

Particle Data Group

C. Amsler,¹ M. Doser,² M. Antonelli,³ D.M. Asner,⁴ K.S. Babu,⁵ H. Baer,⁶ H.R. Band,⁷ R.M. Barnett,⁸ E. Bergren,⁹ J. Beringer,⁸ G. Bernardi,⁹ W. Bertl,¹⁰ H. Bichsel,¹¹ O. Biebel,¹² P. Bloch,² E. Blucher,¹³ S. Blusk,¹⁴ R.N. Cahn,⁸ M. Carena,^{15,13,16} C. Caso,^{17*} A. Ceccucci,² D. Chakraborty,¹⁸ M.-C. Chen,¹⁹ R.S. Chivukula,²⁰ G. Cowan,²¹ O. Dahl,⁸ G. D'Ambrosio,²² T. Damour,²³ A. de Gouvêa,²⁴ T. DeGrand,²⁵ B. Dobrescu,¹⁵ M. Drees,²⁶ D.A. Edwards,²⁷ S. Eidelman,²⁸ V.D. Elvira,¹⁵ J. Erler,²⁹ V.V. Ezhela,³⁰ J.L. Feng,¹⁹ W. Fettscher,³¹ B.D. Fields,³² B. Foster,³³ T.K. Gaisser,³⁴ L. Garren,¹⁵ H.-J. Gerber,³¹ G. Gerbier,³⁵ T. Gherghetta,³⁶ G.F. Giudice,² M. Goodman,³⁷ C. Grab,³¹ A.V. Gritsan,³⁸ J.-F. Grivaz,³⁹ D.E. Groom,⁸ M. Grünewald,⁴⁰ A. Gurtu,^{41,2} T. Gutsche,⁴² H.E. Haber,⁴³ K. Hagiwara,⁴⁴ C. Hagmann,⁴⁵ K.G. Hayes,⁴⁶ J.J. Hernández-Rey,^{47†} K. Hikasa,⁴⁸ I. Hinchliffe,⁸ A. Höcker,² J. Huston,²⁰ P. Igo-Kemenes,⁴⁹ J.D. Jackson,⁸ K.F. Johnson,⁶ T. Junk,¹⁵ D. Karlen,⁵⁰ B. Kayser,¹⁵ D. Kirkby,¹⁹ S.R. Klein,⁵¹ I.G. Knowles,⁵² C. Kolda,⁵³ R.V. Kowalewski,⁵⁰ P. Kreitz,⁵⁴ B. Krusche,⁵⁵ Yu.V. Kuyanov,³⁰ Y. Kwon,⁵⁶ O. Lahav,⁵⁷ P. Langacker,⁵⁸ A. Liddle,⁵⁹ Z. Ligeti,⁸ C.-J. Lin,⁸ T.M. Liss,⁶⁰ L. Littenberg,⁶¹ J.C. Liu,⁵⁴ K.S. Lugovsky,³⁰ S.B. Lugovsky,³⁰ H. Mahlke,⁶² M.L. Mangano,² T. Mannel,⁶³ A.V. Manohar,⁶⁴ W.J. Marciano,⁶¹ A.D. Martin,⁶⁵ A. Masoni,⁶⁶ D. Milstead,⁶⁷ R. Miquel,⁶⁸ K. Mönig,⁶⁹ H. Murayama,^{70,71,8} K. Nakamura,⁴⁴ M. Narain,⁷² P. Nason,⁷³ S. Navas,^{74†} P. Nevski,⁶¹ Y. Nir,⁷⁵ K.A. Olive,⁷⁶ L. Pape,³¹ C. Patrignani,¹⁷ J.A. Peacock,⁵² A. Piepke,⁷⁷ G. Punzi,⁷⁸ A. Quadt,⁷⁹ S. Raby,⁸⁰ G. Raffelt,⁸¹ B.N. Ratcliff,⁵⁴ B. Renk,⁸² P. Richardson,⁶⁵ S. Roesler,² S. Rolli,⁸³ A. Romanouk,⁸⁴ L.J. Rosenberg,¹¹ J.L. Rosner,¹³ C.T. Sachrajda,⁸⁵ Y. Sakai,⁴⁴ S. Sarkar,⁸⁶ F. Sauli,² O. Schneider,⁸⁷ D. Scott,⁸⁸ W.G. Seligman,⁸⁹ M.H. Shaevitz,⁹⁰ T. Sjöstrand,⁹¹ J.G. Smith,²⁵ G.F. Smoot,⁸ S. Spanier,⁵⁴ H. Spieler,⁸ A. Stahl,⁹² T. Stanev,³⁴ S.L. Stone,¹⁴ T. Sumiyoshi,⁹³ M. Tanabashi,⁹⁴ J. Terning,⁹⁵ M. Titov,⁹⁶ N.P. Tkachenko,³⁰ N.A. Törnqvist,⁹⁷ D. Tovey,⁹⁸ G.H. Trilling,⁸ T.G. Trippe,⁸ G. Valencia,⁹⁹ K. van Bibber,⁴⁵ M.G. Vincter,⁴ P. Vogel,¹⁰⁰ D.R. Ward,¹⁰¹ T. Watari,¹⁰² B.R. Webber,¹⁰¹ G. Weiglein,⁶⁵ J.D. Wells,¹⁰³ M. Whalley,⁶⁵ A. Wheeler,⁵⁴ C.G. Wohl,⁸ L. Wolfenstein,¹⁰⁴ J. Womersley,¹⁰⁵ C.L. Woody,⁶¹ R.L. Workman,¹⁰⁶ A. Yamamoto,⁴⁴ W.-M. Yao,⁸ O.V. Zenin,³⁰ J. Zhang,¹⁰⁷ R.-Y. Zhu,¹⁰⁸ P.A. Zyla⁸

Technical Associates: G. Harper,⁸ V.S. Lugovsky,³⁰ P. Schaffner⁸

1. *Physik-Institut, Universität Zürich, CH-8057 Zürich, Switzerland*
2. *CERN, European Organization for Nuclear Research, CH-1211 Genève 23, Switzerland*
3. *Lab. Nazionali di Frascati dell'INFN, CP 13, via E. Fermi, 40, I-00044 Frascati (Roma), Italy*
4. *Department of Physics, Carleton University, 1125 Colonel By Drive, Ottawa, ON K1S 5B6, Canada*
5. *Department of Physics, Oklahoma State University, Stillwater, OK 74078, USA*
6. *Department of Physics, Florida State University, Tallahassee, FL 32306, USA*
7. *Department of Physics, University of Wisconsin, Madison, WI 53706, USA*
8. *Physics Division, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, Berkeley, CA 94720, USA*
9. *LPNHE, IN2P3-CNRS et Universités de Paris 6 et 7, F-75252 Paris, France*
10. *Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland*
11. *Department of Physics, University of Washington, Seattle, WA 98195, USA*
12. *Ludwig-Maximilians-Universität, Department für Physik, Schellingstr. 4, D-80799 München, Germany*
13. *Department of Physics, University of Chicago, Chicago, IL 60637-1433, USA*
14. *Department of Physics, Syracuse University, Syracuse, NY, 13244-1130, USA*
15. *Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510, USA*
16. *Enrico Fermi Institute, University of Chicago, 5640 Ellis Av., Chicago, IL 60637, USA*
17. *Dipartimento di Fisica e INFN, Università di Genova, I-16146 Genova, Italy*
18. *Department of Physics, Northern Illinois University, DeKalb, IL 60115, USA*
19. *Department of Physics and Astronomy, University of California, Irvine, CA 92697-4576, USA*
20. *Michigan State University, Dept. of Physics and Astronomy, East Lansing, MI 48824-2320, USA*
21. *Department of Physics, Royal Holloway, University of London, Egham, Surrey TW20 0EX, UK*
22. *INFN - Sezione di Napoli Complesso Universitario Monte Sant'Angelo, Via Cintia, 80126 Napoli, Italy*
23. *Institut des Hautes Etudes Scientifiques, F-91440 Bures-sur-Yvette, France*
24. *Department of Physics and Astronomy, Northwestern University, Evanston, IL 60208, USA*
25. *Department of Physics, University of Colorado at Boulder, Boulder, CO 80309, USA*
26. *Universität Bonn, Physikalisches Institut, Nussallee 12, D-53115 Bonn, Germany*
27. *Deutsches Elektronen-Synchrotron DESY, Notkestraße 85, D-22603 Hamburg, Germany*
28. *Budker Institute of Nuclear Physics, RU-630090, Novosibirsk, Russia*
29. *Departamento de Física Teórica, Instituto de Física, Universidad Nacional Autónoma de México, México D.F. 04510, México*
30. *COMPAS Group, Institute for High Energy Physics, RU-142284, Protvino, Russia*
31. *Institute for Particle Physics, ETH Zürich, CH-8093 Zürich, Switzerland*
32. *Department of Astronomy, University of Illinois, 1002 W. Green St., Urbana, IL 61801, USA*

* Deceased

† J.J. Hernández-Rey and S. Navas acknowledge support from MICINN, Spain (FPA2005-25354-E and FPA2007-29104-E)

33. Denys Wilkinson Building, Department of Physics, University of Oxford, Oxford, OX1 3RH, UK
34. Bartol Research Institute, University of Delaware, Newark, DE 19716, USA
35. CEA/Saclay, DSM/IRFU, BP 2, F-91191 Gif s Yvette, France
36. School of Physics, University of Melbourne, Victoria, 3010 Australia
37. Argonne National Laboratory, 9700 S. Cass Ave., Argonne, IL 60439-4815, USA
38. Johns Hopkins University, Baltimore, Maryland 21218, USA
39. LAL, IN2P3-CNRS et Univ. de Paris 11, F-91898 Orsay CEDEX, France
40. Dept. Subatomic Physics, University of Ghent, Proeftuinstraat 86, B-9000 Ghent, Belgium
41. Tata Institute of Fundamental Research, Mumbai (Bombay) 400 005, India
42. Institut für Theoretische Physik, Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Germany
43. Santa Cruz Institute for Particle Physics, University of California, Santa Cruz, CA 95064, USA
44. KEK, High Energy Accelerator Research Organization, Oho, Tsukuba-shi, Ibaraki-ken 305-0801, Japan
45. Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA 94550, USA
46. Department of Physics, Hillsdale College, Hillsdale, MI 49242, USA
47. IFIC — Instituto de Física Corpuscular, Universitat de València — C.S.I.C., E-46071 Valencia, Spain
48. Department of Physics, Tohoku University, Aoba-ku, Sendai 980-8578, Japan
49. Physikalisches Institut, Universität Heidelberg, Philosophenweg 12, D-69120 Heidelberg, Germany
50. University of Victoria, Victoria, BC V8W 3P6, Canada
51. Nuclear Science Division, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, Berkeley, CA 94720, USA
52. Institute for Astronomy, University of Edinburgh, Royal Observatory, Blackford Hill, Edinburgh, EH9 3JZ, Scotland, UK
53. Department of Physics, University of Notre Dame, 225 Nieuwland Hall, Notre Dame, IN 46556, USA
54. Stanford Linear Accelerator Center, P.O. box 4349, Stanford, CA 94309, USA
55. Institute of Physics, University of Basel, CH-4056 Basel, Switzerland
56. Yonsei University, Department of Physics, 134 Sinchon-dong, Sudaemoon-gu, Seoul 120-749, South Korea
57. Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, UK
58. School of Natural Science, Institute for Advanced Study, Princeton, NJ 08540, USA
59. Astronomy Centre, University of Sussex, Falmer, Brighton BN1 9QH, UK
60. Department of Physics, University of Illinois, 1110 W. Green Street, Urbana, IL 61801, USA
61. Physics Department, Brookhaven National Laboratory, Upton, NY 11973, USA
62. Laboratory of Elementary-Particle Physics, Cornell University, Ithaca, NY 14853, USA
63. University Siegen, Fachbereich fur Physik, Siegen, Germany
64. Department of Physics, University of California at San Diego, La Jolla, CA 92093, USA
65. Institute for Particle Physics Phenomenology, Department of Physics, University of Durham, Durham DH1 3LE, UK
66. INFN Sezione di Cagliari, Cittadella Universitaria de Monserrato, Casella postale 170, I-09042 Monserrato (CA), Italy
67. Fysikum, Stockholms Universitet, AlbaNova University Centre, SE-106 91 Stockholm, Sweden
68. Institució Catalana de Recerca i Estudis Avançats, Institut de Física d'Altes Energies, E-08193 Bellaterra (Barcelona), Spain
69. DESY-Zeuthen, D-15735 Zeuthen, Germany
70. Institute for the Physics and Mathematics of the Universe, University of Tokyo, Kashiwa, 277-8568, Japan
71. Department of Physics, University of California, Berkeley, CA 94720, USA
72. Brown University, Department of Physics, 182 Hope Street, Providence, RI 02912, USA
73. INFN, Sez. di Milano-Bicocca, Piazza della Scienza, 3, I-20126 Milano, Italy
74. Dpto. de Física Teórica y del Cosmos & C.A.F.P.E., Universidad de Granada, 18071 Granada, Spain
75. Weizmann Institute of Science, Department of Particle Physics, P.O. Box 26 Rehovot 76100, Israel
76. School of Physics and Astronomy, University of Minnesota, Minneapolis, MN 55455, USA
77. Department of Physics and Astronomy University of Alabama, 206 Gallalee Hall, Box 870324, Tuscaloosa, AL 35487-0324, USA
78. INFN and Dipartimento di Fisica, Università di Pisa, I-56127 Pisa, Italy
79. Georg-August-Universität Göttingen, II. Physikalisches Institut, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany
80. Department of Physics, The Ohio State University, 191 W. Woodruff Ave., Columbus, OH 43210, USA
81. Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, D-80805 München, Germany
82. Institut für Physik, Johannes-Gutenberg Universität Mainz, D-55099 Mainz, Germany
83. Tufts University, Robinson Hall, Medford, MA 02155, USA
84. Moscow Engineering and Physics Institute, 31, Kashirskoye shosse, 115409 Moscow, Russia
85. School of Physics and Astronomy, University of Southampton, Highfield, Southampton SO17 1BJ, UK
86. Rudolf Peierls Centre for Theoretical Physics, University of Oxford, 1 Keble Road, Oxford OX1 3NP, UK
87. Ecole Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland
88. Department of Physics and Astronomy, University of British Columbia, Vancouver, BC V6T 1Z1, Canada

-
- 89. *Columbia University, Nevis Labs, PO Box 137, Irvington, NY 10533, USA*
 - 90. *Department of Physics, Columbia University, 538 West 120th St., New York, NY 10027, USA*
 - 91. *Department of Theoretical Physics, Lund University, S-223 62 Lund, Sweden*
 - 92. *III. Physikalisches Institut, Physikzentrum, RWTH Aachen University, 52056 Aachen, Germany*
 - 93. *High Energy Physics Laboratory, Tokyo Metropolitan University, Tokyo, 192-0397, Japan*
 - 94. *Department of Physics, Nagoya University, Chikusa-ku, Nagoya, 464-8602, Japan*
 - 95. *Department of Physics, University of California, Davis, CA 95616, USA*
 - 96. *CEA/Saclay, B.P.2, Orme des Merisiers, F-91191 Gif-sur-Yvette Cedex, France*
 - 97. *Department of Physical Sciences, POB 64 FIN-00014 University of Helsinki, Finland*
 - 98. *Department of Physics and Astronomy, University of Sheffield, Sheffield S3 7RH, UK*
 - 99. *Department of Physics, Iowa State University, Ames, IA 50011, USA*
 - 100. *California Institute of Technology, Kellogg Radiation Laboratory 106-38, Pasadena, CA 91125, USA*
 - 101. *Cavendish Laboratory, J.J. Thomson Avenue, Cambridge CB3 0HE, UK*
 - 102. *Department of Physics, University of Tokyo, Tokyo 113-0033, Japan*
 - 103. *Michigan Center for Theoretical Physics, Physics Dept., 2477 Randall Laboratory, University of Michigan, Ann Arbor, MI 48109, USA*
 - 104. *Department of Physics, Carnegie Mellon University, Pittsburgh, PA 15213, USA*
 - 105. *STFC Rutherford Appleton Laboratory, Didcot, OX11 0QX, UK*
 - 106. *Department of Physics, George Washington University Virginia Campus, Ashburn, VA 20147-2604, USA*
 - 107. *IHEP, Chinese Academy of Sciences, Beijing 100049, P.R. China*
 - 108. *California Institute of Technology, Physics Department, 256-48, Pasadena, CA 91125, USA*