0	M	BEALL E.F. PR 126,1554	NOT INCL
62	BIDAN	D+	1.1	MF	BIDAN U. NC 24,334	NOT INCL
62	CZAPEK	D-	16.	F	CZAPEK G. PL 1,226	NOT INCL
62	KURZ	DO	.54	M	KURZ R.J. UCRL-10564 (BERKELEY)	NOT INCL
62	MIYAKE	DOL	.09		MIYAKE K. PR 126,2188	LB I/7
62	WEINBE	DO	1.1	FB	WEINBERG A. PRL 8,70	NOT INCL
61	BERTAN	D-	1.3	FB	BERTANZA L. NC 19,467	NOT INCL
61	BUDAGO	D-	.22-.67	FB	BUDAGOV YU.A. NP 22,226	LB I/7
61	CARIS	DOL	.34-.49		CARIS J.C. PR 121,893	NOT INCL
61	DARDEL	T-T+	4.5-10.		DARDEL D. VON PRL 7,127	NOT INCL
61	DEAHL	D-	.33	FB	DEAHL J. PR 124,1987	LB I/7
61	FOOTE	P+	.43	BM	FOOTE J.H. PR 122,948	LB I/7
61	GOODWI	D-	.34,.4	FB	GOODWIN L.K. PR 122,655	LB I/7
61	GRARD	D-	.64-1.	B	GRARD F. NC 22,193	NOT INCL
61	LAI	D-	1.5,2.5	BM	LAI K.W. PRL 7,125	NOT INCL
61	LORIA	D+	.22	BM	LORIA A. NC 22,820	NOT INCL
61	ROGERS	D+P+	.43	M	ROGERS E.H. REV.MOD.PHYS.33,356	LB I/7
60	BARNES	D-D+	.1,.15	MB	BARNES.W. PR 117,238 AND 117,226	LB I/7
60	BERGIA	D-	1.0	FB	BERGIA S. NC 15,551	NOT INCL
60	DERADO	D-	1.1	FB	DERADO I. PR 118,309	NOT INCL
60	GIACOM	D-D+	.1	M	GIACOMELLI G. PR 117,250	LB I/7
60	YORK	DOL	.14-.19		YORK C.M. PR 119,1096	NOT INCL
60	KERNAN	DOL	.26		KERNAN W.J. PR 119,1092	NOT INCL
60	KUNZE	P-	.33	BM	KUNZE J.F. PR 117,859	NOT INCL
60	MILLER	D+	.09	MB	MILLER, PR 117,582	LB I/7
60	SHONLE	D-	.73-.79	FB	SHONLE J.I. PRL 5,157	NOT INCL
60	ZINOV	D-DO	.35,.24	FB	ZINOV V.G. SOV.PHYS. 11,794 AND 11,1010	LB I/7