# Fermions, criticality and superconductivity

She, J.H.

# Bibliography


[1] J. Zaanen, Nature **440**, 1118 (2006).

[2] A. F. M. Imada and Y. Tokura, Rev. Mod. Phys. **70**, 1039 (1998).

[3] H. V. Löhneysen, A. Rosch, M. Vojta, and P. Wölfle, Reviews of Modern Physics **79**, 1015 (2007).

[4] F. Kagawa, K. Miyagawa, and K. Kanoda, Nature **436**, 534 (2005).

[5] S. V. Kravchenko and M. P. Sarachik, Reports on Progress in Physics **67**, 1 (2004).

[6] J. Zaanen, Nature **422**, 569 (2003).

[7] A. Damascelli, Z. Hussain, and Z. Shen, Reviews of Modern Physics **75**, 473 (2003).

[8] S. A. Kivelson, I. P. Bindloss, E. Fradkin, V. Oganesyan, J. M. Tranquada, A. Kapitulnik, and C. Howald, Reviews of Modern Physics **75**, 1201 (2003).

[9] P. Abbamonte, A. Rusydi, S. Smadici, G. D. Gu, G. A. Sawatzky, and D. L. Feng, Nature Physics **1**, 155 (2005).

[10] M. Troyer and U. Wiese, Phys. Rev. Lett. **94**, 17201 (2005).

[11] J. G. Bednorz and K. A. Müller, Z. Phys. B: Condens. Matter **64**, 189 (1986).

[12] P. A. Lee, N. Nagaosa, and X. G. Wen, Rev. Mod. Phys. **78**, 17 (2006).

[13] J. Zaanen, G. A. Sawatzky, and J. W. Allen, Phys. Rev. Lett. **55**, 418 (1985).

[14] F. C. Zhang and T. M. Rice, Phys. Rev. B **37**, 3759 (1988).

[15] N. E. Hussey, J. Phys: Cond. Mat. **20**, 123201 (2008).

[16] C. Jaudet, J. Levallois, A. Audouard, D. Vignolles, B. Vignolle, R. Liang, D. A. Bonn, W. N. Hardy, N. Hussey, L. Taillefer, and C. Proust, Physica B **404**, 354 (2009).

[17] J. Zaanen and B. J. Overbosch, arXiv:0911.4070v1 [cond-mat.str-el] (unpublished).

[18] F. Steglich, J. Aarts, C. D. Bredl, W. Lieke, D. Meschede, W. Franz, and H. Schäfer, Phys. Rev. Lett. **43**, 1892 (1976).

[19] H. R. Ott, H. Rudigier, Z. Fisk, and J. L. Smith, Phys. Rev. Lett. **50**, 1595 (1983).

[20] H. v. Löhneysen, T. Pietrus, G. Portisch, H. G. Schlager, A. Schröder, M. Sieck, and T. Trappmann, Phys. Rev. Lett. **72**, 3262 (1994).

[21] P. Coleman, in *Handbook of Magnetism and Advanced Magnetic Materials*, edited by H. Kronmuller and S. Parkin (John Wiley and Sons, Hoboken, New Jersey, 2007), Vol. 1, p. 95.

[22] S. Doniach, Physica B **91**, 231 (1977).

[23] P. Gegenwart, Q. Si, and F. Steglich, Nature Physics **4**, 186 (2008).

[24] H. Shishido, R. Settai, H. Harima, and Y. Ōnuki, J. Phys. Soc. Jpn. **74**, 1103 (2005).

[25] G. R. Stewart, Rev. Mod. Phys. **73**, 797 (2006).

[26] C. Pfleiderer, Rev. Mod. Phys. **81**, 1551 (2009).

[27] A. A. Abrikosov, L. P. Gorkov, and I. E. Dzayloshinskii, *Methods of Quantum Field Theory in Statistical Physics* (Dover, New York, 1963).

[28] J. van Wezel, J. van den Brink, and J. Zaanen, Physical Review Letters **94**, 230401 (2005).

[29] M. Salmhofer and C. Honerkamp, Progress of Theoretical Physics **105**, 1 (2001).

[30] N. Mannella, W. L. Yang, X. J. Zhou, H. Zheng, J. F. Mitchell, J. Zaanen, T. P. Devereaux, N. Nagaosa, Z. Hussain, and Z. Shen, Nature **438**, 474 (2005).

[31] J. M. Luttinger, Physical Review **119**, 1153 (1960).

[32] M. Oshikawa, Physical Review Letters **84**, 3370 (2000).

[33] S. Weinberg, *The Quantum Theory of Fields* (Cambridge University Press, Cambridge, UK, 2000).

[34] R. P. Feynman, Phys. Rev. **91**, 1291 (1953).

[35] R. P. Feynman, Phys. Rev. **91**, 1301 (1953).

[36] H. Kleinert, *Path Integrals in Quantum Mechanics, Statistics, Polymer Physics, and Financial Markets* (World Scientific, Singapore, 2009).

[37] S. Bund and A. M. J. Schakel, Modern Physics Letters B **13**, 349 (1999).

[38] D. M. Ceperley, Reviews of Modern Physics **67**, 279 (1995).

[39] D. M. Ceperley and E. L. Pollock, Physical Review Letters **56**, 351 (1986).

[40] S. Sachdev, *Quantum Phase Transitions* (Cambridge University Press, New York, 1999).

[41] W. Meissner and R. Ochsenfeld, Naturwissenschaften **21**, 787 (1933).

[42] J. R. Schrieffer, *Theory Of Superconductivity* (Perseus Books, Massachusetts, 1999).

[43] L. N. Cooper, Phys. Rev. **104**, 1189 (1956).

[44] J. Bardeen, L. N. Cooper, and J. R. Schrieffer, Phys. Rev. **108**, 1175 (1957).

[45] J. Bardeen, L. N. Cooper, and J. R. Schrieffer, Phys. Rev. **106**, 162 (1957).

[46] P. W. Anderson, Phys. Rev. **110**, 827 (1958).

[47] P. W. Anderson, Phys. Rev. **130**, 439 (1963).

[48] R. P. Feynman, Phys. Rev. **90**, 1116 (1953).

[49] R. P. Feynman, Phys. Rev. **91**, 1291 (1953).

[50] E. L. Pollock and D. M. Ceperley, Phys. Rev. B **36**, 8343 (1987).

[51] D. M. Ceperley, Rev. Mod. Phys. **67**, 279 (1995).

[52] P. W. Higgs, Phys. Lett. **12**, 132 (1964).

[53] P. W. Higgs, Phys. Rev. **145**, 1156 (1966).

[54] P. W. Higgs, Phys. Rev. Lett. **13**, 508 (1964).

[55] G. 't Hooft and M. J. G. Veltman, Nucl. Phys. **B44**, 189 (1972).

[56] G. 't Hooft, Nucl. Phys. **B33**, 173 (1971).

[57] G. 't Hooft, Nucl. Phys. **B35**, 167 (1971).

[58] S. Weinberg, Phys. Rev. Lett. **19**, 1264 (1967).

[59] S. L. Glashow, J. Iliopoulos, and L. Maiani, Phys. Rev. **D2**, 1285 (1970).

[60] E. Farhi and L. Susskind, Phys. Rept. **74**, 277 (1981).

[61] A. J. Leggett, *The Quantum Liquids: Bose Condensation and Cooper Pairing in Condensed-Matter Systems* (Oxford University Press, Oxford, 2006).

[62] G. C. Wick, A. S. Wightman, and E. P. Wigner, Phys. Rev. **88**, 101 (1952).

[63] A. F. Andreev, Phys. Rev. B **68**, 155419 (2003).

[64] J. Zaanen, F. Kruger, J. H. She, D. Sadri, and S. I. Mukhin, Iranian Journal of Physics Research **8**, 39 (2008).

[65] V. L. Goncharov, Izvestia Akad. Nauk. SSSR **8**, 3 (1944).

[66] V. L. Goncharov, Trans. Amer. Math. Soc. **19**, 1 (1962).

[67] M. R. Schafroth, Phys. Rev. **100**, 463 (1955).

[68] F. A. Berezin and M. S. Marinov, Ann. Phys. **104**, 336 (1977).

[69] C. Schubert, Phys. Rept. **355**, 73 (2001).

[70] P. A. M. Dirac, *Lectures on Quantum Mechanics* (Dover Publications, New York, 2001).

[71] M. Henneaux and C. Teitelboim, *Quantization of gauge systems* (Princeton University Press, Princeton, New Jersey, 1992).

[72] L. Brink, P. Di Vecchia, and P. S. Howe, Nucl. Phys. **B118**, 76 (1977).

[73] D. M. Ceperley, J. Stat. Phys. **63**, 1237 (1991).

[74] D. M. Ceperley, in *Monte Carlo and Molecular Dynamics of Condensed Matter Systems*, edited by K. Binder and G. Ciccotti (Editrice Compositori, Bologna, Italy, 1996).

[75] D. M. Ceperley, Physical Review Letters **69**, 331 (1992).

[76] G. Baskaran and P. W. Anderson, Phys. Rev. B **37**, 580 (1988).

[77] J. B. Kogut, Reviews of Modern Physics **51**, 659 (1979).

[78] J. Zaanen, Z. Nussinov, and S. I. Mukhin, Annals of Physics **310**, 181 (2004).

[79] L. Mitas, Physical Review Letters **96**, 240402 (2006).

[80] M. A. Continentino, *Quantum Scaling in Many-Body Systems* (World Scientific, Singapore, 2001).

[81] H. von Löhneisen, A. Rosch, M. Vojta, and P. Wölfle, Rev. Mod. Phys. **79**, 1015 (2007).

[82] N. D. Mathur, F. M. Grosche, S. R. Julian, I. R. Walker, D. M. Freye, R. K. W. Haselwimmer, and G. G. Lonzarich, Nature **394**, 39 (1998).

[83] S. Sachdev, Rev. Mod. Phys. **75**, 913 (2003).

[84] J. Zhao, Q. Huang, C. de la Cruz, S. Li, J. W. Lynn, Y. Chen, M. A. Green, G. F. Chen, G. Li, Z. Li, J. L. Luo, N. L. Wang, and P. Dai, Nature Mater. **7**, 953 (2008).

[85] R. H. Liu, G. Wu, T. Wu, D. F. Fang, H. Chen, S. Y. Li, K. Liu, Y. L. Xie, X. F. Wang, R. L. Yang, L. Ding, C. He, D. L. Feng, and X. H. Chen, Phys. Rev. Lett. **101**, 087001 (2008).

[86] S. Margadonna, Y. Takabayashi, M. T. McDonald, M. Brunelli, G. Wu, R. H. Liu, X. H. Chen, and K. Prassides, Phys. Rev. B **79**, 014503 (2009).

[87] J. Chu, J. G. Analytis, C. Kucharczyk, and I. R. Fisher, Phys. Rev. B **79**, 014506 (2009).

[88] N. Ni, M. E. Tillman, J. Yan, A. Kracher, S. T. Hannahs, S. L. Bud'ko, and P. C. Canfield, Phys. Rev. B **78**, 214515 (2008).

[89] F. L. Ning, K. Ahilan, T. Imai, A. S. Sefat, R. Jin, M. A. McGuire, B. C. Sales, and D. Mandrus, J. Phys. Soc. Jpn. **78**, 013711 (2009).

[90] D. S. Chow, F. Zamborszky, B. Alavi, D. J. Tantillo, A. Baur, C. A. Merlic, and S. E. Brown, Phys. Rev. Lett. **85**, 1698 (2000).

[91] M. Itoi, M. Kano, N. Kurita, M. Hedo, Y. Uwatoko, and T. Nakamura, J. Phys. Soc. Jpn. **76**, 053703 (2007).

[92] M. Itoi, C. Araki, M. Hedo, Y. Uwatoko, and T. Nakamura, J. Phys. Soc. Jpn. **77**, 023701 (2007).

[93] A. J. S. S. A. Grigera, R. S. Perry, M. Chiao, S. R. Julian, G. G. Lonzarich, S. I. Ikeda, Y. Maeno, A. J. Millis, and A. P. Mackenzie, Science **294**, 329 (2001).

[94] S. A. Grigera, P. Gegenwart, R. A. Borzi, F. Weickert, A. J. Schofield, R. S. Perry, T. Tayama, T. Sakakibara, Y. Maeno, A. G. Green, *et al.*, Science **306**, 1154 (2004).

[95] R. A. Borzi, S. A. Grigera, J. Farrell, R. S. Perry, S. J. S. Lister, S. L. Lee, D. A. Tennant, Y. Maeno, and A. P. Mackenzie, Science **315**, 214 (2007).

[96] A. W. Rost, R. S. Perry, J. Mercure, A. P. Mackenzie, and S. A. Grigera, Science **325**, 1360 (2009).

[97] H. Kee and Y. B. Kim, Phys. Rev. B **71**, 184402 (2005).

[98] A. M. Berridge, A. G. Green, S. A. Grigera, and B. D. Simons, Phys. Rev. Lett. **102**, 136404 (2009).

[99] S. Raghu, A. Paramekanti, E. Kim, R. A. Borzi, S. Grigera, A. P. Mackenzie, and S. A. Kivelson, Phys. Rev. B **79**, 214402 (2009).

[100] W. Lee and C. Wu, Phys. Rev. B **80**, 104438 (2009).

[101] M. H. Fischer and M. Sigrist, Phys. Rev. B **81**, 064435 (2010).

[102] R. Roussev and A. J. Millis, Phys. Rev. B **67**, 014105 (2003).

[103] S. E. Rowley, L. J. Spalek, R. P. Smith, M. P. M. Dean, G. G. Lonzarich, J. F. Scott, and S. S. Saxena, arXiv:0903.1445v1 [cond-mat.str-el] (unpublished).

[104] R. J. Cava, B. Batlogg, J. Krajewski, R. C. Ferrel, L. W. Rupp, A. E. White, W. F. Peck, and T. W. Kometani, Nature **332**, 814 (1988).

[105] L. F. Mattheiss, E. M. Gyorgy, and D. W. Johnson, Phys. Rev. B **37**, 3745 (1988).

[106] S. Pei, J. D. Jorgensen, B. Dabrowski, D. G. Hinks, D. R. Richards, A. W. Mitchell, J. M. Newsam, S. K. Sinha, D. Vaknin, and A. J. Jacobson, Phys. Rev. B **41**, 4126 (1990).

[107] J. B. Goodenough, Phase Transitions **22**, 79 (1990).

[108] P. B. Allen and V. N. Kostur, Z. Phys. B: Condens. Matter **104**, 613 (1997).

[109] I. B. Bischofs, V. N. Kostur, and P. B. Allen, Phys. Rev. B **65**, 115112 (2002).

[110] C. Pfleiderer, J. Phys: Cond. Mat. **17**, S987 (2005).

[111] R. Jaramillo, Y. Feng, J. C. Lang, Z. Islam, G. Srajer, P. B. Littlewood, D. B. McWhan, and T. F. Rosenbaum, Nature **459**, 405 (2009).

[112] S. S. Saxena, P. Agarwal, K. Ahilan, F. M. Grosche, R. K. W. Haselwimmer, M. J. Steiner, E. Pugh, I. R. Walker, S. R. Julian, P. Monthoux, G. G. Lonzarich, A. Huxley, I. Sheikin, D. Braithwaite, , and J. Flouquet, Nature **406**, 587 (2000).

[113] A. Huxley, I. Sheikin, E. Ressouche, N. Kernavanois, D. Braithwaite, R. Calemczuk, and J. Flouquet, Phys. Rev. B **63**, 144519 (2001).

[114] C. Pfleiderer and A. D. Huxley, Phys. Rev. Lett. **89**, 147005 (2002).

[115] T. Graf, J. D. Thompson, M. F. Hundley, R. Movshovich, Z. Fisk, D. Mandrus, R. A. Fisher, and N. E. Phillips, Phys. Rev. Lett. **78**, 3769 (1997).

[116] R. Movshovich, T. Graf, D. Mandrus, J. D. Thompson, J. L. Smith, and Z. Fisk, Phys. Rev. B **53**, 8241 (1996).

[117] S. Kawasaki, M. Yashima, Y. Kitaoka, K. Takeda, K. Shimizu, Y. Oishi, M. Takata, T. C. Kobayashi, H. Harima, S. Araki, H. Shishido, R. Settai, and Y. Onuki, Phys. Rev. B **77**, 064508 (2008).

[118] F. Lévy, I. Sheikin, B. Grenier, and A. D. Huxley, Science **309**, 1343 (2005).

[119] M. Uhlarz, C. Pfleiderer, and S. M. Hayden, Phys. Rev. Lett. **93**, 256404 (2004).

[120] C. Pfleiderer, P. Böni, T. Keller, U. K. Rößler, and A. Rosch, Science **316**, 1871 (2007).

[121] J. She and J. Zaanen, Phys. Rev. B **80**, 184518 (2009).

[122] R. Penrose, Riv. Nuovo Cimento **1**, 252 (1969).

[123] J. Maldacena, Adv. Theor. Math. Phys. **2**, 231 (1998).

[124] E. Witten, Adv. Theor. Math. Phys. **2**, 253 (1998).

[125] S. S. Gubser, I. R. Klebanov, and A. M. Polyakov, Phys. Lett. B **428**, 105 (1998).

[126] S. A. Hartnoll, C. P. Herzog, and G. T. Horowitz, Journal of High Energy Physics **12**, 015 (2008).

[127] S. Sachdev, arXiv:1006.3794v3 [hep-th] (unpublished).

[128] D. Belitz, T. R. Kirkpatrick, and T. Vojta, Rev. Mod. Phys. **77**, 579 (2005).

[129] M. A. Continentino and A. S. Ferreira, Physica A **339**, 461 (2004).

[130] A. S. Ferreira, M. A. Continentino, and E. C. Marino, Sol. St. Comm. **130**, 321 (2004).

[131] A. S. Ferreira, M. A. Continentino, and E. C. Marino, Phys. Rev. B **70**, 174507 (2004).

[132] A. S. Ferreira and M. A. Continentino, J. Stat. Mech. P05005 (2005).

[133] Y. Qi and C. Xu, Phys. Rev. B **80**, 094402 (2009).

[134] A. J. Millis, Phys. Rev. B **81**, 035117 (2010).

[135] S. Coleman and E. Weinberg, Phys. Rev. D **7**, 1888 (1973).

[136] B. I. Halperin, T. Lubensky, and S. K. Ma, Phys. Rev. Lett. **32**, 292 (1974).

[137] Z. Nussinov, I. Vekhter, and A. V. Balatsky, Phys. Rev. B **79**, 165122 (2009).

[138] T. Senthil, A. Vishwanath, L. Balents, S. Sachdev, and M. P. A. Fisher, Science **303**, 1490 (2004).

[139] T. Senthil, L. Balents, S. Sachdev, A. Vishwanath, and M. P. A. Fisher, Phys. Rev. B **70**, 144407 (2004).

[140] E. G. Moon and S. Sachdev, Phys. Rev. B **80**, 035117 (2009).

[141] E. G. Moon and S. Sachdev, arXiv:1005.3312v4 [cond-mat.supr-con] (unpublished).

[142] R. M. Fernandes and J. Schmalian, Phys. Rev. B **82**, 014521 (2010).

[143] J. A. Hertz, Phys. Rev. B **14**, 1165 (1976).

[144] A. J. Millis, Phys. Rev. B **48**, 7183 (1993).

[145] T. Moriya, *Spin Fluctuations in Itinerant Electron Magnetism* (Springer-Verlag, Berlin, New York, 1985).

[146] Y. Zhang, E. Demler, and S. Sachdev, Phys. Rev. B **66**, 094501 (2002).

[147] J. H. Chen, T. C. Lubensky, and D. R. Nelson, Phys. Rev. B **17**, 4274 (1978).

[148] E. Domany, D. Mukamel, and M. E. Fisher, Phys. Rev. B **15**, 5432 (1977).

[149] J. Rudnick, Phys. Rev. B **18**, 1406 (1978).

[150] H. H. Iacobson and D. J. Amit, Annals of Physics **133**, 57 (1981).

[151] J. Cardy, *Scaling and renormalization in Statistical Physics* (Cambridge University Press, Cambridge, UK, 1996).

[152] J. M. Tranquada, B. J. Sternlieb, J. D. Axe, Y. Nakamura, and S. Uchida, Nature **375**, 561 (1995).

[153] Y. Ando, K. Segawa, S. Komiya, and A. N. Lavrov, Phys. Rev. Lett. **88**, 137005 (2002).

[154] N. Doiron-Leyraud, C. Proust, D. LeBoeuf, J. Levallois, J. Bonnemaison, R. Liang, D. A. Bonn, W. N. Hardy, and L. Taillefer, Nature **447**, 565 (2007).

[155] S. A. Kivelson, E. Fradkin, and V. J. Emery, Nature **393**, 550 (1998).

[156] E. Fradkin, S. A. Kivelson, M. J. Lawler, J. P. Eisenstein, and A. P. Mackenzie, arXiv:0910.4166v2 [cond-mat.str-el] (unpublished).

[157] C. de la Cruz, Q. Huang, J. W. Lynn, J. Li, W. R. II, J. L. Zarestky, H. A. Mook, G. F. Chen, J. L. Luo, N. L. Wang, and P. Dai, Nature **453**, 899 (2008).

[158] C. Xu, M. Muller, and S. Sachdev, Phys. Rev. B **78**, 020501(R) (2008).

[159] C. Fang, H. Yao, W. F. Tsai, J. P. Hu, and S. A. Kivelson, Phys. Rev. B **77**, 224509 (2008).

[160] Q. Huang, Y. Qiu, W. Bao, M. A. Green, J. W. Lynn, Y. C. Gasparovic, T. Wu, G. Wu, and X. H. Chen, Phys. Rev. Lett. **101**, 257003 (2008).

[161] C. Krellner, N. Caroca-Canales, A. Jesche, H. Rosner, A. Ormeci, and C. Geibel, Phys. Rev. B **78**, 100504(R) (2008).

[162] J. Yan, A. Kreyssig, S. Nandi, N. Ni, S. L. Bud'ko, A. Kracher, R. J. McQueeney, R. W. McCallum, T. A. Lograsso, A. I. Goldman, and P. C. Canfield, Phys. Rev. B **78**, 024516 (2008).

[163] J. Zhao, W. Ratcliff, J. W. Lynn, G. F. Chen, J. L. Luo, N. L. Wang, J. Hu, and P. Dai, Phys. Rev. B **78**, 140504(R) (2008).

[164] A. I. Goldman, D. N. Argyriou, B. Ouladdiaf, T. Chatterji, A. Kreyssig, S. Nandi, N. Ni, S. L. Bud'ko, P. C. Canfield, and R. J. McQueeney, Phys. Rev. B **78**, 100506(R) (2008).

[165] M. D. Prato, A. Pelissetto, and E. Vicari, Phys. Rev. B **74**, 144507 (2006).

[166] J. M. Kosterlitz, D. R. Nelson, and M. E. Fisher, Phys. Rev. B **13**, 412 (1976).

[167] S. Murakami and N. Nagaosa, J. Phys. Soc. Jpn. **69**, 2395 (2000).

[168] F. Fucito and G. Parisi, J. Phys. A: Math. Gen. **14**, L499 (1981).

[169] D. Belitz and T. R. Kirkpatrick, Phys. Rev. Lett. **89**, 247202 (2002).

[170] P. Jakubczyk, Phys. Rev. B **79**, 125115 (2009).

[171] P. Jakubczyk, W. Metzner, and H. Yamase, Phys. Rev. Lett. **103**, 220602 (2009).

[172] M. Zacharias, P. Wölfle, and M. Garst, Phys. Rev. B **80**, 165116 (2009).

[173] P. C. Hohenberg and J. B. Swift, Phys. Rev. E **52**, 1828 (1995).

[174] K. Yonemitsu, A. R. Bishop, and J. Lorenzana, Phys. Rev. B **47**, 12059 (1993).

[175] M. Garst and A. V. Chubukov, Phys. Rev. B **81**, 235105 (2010).

[176] I. Pomeranchuk, Sov. Phys. JETP **8**, 361 (1958).

[177] P. Phillips and C. Chamon, Phys. Rev. Lett. **95**, 107002 (2005).

[178] W. Kohn and J. M. Luttinger, Phys. Rev. Lett. **15**, 524 (1965).

[179] T. Senthil, Phys. Rev. B **78**, 035103 (2008).

[180] A. Altland and B. Simons, *Condensed Matter Field Theory* (Cambridge University Press, Cambridge, UK, 2006).

[181] I. Herbut, *A Modern Approach to Critical Phenomena* (Cambridge University Press, Cambridge, UK, 2007).

[182] J. Zaanen, Science **319**, 5867 (2008), and references therein.

[183] P. Coleman, C. Pépin, Q. Si, and R. Ramazashvili, J. Phys: Cond. Mat. **13**, 723 (2001).

[184] P. Coleman and A. J. Schofield, Nature **433**, 226 (2005).

[185] S. Paschen, T. Lühmann, S. Wirth, P. Gegenwart, O. Trovarelli, C. Geibel, F. Steglich, P. Coleman, and Q. Si, Nature **432**, 881 (2004).

[186] Q. Si, S. Rabello, K. Ingersent, and J. L. Smith, Nature **413**, 804 (2001).

[187] D. van der Marel, H. J. A. Molegraaf, J. Zaanen, Z. Nussinov, F. Carbone, A. Damascelli, H. Eisaki, M. Greven, P. H. Kes, and M. Li, Nature **425**, 271 (2003).

[188] R. A. Cooper, Y. Wang, B. Vignolle, O. J. Lipscombe, S. M. Hayden, Y. Tanabe, T. Adachi, Y. Koike, M. Nohara, H. Takagi, C. Proust, and N. E. Hussey, Science **323**, 603 (2009).

[189] S. L. Bud'ko, N. Ni, and P. C. Canfield, Phys. Rev. B **79**, 220516 (2009).

[190] J. Zaanen, Phys. Rev. B **80**, 212502 (2009).

[191] C. M. Varma, P. B. Littlewood, S. Schmitt-Rink, E. Abrahams, and A. E. Ruckenstein, Phys. Rev. Lett. **63**, 1996 (1989).

[192] P. Monthoux, D. Pines, and G. G. Lonzarich, Nature **450**, 1177 (2007).

[193] A. V. Chubukov and S. Sachdev, Phys. Rev. Lett. **71**, 169 (1993).

[194] C. M. Varma, Z. Nussinov, and W. van Saarloos, Phys. Rep. **361**, 267 (2002).

[195] N. E. Bonesteel, I. A. McDonald, and C. Nayak, Phys. Rev. Lett. **77**, 3009 (1996).

[196] V. Galitski and S. Sachdev, Phys. Rev. B **79**, 134512 (2009).

[197] A. V. Chubukov and J. Schmalian, Phys. Rev. B **72**, 174520 (2005).

[198] A. V. Chubukov and A. M. Tsvelik, Phys. Rev. B **76**, 100509 (2007).

[199] A. Abanov, A. V. Chubukov, and A. M. Finkel'stein, Euro. Phys. Lett. **54**, 488 (2001).

[200] A. Abanov, A. V. Chubukov, and J. Schmalian, Euro. Phys. Lett. **55**, 369 (2001).

[201] A. V. Chubukov, A. M. Finkel'stein, R. Haslinger, and D. K. Morr, Phys. Rev. Lett. **90**, 077002 (2003).

[202] P. Krotkov and A. V. Chubukov, Phys. Rev. Lett. **96**, 107002 (2006).

[203] P. Krotkov and A. V. Chubukov, Phys. Rev. B **74**, 014509 (2006).

[204] A. Abanov, A. V. Chubukov, and M. R. Norman, Phys. Rev. B **78**, 220507 (2008).

[205] D. V. Khveshchenko and W. F. Shively, Phys. Rev. B **73**, 115104 (2006).

[206] E. G. Moon and S. Sachdev, Phys. Rev. B **80**, 035117 (2009).

[207] Z. Fisk and D. Pines, Nature **394**, 22 (1998).

[208] I. I. Mazin and D. J. Singh, Phys. Rev. Lett. **79**, 733 (1997).

[209] P. Monthoux and G. G. Lonzarich, Phys. Rev. B **59**, 14598 (1999).

[210] D. Fay and J. Appel, Phys. Rev. B **22**, 3173 (1980).

[211] A. Millis, S. Sachdev, and C. M. Varma, Phys. Rev. B **37**, 4975 (1988).

[212] M. Franz and A. J. Millis, Phys. Rev. B **58**, 14572 (1998).

[213] R. Roussev and A. J. Millis, Phys. Rev. B **63**, 140504 (2001).

[214] K. B. Blagoev, J. R. Engelbrecht, and K. S. Bedell, Phys. Rev. Lett. **82**, 133 (1999).

[215] Z. Wang, W. Mao, and K. Bedell, Phys. Rev. Lett. **87**, 257001 (2001).

[216] P. B. Allen and R. C. Dynes, Phys. Rev. B **12**, 905 (1975).

[217] F. Marsiglio and J. P. Carbotte, Phys. Rev. B **33**, 6141 (1986).

[218] J. P. Carbotte, Rev. Mod. Phys. **62**, 1027 (1990).

[219] D. J. Scalapino, E. Loh, and J. E. Hirsch, Phys. Rev. B **34**, 8190 (1986).

[220] L. N. Bulaevskii and M. V. Zyskin, Phys. Rev. B **42**, 10230 (1990).

[221] T. R. Kirkpatrick, D. Belitz, T. Vojta, and R. Narayanan, Phys. Rev. Lett. **87**, 127003 (2001).

[222] K. G. Sandeman, G. G. Lonzarich, and A. J. Schofield, Phys. Rev. Lett. **90**, 167005 (2003).

[223] P. Strack, S. Takei, and W. Metzner, Phys. Rev. B **81**, 125103 (2010).

[224] D. T. Son, Phys. Rev. D **59**, 094019 (1999).

[225] O. V. Dolgov and E. G. Maksimov, Sov. Phys. Usp. **25**, 688 (1982).

[226] O. Dolgov, I. Mazin, A. Golubov, S. Savrasov, and E. Maksimov, J. Phys: Cond. Mat. **20**, 434226 (2008).

[227] R. Combescot, Euro. Phys. Lett. **43**, 701 (1997).

[228] M. Troyer and U. Wiese, Phys. Rev. Lett. **94**, 17201 (2005).

[229] F. Krüger and J. Zaanen, Phys. Rev. B **78**, 035104 (2008).

[230] M. Cubrovic, J. Zaanen, and K. Schalm, Science **325**, 439 (2009).

[231] H. Liu, J. McGreevy, and D. Vegh, arXiv:0903.2477[hep-th] (unpublished).

[232] T. Faulkner, H. Liu, J. McGreevy, and D. Vegh, arXiv:0907.2694[hep-th] (unpublished).

[233] J. R. Schrieffer, *Theory Of Superconductivity* (Perseus Publishing, Massachusetts, 1971).

[234] F. Levy, I. Sheikin, and A. Huxley, Nature Physics **3**, 460 (2007).

[235] A. Balatsky, Philos. Mag. Lett. **68**, 251 (1993).

[236] A. Sudbo, Phys. Rev. Lett. **74**, 2575 (1995).

[237] L. Yin and S. Chakravarty, Int. J. Mod. Phys. B **10**, 805 (1996).

[238] W. Muck and K. S. Viswanathan, Phys. Rev. D **58**, 041901 (1998).

[239] D. Freedman, S. Mathur, A. Matusis, and L. Rastelli, Phys. Lett. B **452**, 61 (1999).

[240] E. D'Hoker and D. Freedman, Nucl. Phys. B **544**, 612 (1998).

[241] H. Liu, Phys. Rev. D **60**, 106005 (1998).

[242] E. D'Hoker and D. Z. Freedman, Nucl. Phys. B **550**, 261 (1998).

[243] E. D'Hoker, D. Z. Freedman, S. D. Mathur, A. Matusis, and L. Rastelli, Nucl. Phys. B **562**, 353 (1999).

[244] G. Chalmers and K. Schalm, Nucl. Phys. B **554**, 215 (1998).

[245] G. Chalmers and K. Schalm, Phys. Rev. D **61**, 046001 (1999).

[246] P. B. Allen, in *Modern Trends in the Theory of Condensed Matter*, edited by A. Pekalski and J. Przystawa (Springer-Verlag, Berlin, New York, 1980).

[247] B. Uchoa and A. H. C. Neto, Phys. Rev. Lett. **98**, 146801 (2007).

[248] N. B. Kopnin and E. B. Sonin, Phys. Rev. Lett. **100**, 246808 (2008).

[249] A. H. C. Neto, Phys. Rev. Lett. **86**, 4382 (2001).

[250] B. Uchoa, G. G. Cabrera, and A. H. C. Neto, Phys. Rev. B **71**, 184509 (2005).

[251] J. Lee, K. Fujita, K. McElroy, J. A. Slezak, M. Wang, Y. Aiura, H. Bando, M. Ishikado, T. Masui, J.-X. Zhu, A. V. Balatsky, H. Eisaki, S. Uchida, and J. C. Davis, Nature **442**, 546 (2006).

[252] A. Damascelli, Z. Hussain, and Z. X. Shen, Rev. Mod. Phys. **75**, 473 (2003).

[253] E. van Heumen, E. Muhlethaler, A. Kuzmenko, H. Eisaki, W. Meevasana, M. Greven, and D. van der Marel, Phys. Rev. B **79**, 184512 (2009).

[254] I. E. Dzyaloshinskii, J. Phys. I France **6**, 119 (1996).

[255] V. Y. Irkhin, A. A. Katanin, and M. I. Katsnelson, Phys. Rev. B **64**, 165107 (2001).

[256] V. Y. Irkhin, A. A. Katanin, and M. I. Katsnelson, Phys. Rev. Lett. **89**, 076401 (2002).

[257] A. N. Rubtsov, M. I. Katsnelson, A. I. Lichtenstein, and A. Georges, Phys. Rev. B **79**, 045133 (2009).

[258] T. Moriya and T. Takimoto, J. Phys. Soc. Jpn. **64**, 960 (1995).

[259] C. Pepin, Phys. Rev. Lett. **94**, 066402 (2005).

[260] J. Custers, P. Gegenwart, H. Wilhelm, K. Neumaier, Y. Tokiwa, O. Trovarelli, C. Geibel, F. Steglich, C. Pépin, and P. Coleman, Nature **424**, 524 (2003).

[261] L. Zhu, M. Garst, A. Rosch, and Q. Si, Phys. Rev. Lett. **91**, 066404 (2003).

[262] J. Zaanen and B. Hosseinkhani, Phys. Rev. B **70**, 060509 (2004).

[263] A. K. Rajagopal and R. Vasudevan, Phys. Lett. **23**, 539 (1966).

[264] R. G. Dias and J. M. Wheatley, Phys. Rev. B **50**, 13887 (1994).

[265] A. J. Schofield, Phys. Rev. B **51**, 11733 (1995).

[266] E. Helfand and N. R. Werthamer, Phys. Rev. B **147**, 288 (1966).

[267] R. Kuchler, N. Oeschler, P. Gegenwart, T. Cichorek, K. Neumaier, O. Tegus, C. Geibel, J. A. Mydosh, F. Steglich, L. Zhu, and Q. Si, Phys. Rev. Lett. **91**, 066405 (2003).

[268] Y. Tokiwa, T. Radu, C. Geibel, F. Steglich, and P. Gegenwart, Phys. Rev. Lett. **102**, 066401 (2009).

[269] N. Kimura, K. Ito, K. Saitoh, Y. Umeda, H. Aoki, and T. Terashima, Phys. Rev. Lett. **95**, 247004 (2005).

[270] Y. Muro, M. Ishikawa, K. Hirota, Z. Hiroi, N. Takeda, N. Kimura, and H. Aoki, J. Phys. Soc. Jpn. **76**, 033706 (2007).

[271] I. Sugitani, Y. Okuda, H. Shishido, T. Yamada, A. Thamizhavel, E. Yamamoto, T. D. Matsuda, Y. Haga, T. Takeuchi, R. Settai, and Y. Ōnuki, J. Phys. Soc. Jpn. **75**, 043703 (2006).

[272] Y. Okuda, Y. Miyauchi, Y. Ida, Y. Takeda, C. Tonohiro, Y. Oduchi, T. Yamada, N. D. Dung, T. D. Matsuda, Y. Haga, T. Takeuchi, M. Hagiwara, K. Kindo, H. Harima, K. Sugiyama, R. Settai, and Y. Ōnuki, J. Phys. Soc. Jpn. **76**, 044708 (2007).

[273] N. Kimura, K. Ito, H. Aoki, S. Uji, and T. Terashima, Phys. Rev. Lett. **98**, 197001 (2007).

[274] R. Settai, Y. Miyauchi, T. Takeuchi, F. Lévy, I. Siieikin, and Y. Onuki, J. Phys. Soc. Jpn. **77**, 073705 (2008).

[275] Y. Tada, N. Kawakami, and S. Fujimoto, Phys. Rev. Lett. **101**, 267006 (2008).

[276] R. A. Ferrell, J. Low Temp. Phys. **1**, 423 (1969).

[277] D. J. Scalapino, Phys. Rev. Lett. **24**, 1052 (1970).

[278] J. T. Anderson and A. M. Goldman, Phys. Rev. Lett. **25**, 743 (1970).

[279] H. Takayama, Prog. Theor. Phys. (Japan) **46**, 1 (1971).

[280] K. Yoshihiro and K. Kajimura, Phys. Lett. **32A**, 71 (1970).

[281] A. M. Goldman, Journal of Superconductivity and Novel Magnetism **19**, 317 (2006).

[282] A. Larkin and A. Varlamov, *Theory of Fluctuations in Superconductors* (Oxford University Press, Oxford, 2005).

[283] N. Bergeal, J. Lesueur, M. Aprili, G. Faini, J. P. Contour, and B. Leridon, Nature Physics **4**, 608 (2008).

[284] E.-G. Moon and A. Chubukov, Journal of Low Temperature Physics **161**, 263 (2010).

[285] S. A. Hartnoll, C. P. Herzog, and G. T. Horowitz, Phys. Rev. Lett. **101**, 031601 (2008).

[286] G. E. Blonder, M. Tinkham, and T. M. Klapwijk, Phys. Rev. B **25**, 4515 (1982).

[287] Y. Tanaka and S. Kashiwaya, Phys. Rev. Lett. **74**, 3451 (1995).

[288] B. Janko, I. Kosztin, K. Levin, M. R. Norman, and D. J. Scalapino, Phys. Rev. Lett. **82**, 4304 (1999).

[289] P. W. Anderson, Science **316**, 1705 (2007).

[290] S. S. Gubser, Phys. Rev. D **78**, 065034 (2008).

[291] D. T. Son and A. O. Starinets, Journal of High Energy Physics **0209**, 042 (2002).

[292] J. McGreevy, arXiv:0909.0518 [hep-th] (unpublished).

[293] S. Kambe, H. Sakai, Y. Tokunaga, and R. E. Walstedt, Phys. Rev. B **82**, 144503 (2010).

[294] P. Aynajian, E. H. da Silva Neto, C. V. Parker, Y. Huang, A. Pasupathy, J. Mydosh, and A. Yazdani, Proceedings of the National Academy of Science **107**, 10383 (2010).

[295] A. R. Schmidt, M. H. Hamidian, P. Wahl, F. Meier, A. V. Balatsky, J. D. Garrett, T. J. Williams, G. M. Luke, and J. C. Davis, Nature **465**, 570 (2010).

[296] X. G. Wen and Z. Wang, Phys. Rev. B **78**, 155109 (2008).

[297] M. Barkeshli and X. G. Wen, Phys. Rev. B **82**, 24530 (2010).

[298] Y. M. Lu, X. G. Wen, Z. Wang, and Z. Wang, Phys. Rev. B **81**, 115124 (2010).

[299] M. Robnik, Phys. Lett. **80A**, 117 (1980).

[300] S.-X. Yang, H. Fotso, S.-Q. Su, D. Galanakis, E. Khatami, J.-H. She, J. Moreno, J. Zaanen, and M. Jarrell, Phys. Rev. Lett. **106**, 047004 (2011).