

6. RADIATION SOURCES AND OPTICS

References

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- Arndt, U. W., Duncumb, P., Long, J. V. P., Pina, L. & Inneman, A. (1998). *Focusing mirrors for use with microfocus X-ray tubes*. *J. Appl. Cryst.* **31**, 733.
- Arndt, U. W., Long, J. V. P. & Duncumb, P. (1998). *A microfocus X-ray tube used with focusing collimators*. *J. Appl. Cryst.* **31**, 936–944.
- Arndt, U. W. & Stubbings, S. J. (1988). *Miniature ionisation chambers*. *J. Appl. Cryst.* **21**, 577.
- Bailey, R. L. (1978). *The design and operation of magnetic liquid shaft seals*. In *Thermomechanics of magnetic fluids*, edited by B. Berkovsky. London: Hemisphere.
- Beuville, E., Beche, J.-F., Cork, C., Douence, V., Earnest, J., Millaud, D., Nygren, H., Padmore, B., Turko, G., Zizka, G., Datte, P. & Xuong Ng, H. (1997). *Two-dimensional pixel array sensor for protein crystallography*. *Proc. SPIE*, **2859**, 85–92.
- Bilderback, D. H., Thiel, D. J., Pahl, R. & Brister, K. E. (1994). *X-ray applications with glass-capillary optics*. *J. Synchrotron Rad.* **1**, 37–42.
- Bly, P. & Gibson, D. (1996). *Polycapillary optics focus and collimate X-rays*. *Laser Focus World*, March issue.
- Buras, B. & Tazzari, S. (1984). Editors. *European Synchrotron Radiation Facility*. Geneva: ESRP.
- Elliott, A. (1965). *The use of toroidal reflecting surfaces in X-ray diffraction cameras*. *J. Sci. Instrum.* **42**, 312–316.
- Forsyth, J. M. & Frankel, R. D. (1984). *Experimental facility for nanosecond time-resolved low-angle X-ray diffraction experiments using a laser-produced plasma source*. *Rev. Sci. Instrum.* **55**, 1235–1242.
- Fourme, R., Ducruix, A., Ries-Kautt, M. & Capelle, B. (1995). *The perfection of protein crystals probed by direct recording of Bragg reflection profiles with a quasi-planar X-ray wave*. *J. Synchrotron Rad.* **2**, 136–142.
- Franks, A. (1995). *An optically focusing X-ray diffraction camera*. *Proc. Phys. Soc. London Sect. B*, **68**, 1054–1069.
- Genz, H., Graf, H.-D., Hoffmann, P., Lotz, W., Nething, U., Richter, A., Kohl, H., Weickenmeyer, A., Knüpfner, W. & Sellschop, J. P. F. (1990). *High intensity electron channeling and perspectives for a bright tunable X-ray source*. *Appl. Phys. Lett.* **57**, 2956–2958.
- Green, M. (1963). *The target absorption correction in X-ray microanalysis*. In *X-ray optics and X-ray microanalysis*, edited by H. H. Pattee, V. E. Cosslett & A. Engström, pp. 361–377. New York and London: Academic Press.
- Green, M. & Cosslett, V. E. (1968). *Measurements of K, L and M shell X-ray production efficiencies*. *Br. J. Appl. Phys. Ser. 2*, **1**, 425–436.
- Hofmann, A. (1978). *Quasi-monochromatic synchrotron radiation from undulators*. *Nucl. Instrum. Methods*, **152**, 17–21.
- International Tables for Crystallography* (1999). Vol. C. *Mathematical, physical and chemical tables*, edited by A. J. C. Wilson & E. Prince. Dordrecht: Kluwer Academic Publishers.
- Ishimura, T., Shiraiwa, Y. & Sawada, M. (1957). *The input power limit of the cylindrical rotating anode of an X-ray tube*. *J. Phys. Soc. Jpn.* **12**, 1064–1070.
- Kirkpatrick, P. & Baez, A. V. (1948). *J. Opt. Soc. Am.* **56**, 1–13.
- Kirz, J. (1974). *Phase zone plates for X-rays and the extreme UV*. *J. Opt. Soc. Am.* **64**, 301–309.
- Kleffer, J. C., Chaker, M., Matte, J. P., Pépin, H., Côté, C. Y., Beaudouin, Y., Johnston, T. W., Chien, C. Y., Coe, S., Mourou, G. & Peyrusse, O. (1993). *Ultra-fast X-ray sources*. *Phys. Fluids*, **B5**, 2676–2681.
- Kohra, K., Ando, M., Natsushita, T. & Hashizume, H. (1978). *Nucl. Instrum. Methods*, **152**, 161–166.
- Kumakhov, M. A. & Komarov, F. K. (1990). *Phys. Rep.* **191**, 289–350.
- Lemonnier, M., Fourme, R., Rousseaux, F. & Kahn, R. (1978). *X-ray curved-crystal monochromator system at the storage ring DCI*. *Nucl. Instrum. Methods*, **152**, 173–177.
- MacDonald, C. A., Owens, S. M. & Gibson, W. M. (1999). *Polycapillary X-ray optics for microdiffraction*. *J. Appl. Cryst.* **32**, 160–167.
- Milch, J. R. (1983). *A focusing X-ray camera for recording low-angle diffraction from small specimens*. *J. Appl. Cryst.* **16**, 198–203.
- Montel, M. (1957). *X-ray microscopy with catamegonic roof mirrors*. In *X-ray microscopy and microradiography*, edited by V. E. Cosslett, A. Engstrom & H. H. Pattee Jr, pp. 177–185. New York: Academic Press.
- Müller, A. (1929). *A spinning target X-ray generator and its input limit*. *Proc. R. Soc. London Ser. A*, **125**, 507–516.
- Müller, A. (1931). *Further estimates of the input limits of X-ray generators*. *Proc. R. Soc. London Ser. A*, **132**, 646–649.
- Nagel, D. J. (1980). *Comparison of X-ray sources*. *Ann. N. Y. Acad. Sci.* **342**, 235–247.
- Nave, C., Clark, G., Gonzalez, A., McSweeney, S., Hart, M. & Cummings, S. (1995). *Tests of an asymmetric monochromator to provide increased flux on a synchrotron radiation beam line*. *J. Synchrotron Rad.* **2**, 292–295.
- Oosterkamp, W. J. (1948). *The heat dissipation in the anode of an X-ray tube*. *Philips Res. Rep.* **3**, 49–59, 161–173, 303–317.
- Osmic Inc. (1998). Sales literature. Osmic Inc., Troy, Michigan, USA.
- Padmore, H. A., Ackermann, G., Celestre, R., Chang, C. H., Franck, K., Howells, M., Hussain, Z., Irick, S., Locklin, S., MacDowell, A. A., Patel, J. R., Rah, S. Y., Renner, T. R. & Sandler, R. (1997). *Submicron white-beam focusing using elliptically bent mirrors*. *Synchrotron Radiat. News*, **10**, 18–26.
- Phillips, W. C. (1985). *X-ray sources*. *Methods Enzymol.* **114**, 300–316.
- Piestrup, M. A., Boyers, D. G., Pincus, C. I., Harris, J. L., Maruyama, X. K., Bergstrom, J. C., Caplan, H. S., Silzer, R. M. & Skopik, D. M. (1991). *Quasimonochromatic X-ray source using photo-absorption-edge transition radiation*. *Phys. Rev. A*, **43**, 3653–3661.
- Quintana, J. P. & Hart, M. (1995). *Adaptive silicon monochromators for high-power wigglers; design, finite-element analysis and laboratory tests*. *J. Synchrotron Rad.* **2**, 119–123.
- Schuster, M. & Göbel, H. (1997). *Application of graded multi-layer optics in X-ray diffraction*. *Adv. X-ray Anal.* **39**, 57–71.
- Schwinger, J. (1949). *On the classical radiation of accelerated electrons*. *Phys. Rev.* **75**, 1912–1925.
- Silfhout, R. G. van (1998). *A new water-cooled monochromator at DORIS III*. *Synchrotron Radiat. News*, **11**, 11–13.
- Smither, R. K. (1982). *New methods for focusing X-rays and gamma rays*. *Rev. Sci. Instrum.* **53**, 131–141.
- Winick, H. (1980). *Properties of synchrotron radiation*. In *Synchrotron radiation research*, edited by H. Winick & S. Doniach. New York: Plenum.
- Yoshimatsu, M. & Kozaki, S. (1977). *High brilliance X-ray source*. In *X-ray optics*, edited by H.-J. Queisser, ch. 2. Berlin: Springer.

6.2

- Ageron, P. (1989). *Cold neutron sources at ILL*. *Nucl. Instrum. Methods A*, **284**, 197–199.
- Akcasu, A. Z., Lellouche, G. S. & Shotkin, L. M. (1971). *Mathematical methods in nuclear reactor dynamics*. New York: Academic Press.
- Alberi, J., Fischer, J., Radeka, V., Rogers, L. C. & Schoenborn, B. P. (1975). *A two-dimensional position-sensitive detector for thermal neutrons*. *Nucl. Instrum. Methods*, **127**, 507–523.
- Alsmiller, R. G. & Lillie, R. A. (1992). *Design calculations for the ANS cold source. Part II. Heating rates*. *Nucl. Instrum. Methods A*, **321**, 265–270.
- Bacon, G. E. (1962). *Neutron diffraction*. Oxford University Press.
- Böni, P. (1997). *Supermirror-based beam devices*. *Physica B*, **234–236**, 1038–1043.

REFERENCES

6.2 (cont.)

- Borkowski, C. J. & Kopp, M. K. (1975). *Design and properties of position-sensitive proportional counters using resistance-capacitance position encoding*. *Rev. Sci. Instrum.* **46**, 951–962.
- Carpenter, J. M. (1977). *Pulsed spallation neutron sources for slow neutron scattering*. *Nucl. Instrum. Methods*, **145**, 91–113.
- Carpenter, J. M. & Yelon, W. B. (1986). *Neutron sources*. In *Methods of experimental physics*, Vol. 23A. New York: Academic Press.
- Cipriani, F., Castagna, J.-C., Caustre, L., Wilkinson, C. & Lehmann, M. S. (1997). *Large area neutron and X-ray image-plate detectors for macromolecular biology*. *Nucl. Instrum. Methods A*, **392**, 471–474.
- Clark, C. D., Mitchell, E. W. J., Palmer, D. W. & Wilson, I. H. (1966). *The design of a velocity selector for long wavelength neutrons*. *J. Sci. Instrum.* **43**, 1–5.
- Convert, P. & Forsyth, J. B. (1983). Editors. *Position-sensitive detection of thermal neutrons*. London: Academic Press.
- Copley, J. R. D. (1991). *Acceptance diagram analysis of the performance of vertically curved neutron monochromators*. *Nucl. Instrum. Methods*, **301**, 191–201.
- Copley, J. R. D. & Mildner, D. F. R. (1992). *Simulation and analysis of the transmission properties of curved-straight neutron guide systems*. *Nucl. Sci. Eng.* **110**, 1–9.
- Crawford, R. K. (1992). *Position-sensitive detection of slow neutrons – survey of fundamental principles*. *SPIE*, **1737**, 210–223.
- Ebisawa, T., Achiwa, N., Yamada, S., Akiyoshi, T. & Okamoto, S. (1979). *Neutron reflectivities of Ni–Mn and Ni–Ti multilayers for monochromators and supermirrors*. *J. Nucl. Sci. Technol.* **16**, 647–659.
- Freund, A. K. & Dolling, G. (1995). *Devices for neutron beam definition*. In *International tables for crystallography*, Vol. C. *Mathematical, physical and chemical tables*, edited by A. J. C. Wilson, pp. 375–382. Dordrecht: Kluwer Academic Publishers.
- Glasstone, S. & Sesonske, A. (1994). *Nuclear reactor engineering*. New York: Chapman and Hall.
- Hallsall, M. J. (1995). *WIMS – a general purpose code for reactor core analysis*. AEA Technology, Vienna.
- Harris, P., Lebeck, B. & Pedersen, J. S. (1995). *The three-dimensional resolution function for small-angle scattering and Laue geometries*. *J. Appl. Cryst.* **28**, 209–222.
- Hayter, J. B. & Mook, H. A. (1989). *Discrete thin-film multilayer design for X-ray and neutron supermirrors*. *J. Appl. Cryst.* **22**, 35–41.
- Hjelm, R. (1996). Editor. *Proceedings of the workshop on methods for neutron scattering instrumentation design*. Lawrence Berkeley National Laboratory, USA.
- Hughes, H. G. III (1988). *Monte Carlo simulation of the LANSCE target geometry*. *Proceedings of the tenth international collaboration on advanced neutron sources*, p. 455. New York: Institute of Physics.
- Jacobé, J., Feltn, D., Rambaud, A., Ratel, F., Gamon, M. & Pernock, J. B. (1983). *High pressure ³He multielectrode detectors for neutron localisation*. In *Position-sensitive detection of thermal neutrons*, edited by P. Convert & J. B. Forsyth, pp. 106–119. London: Academic Press.
- Jakeman, D. (1966). *Physics of nuclear reactors*. London: The English Universities Press.
- Johnson, M. W. (1986). Editor. *Workshop on neutron scattering data analysis*. Rutherford Appleton Laboratory, Chilton, England. Bristol: Institute of Physics.
- Johnson, M. W. & Stephanou, C. (1978). *MCLIB: a library of Monte Carlo subroutines for neutron scattering problems*. Report RL-78-090. Science Research Council, Chilton, England.
- Knott, R. B., Smith, G. C., Watt, G. & Boldeman, J. B. (1997). *A large 2D PSD for thermal neutron detection*. *Nucl. Instrum. Methods A*, **392**, 62–67.
- Komura, S., Takeda, T., Fujii, H., Toyoshima, Y., Osamura, K., Mochiki, K. & Hasegawa, K. (1983). *The 6-meter neutron small-angle scattering spectrometer at KUR*. *Jpn. J. Appl. Phys.* **22**, 351–356.
- Kostorz, G. (1979). *Neutron scattering. Treatise on materials science and technology*, Vol. 15. New York: Academic Press.
- Krueger, S., Koenig, B. W., Orts, W. J., Berk, N. F., Majkrzak, C. F. & Gawrisch, K. (1996). *Neutron reflectivity studies of single lipid bilayers supported on planar substrates*. In *Neutrons in biology*, edited by B. P. Schoenborn & R. B. Knott, pp. 205–213. New York: Plenum Press.
- Lewis, E. E. & Miller, W. F. (1993). *Computational methods of neutron transport*. Washington: American Nuclear Society Inc.
- Lillie, R. A. & Alsmiller, R. G. (1990). *Design calculations for the ANS cold neutron source*. *Nucl. Instrum. Methods A*, **295**, 147–154.
- Lowde, R. D. (1960). *The principles of mechanical neutron-velocity selection*. *J. Nucl. Energy*, **11**, 69–80.
- Mâaza, M., Farnoux, B., Samuel, F., Sella, C., Wehling, F., Bridou, F., Groos, M., Pardo, B. & Foulet, G. (1993). *Reduction of the interfacial diffusion in Ni–Ti neutron-optics multilayers by carburization of the Ni–Ti interfaces*. *J. Appl. Cryst.* **26**, 574–582.
- Magerl, A. & Wagner, V. (1994). Editors. *Proceedings of the workshop on focusing Bragg optics*. *Nucl. Instrum. Methods A*, Vol. 338.
- Maier-Leibnitz, H. & Springer, T. (1963). *The use of neutron optical devices on beam-hole experiments*. *J. Nucl. Energy*, **17**, 217–225.
- Majkrzak, C. F. (1991). *Polarised neutron reflectometry*. *Physica B*, **173**, 75–88.
- Mikula, P., Krüger, E., Scherm, R. & Wagner, V. (1990). *An elastically bent silicon crystal as a monochromator for thermal neutrons*. *J. Appl. Cryst.* **23**, 105–110.
- Mildner, D. F. R. & Hammouda, B. (1992). *The transmission of curved neutron guides with non-perfect reflectivity*. *J. Appl. Cryst.* **25**, 39–45.
- Niimura, N., Karasawa, Y., Tanaka, I., Miyahara, J., Takahashi, K., Saito, H., Koizumi, S. & Hidaka, M. (1994). *An imaging plate neutron detector*. *Nucl. Instrum. Methods A*, **349**, 521–525.
- Niimura, N., Minezaki, Y., Nonaka, T., Castagna, J.-C., Cipriani, F., Høghøj, P., Lehmann, M. S. & Wilkinson, C. (1997). *Neutron Laue diffractometry with an imaging plate provides an effective data collection regime for neutron protein crystallography*. *Nature Struct. Biol.* **4**, 909–914.
- Oed, A. (1988). *Position-sensitive detector with microstrip anode for electron multiplication with gases*. *Nucl. Instrum. Methods A*, **263**, 351–359.
- Oed, A. (1995). *Properties of micro-strip gas chambers (MSGC) and recent developments*. *Nucl. Instrum. Methods A*, **367**, 34–40.
- Pedersen, J. S., Posselt, D. & Mortensen, K. (1990). *Analytical treatment of the resolution function for small-angle scattering*. *J. Appl. Cryst.* **23**, 321–333.
- Popovici, M. & Yelon, W. B. (1995). *Focusing monochromators for neutron diffraction*. *J. Neutron Res.* **3**, 1–26.
- Prael, R. E. (1994). *A review of the physics models in the LAHET code*. Report LA-UR-94-1817. Los Alamos National Laboratory, USA.
- Prask, H. J., Rowe, J. M., Rush, J. J. & Schroeder, I. G. (1993). *The NIST cold neutron research facility*. *J. Res. NIST*, **98**, 1–14.
- Pynn, R. (1984). *Neutron scattering instrumentation at reactor based installations*. *Rev. Sci. Instrum.* **55**, 837–848.
- Radeka, V. (1988). *Low noise techniques in detectors*. *Annu. Rev. Nucl. Part. Sci.* **38**, 217–277.
- Radeka, V. & Boie, R. A. (1980). *Centroid finding method for position-sensitive detectors*. *Nucl. Instrum. Methods*, **178**, 543–554.
- Radeka, V., Schaknowski, N. A., Smith, G. C. & Yu, B. (1996). *High precision thermal neutron detectors*. In *Neutrons in biology*, edited by B. P. Schoenborn & R. B. Knott, pp. 57–67. New York: Plenum Press.
- Rausch, C., Bücherl, T., Gähler, R., Seggern, H. & Winnacker, A. (1992). *Recent developments in neutron detection*. *SPIE*, **1737**, 255–263.
- Richter, D. & Springer, T. (1998). *A twenty years forward look at neutron scattering facilities in the OECD countries and Russia*. OECD Publication. Strasbourg: European Science Foundation.

6.2 (cont.)

- Riste, T. (1970). *Singly bent graphite monochromators for neutrons*. *Nucl. Instrum. Methods*, **86**, 1–4.
- Russell, G. J., Ferguson, P. D., Pitcher, E. J. & Court, J. D. (1996). *Neutronics and the MLNSC spallation target system*. In *Applications of accelerators in research and industry – proceedings of the 14th international conference*, edited by J. L. Duggan and I. L. Morgan. AIP Conference Proceedings, Vol. 392, pp. 361–364.
- Sauli, F. (1977). *Principles of operation of multiwire proportional and drift chambers*. Report CERN-77-09. CERN, Geneva, Switzerland.
- Saxena, A. M. & Schoenborn, B. P. (1977). *Multilayer neutron monochromators*. *Acta Cryst.* **A33**, 805–813.
- Saxena, A. M. & Schoenborn, B. P. (1988). *Multilayer monochromators for neutron spectrometers*. *Mater. Sci. Forum*, **27/28**, 313–318.
- Schärpf, O. & Anderson, I. S. (1994). *The role of surfaces and interfaces in the behaviour of non-polarizing and polarizing supermirrors*. *Physica B*, **198**, 203–212.
- Schefer, J., Medarde, M., Fischer, S., Thut, R., Koch, M., Fischer, P., Staub, U., Horisberger, M., Bottger, G. & Donni, A. (1996). *Sputtering method for improving neutron composite germanium monochromators*. *Nucl. Instrum. Methods A*, **372**, 229–232.
- Schneider, D. K. & Schoenborn, B. P. (1984). *A new neutron small-angle diffraction instrument at the Brookhaven High Flux Beam Reactor*. In *Neutrons in biology*, edited by B. P. Schoenborn, pp. 119–141. New York: Plenum Press.
- Schoenborn, B. P. (1992a). *Multilayer monochromators and super mirrors for neutron protein crystallography using a quasi Laue technique*. *SPIE*, **1738**, 192–199.
- Schoenborn, B. P. (1992b). *Area detectors for neutron protein crystallography*. *SPIE*, **1737**, 235–243.
- Schoenborn, B. P. (1996). *A protein crystallography station at the Los Alamos Neutron Science Center*. Report LA-UR-96-3508, 11–64. Los Alamos National Laboratory, USA.
- Schoenborn, B. P., Court, D., Larson, A. C. & Ferguson, P. (1999). *Moderator decoupling options for structural biology at spallation neutron sources*. *J. Neutron Res.* **7**, 89–106.
- Schoenborn, B. P., Saxena, A. M., Stamm, M., Dimmler, G. & Radeka, V. (1985). *A neutron spectrometer with a two-dimensional detector for time resolved studies*. *Aust. J. Phys.* **38**, 337–351.
- Schoenborn, B. P., Schefer, J. & Schneider, D. (1986). *The use of wire chambers in structural biology*. *Nucl. Instrum. Methods A*, **252**, 180–187.
- Sears, V. F. (1983). *Theory of multilayer neutron monochromators*. *Acta Cryst.* **A39**, 601–608.
- Sears, V. F. (1989). *Neutron optics: an introduction to the theory of neutron optical phenomena and their applications*. *Oxford series on neutron scattering in condensed matter*. New York: Oxford University Press.
- Sivia, D. S., Silver, R. N. & Pynn, R. (1990). *The Bayesian approach to optimal instrument design*. In *Neutron scattering data analysis*, edited by M. W. Johnson, Institute of Physics Conference Series, Vol. 107, pp. 45–55.
- Soodak, H. (1962). Editor. *Reactor handbook*. New York: Wiley.
- Spanier, J. & Gelbard, E. M. (1969). *Monte Carlo principles and neutron transport problems*. London: Addison-Wesley.
- Stamm'ler, R. J. J. & Abbate, M. J. (1983). *Methods of steady-state reactor physics in nuclear design*. London: Academic Press.
- Stuhrmann, H. B. & Nierhaus, K. H. (1996). *The determination of the in situ structure by nuclear spin contrast variation*. In *Neutrons in biology*, edited by B. P. Schoenborn & R. B. Knott, pp. 397–413. New York: Plenum Press.
- Takahashi, K., Tazaki, S., Miyahara, J., Karasawa, Y. & Niimura, N. (1996). *Imaging performance of imaging plate neutron detectors*. *Nucl. Instrum. Methods A*, **377**, 119–122.
- Vellettaz, N., Assaf, J. E. & Oed, A. (1997). *Two dimensional gaseous microstrip detector for thermal neutrons*. *Nucl. Instrum. Methods A*, **392**, 73–79.
- Vogt, T., Passell, L., Cheung, S. & Axe, J. D. (1994). *Using wafer stacks as neutron monochromators*. *Nucl. Instrum. Methods A*, **338**, 71–77.
- Wagner, V., Friedrich, H. & Wille, P. (1992). *Performance of a high-tech neutron velocity selector*. *Physica B*, **180–181**, 938–940.
- Weisman, J. (1983). Editor. *Elements of nuclear reactor design*. Amsterdam: Elsevier Scientific Publishing Company.
- Well, A. A. van, de Haan, V. O. & Mildner, D. F. R. (1991). *The average number of reflections in a curved neutron guide*. *Nucl. Instrum. Methods A*, **309**, 284–286.
- West, C. D. (1989). *The US advanced neutron source*. ICANS X, Los Alamos USA, pp. 643–654.
- Wignall, G. D., Christen, D. K. & Ramakrishnan, V. (1988). *Instrumental resolution effects in small-angle neutron scattering*. *J. Appl. Cryst.* **21**, 438–451.
- Williams, M. M. R. (1966). *The slowing down and thermalization of neutrons*. Amsterdam: North Holland.
- Windsor, C. G. (1981). *Pulsed neutron scattering*. London: Wiley.
- Windsor, C. G. (1986). *Experimental techniques*. In *Methods of experimental physics*, Vol. 23A. New York, London: Academic Press.