Supporting Information

Transition Metal-Free Synthesis of Thiocyanato- or Nitro-Arenes through Diaryliodonium Salts

Xiao-Hua Li, Liang-Gui Li, Xue-Ling Mo and Dong-Liang Mo*

Key Laboratory for the Chemistry and Molecular Engineering of Medicinal Resources, Ministry of Education of China; School of Chemistry & Pharmaceutical Sciences, Guangxi Normal University, 15 Yu Cai Road, Guilin 541004, China.

Contents

1.	General Experimental Information	S-2
2.	Synthesis of thiocyanato arenes 2	S-2
3.	Synthesis of nitro arenes 3	S-16
4.	Synthesis of 4 , 5 and 6	S-9
6.	Synthesis of diaryliodonium salts 1	S-10
7.	References	S-10
8.	NMR spectra	S-12

1. General Experimental Information:

^1H NMR and ^{13}C NMR spectra were recorded at ambient temperature using 400, 500 MHz spectrometers. The data are reported as follows: chemical shift in ppm from internal tetramethylsilane on the δ scale, multiplicity (br = broad, s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz), and integration. High resolution mass spectra were acquired on an LTQ FT spectrometer, and were obtained by peak matching. Melting points are reported uncorrected. Analytical thin layer chromatography was performed on 0.25 mm extra hard silica gel plates with UV254 fluorescent indicator. Chromatography was performed using with 300-400 mesh silica gel (SiO_2). Unless otherwise noted, all reagents and solvents were obtained from commercial sources and, where appropriate, purified prior to use.

2. Synthesis of thiocyanato arenes **2** (Tables 2):

General procedure A: In Schlenk tube was charged with diaryliodonium salts **1** (0.5 mmol) and KSCN (2.0 mmol, 4.0 equiv) in air atmosphere, dissolved in DCE (5 mL). The mixture was stirred vigorously at RT for 5 min. Then, the reaction was stirred at 80 °C and monitored by TLC until **1** was consumed completely (18-24 h). At this time, the DCE was removed under reduced pressure and crude product was purified by flash chromatography (dry loading with SiO_2) using eluents (1:50 ethyl acetate:petroleum ether to 10:1) to provide product **2** as oil or solid.

2a

Thiocyanatobenzene (2a),^[1] colorless oil, 56.0 mg, 83% yield. ^1H NMR (400 MHz, CDCl_3): δ 7.44-7.42 (m, 2H), 7.36-7.32 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 130.1, 129.9, 129.4, 124.3, 110.4.

2b

1-Methoxy-4-thiocyanatobenzene (2b),^[1] colorless oil, 78.4 mg, 95% yield. ¹H NMR (400 MHz, CDCl₃): δ 7.51 (d, *J* = 7.2 Hz, 2H), 6.95 (d, *J* = 7.2 Hz, 2H), 3.82 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 161.36, 133.8, 115.8, 113.8, 111.6, 55.5.

2c

1-tert-Butyl-4-thiocyanatobenzene (2c),^[2] colorless oil, 74.5 mg, 78% yield. ¹H NMR (500 MHz, CDCl₃): δ 7.47 (d, *J* = 7.0 Hz, 2H), 7.45 (d, *J* = 7.0 Hz, 2H), 1.32 (s, 9H); ¹³C NMR (125 MHz, CDCl₃): δ 153.3, 130.4, 127.3, 120.5, 110.9, 34.7, 31.0.

2d

1-Chloro-4-thiocyanatobenzene (2d),^[1] white solid, 65.8 mg, 78% yield. mp: 36-38 °C; ¹H NMR (400 MHz, CDCl₃): δ 7.48 (d, *J* = 8.4 Hz, 2H), 7.43 (d, *J* = 8.4 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 136.1, 131.4, 130.4, 122.7, 109.9.

2e

1-Bromo-4-thiocyanatobenzene (2e),^[1] white solid, 63.8 mg, 60% yield. mp: 56-60 °C; ¹H NMR (400 MHz, CDCl₃): δ 7.58 (d, *J* = 8.4 Hz, 2H), 7.41 (d, *J* = 8.4 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 133.3, 131.4, 124.1, 123.4, 109.7.

2f

1-Fluoro-4-thiocyanatobenzene (2f),^[1] colorless oil, 51.2 mg, 67% yield. ¹H NMR (600 MHz, CDCl₃): δ 7.57 (d, *J* = 7.0 Hz, 2H), 7.16 (d, *J* = 7.0 Hz, 2H); ¹³C NMR (150 MHz, CDCl₃): δ 164.5 (d, *J* = 251.8 Hz), 133.3 (d, *J* = 8.7 Hz), 119.2 (d, *J* = 3.3 Hz), 117.7 (d, *J* = 22.9 Hz), 110.6.

2g

1-Nitro-3-thiocyanatobenzene (2g),^[3] yellow solid, 54.0 mg, 60% yield. ¹H NMR (500 MHz, CDCl₃): δ 8.39 (s, 1H), 8.29 (d, *J* = 8.0 Hz, 1H), 7.89 (d, *J* = 7.5 Hz, 1H), 7.70-7.67 (m, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 148.9, 134.9, 131.2, 127.3, 124.3, 124.2, 108.6.

2h

1-Methyl-2-thiocyanatobenzene (2h),^[4] yellow oil, 54.3 mg, 73% yield. ¹H NMR (500 MHz, CDCl₃): δ 7.62-7.61 (m, 1H), 7.33 (d, *J* = 7.0 Hz, 1H), 7.29-7.26 (m, 2H), 2.47 (s, 3H); ¹³C NMR (125 MHz, CDCl₃): δ 139.2, 131.9, 131.3, 130.1, 127.7, 123.5, 110.3, 20.3.

2i

1-Phenoxy-4-thiocyanatobenzene (2i),^[5] colorless oil, 63.5 mg, 56% yield. ¹H NMR (500 MHz, CDCl₃): δ 7.51 (d, *J* = 7.0 Hz, 2H), 7.38-7.37 (m, 2H), 7.19-7.18 (m, 1H), 7.03-7.01 (m, 4H); ¹³C NMR (125 MHz, CDCl₃): δ 159.6, 155.6, 133.3, 130.0, 124.5, 119.8, 119.6, 116.5, 111.1.

2j

4-Thiocyanatobiphenyl (2j),^[4] white solid, 73.8 mg, 70% yield. mp: 89-90 °C; ¹H NMR (500 MHz, CDCl₃): δ 7.64 (d, *J* = 8.0 Hz, 2H), 7.59-7.55 (m, 4H), 7.47 (t, *J* = 6.5 Hz, 2H), 7.40-7.37 (m, 1H); ¹³C NMR (125 MHz, CDCl₃): δ 142.8, 139.3, 130.6, 129.0, 128.8, 128.2, 127.1, 122.9, 110.5.

2k

1-Isopropyl-4-thiocyanatobenzene (2k),^[6] oil, 61.9 mg, 70% yield. ¹H NMR (500 MHz, CDCl₃): δ 7.46 (d, *J* = 8.0 Hz, 2H), 7.29 (d, *J* = 8.0 Hz, 2H), 2.92 (m, 1H), 1.25 (d, *J* = 7.0 Hz, 6H); ¹³C NMR (125 MHz, CDCl₃): δ 151.0, 130.7, 128.3, 120.7, 111.0, 33.8, 23.6; IR (thin film) 3083, 2963, 2872, 2157, 1492, 1012, 825 cm⁻¹.

2l

1-Thiocyanato-4-(trifluoromethyl)benzene (2l),^[2] white solid, 70.0 mg, 69% yield. mp: 82-84 °C; ¹H NMR (500 MHz, CDCl₃): δ 7.69 (d, *J* = 7.0 Hz, 2H), 7.64 (d, *J* = 7.0 Hz, 2H); ¹³C NMR (125 MHz, CDCl₃): δ 131.8 (q, *J* = 33.7 Hz), 129.5, 129.0, 127.0, 126.6 (q, *J* = 271.3 Hz), 108.9.

2m

1-Bromo-3-thiocyanatobenzene (2m),^[7] oil, 69.1 mg, 65% yield. ¹H NMR (500 MHz, CDCl₃): δ 7.67 (s, 1H), 7.55 (d, *J* = 7.5 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.32 (t, *J* = 8.0 Hz, 1H); ¹³C NMR (125 MHz, CDCl₃): δ 132.6, 132.1, 131.3, 128.1, 126.2, 123.7, 109.4; IR (thin film) 3061, 2958, 2854, 2159, 1567, 1492, 1461, 1405, 1069, 747, 674 cm⁻¹.

2n

1-Bromo-2-thiocyanatobenzene (2n),^[2] colorless oil, 91.5 mg, 86% yield. ¹H NMR (600 MHz, CDCl₃): δ 7.72 (d, *J* = 7.8 Hz, 1H), 7.62 (d, *J* = 7.8 Hz, 1H), 7.45 (t, *J* = 7.8 Hz, 1H), 7.27-7.25 (m, 1H); ¹³C NMR (150 MHz, CDCl₃): δ 133.5, 130.0, 129.4, 129.0, 127.1, 121.7, 109.5.

2o

Methyl 4-thiocyanatobenzoate (2o),^[4] white solid, 62.7 mg, 65% yield. mp: 94-95 °C; ¹H NMR (500 MHz, CDCl₃): δ 8.09 (d, *J* = 7.0 Hz, 2H), 7.57 (d, *J* = 7.5 Hz, 2H), 3.94 (s, 3H); ¹³C NMR (125 MHz, CDCl₃): δ 165.6, 131.0, 130.7, 130.3, 128.2, 109.0, 52.4.

3. Synthesis of nitroarenes **3** (Tables 3):

General procedure B: In Schlenk tube was charged with diaryliodonium salts **1** (0.5 mmol) and NaNO₂ (2.0 mmol, 4.0 equiv) in air atmosphere, dissolved in DCE (5 mL). The mixture was stirred vigorously at RT for 5 min. Then, the reaction was stirred at 80 °C and monitored by TLC until **1** was consumed completely (18-24 h). At this time, the DCE was removed under reduced pressure and crude product was purified by flash chromatography (dry loading with SiO₂) using eluents (1:50 ethyl acetate:petroleum ether to 10:1) to provide product **3** as oil or solid.

3a

Nitrobenzene (3a),^[8] yellow oil, 44.8 mg, 73% yield. ¹H NMR (500 MHz, CDCl₃): δ 8.23 (d, *J* = 7.8 Hz, 2H), 7.70-7.69 (m, 1H), 7.55-7.49 (m, 2H); ¹³C NMR (125 MHz, CDCl₃): δ 148.1, 134.5, 129.2, 123.4.

3b

1-Methoxy-4-nitrobenzene (3b),^[9] yellow solid, 52.0 mg, 68% yield. mp: 104-105 °C; ¹H NMR (500 MHz, CDCl₃): δ 8.19 (d, *J* = 8.0 Hz, 2H), 6.96 (d, *J* = 8.0 Hz, 2H), 3.91 (s, 3H); ¹³C NMR (125 MHz, CDCl₃): δ 164.5, 141.4, 125.8, 113.9, 55.9.

3c

1-tert-Butyl-4-nitrobenzene (3c),^[10] yellow oil, 62.1 mg, 69% yield. ¹H NMR (400 MHz, CDCl₃): δ 8.15 (d, *J* = 8.8 Hz, 2H), 7.55 (d, *J* = 8.8 Hz, 2H), 1.36 (s, 9H); ¹³C NMR (100 MHz, CDCl₃): δ 158.8, 145.8, 126.2, 123.3, 35.4, 31.0.

3d

1-Chloro-4-nitrobenzene (3d),^[9] white solid, 59.6 mg, 76% yield. mp: 82-83 °C; ¹H NMR (400 MHz, CDCl₃): δ 8.20 (d, *J* = 8.8 Hz, 2H), 7.53 (d, *J* = 8.8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 146.5, 141.4, 129.6, 124.9.

3e

1-Bromo-4-nitrobenzene (3e),^[8] yellow solid, 88.3 mg, 88% yield. mp: 132-133 °C; ¹H NMR (400 MHz, CDCl₃): δ 8.12 (d, *J* = 8.8 Hz, 2H), 7.70 (d, *J* = 8.8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 147.0, 132.6, 129.9, 124.9.

3f

1-Fluoro-4-nitrobenzene (3f),^[10] yellow oil, 38.1 mg, 54% yield. ¹H NMR (500 MHz, CDCl₃): δ 8.27 (d, *J* = 8.0 Hz, 2H), 7.22 (d, *J* = 8.0 Hz, 2H); ¹³C NMR (125 MHz, CDCl₃): δ 167.2 (d, *J* = 256.3 Hz), 144.4, 126.3 (d, *J* = 9.8 Hz), 116.4 (d, *J* = 23.3 Hz).

3g

1,3-Dinitrobenzene (3g),^[11] white solid, 50.4 mg, 60% yield. mp: 134-135 °C; ¹H NMR (500 MHz, CDCl₃): δ 9.08 (s, 1H), 8.59 (dd, *J* = 7.0 Hz, 1.0 Hz, 2H), 7.84 (t, *J* = 8.0 Hz, 1H); ¹³C NMR (125 MHz, CDCl₃): δ 148.5, 130.7, 128.9, 119.1.

3j

4-Nitrobiphenyl (3j),^[10] yellow solid, 67.6 mg, 68% yield. mp: 115-116 °C; ¹H NMR (400 MHz, CDCl₃): δ 8.31 (d, *J* = 8.8 Hz, 2H), 7.74 (d, *J* = 8.8 Hz, 2H), 7.63 (d, *J* = 7.2 Hz, 2H), 7.52-7.44 (m, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 147.5, 147.0, 138.7, 129.1, 128.8, 127.7, 127.3, 124.0.

3l

1-Nitro-4-(trifluoromethyl)benzene (3l),^[12] yellow oil, 59.8 mg, 63% yield. ¹H NMR (400 MHz, CDCl₃): δ 8.38 (d, *J* = 8.8 Hz, 2H), 7.86 (d, *J* = 8.8 Hz, 2H); ¹³C NMR (100 MHz, CDCl₃): δ 149.9, 136.5(q, *J* = 33.6 Hz), 126.8 (q, *J* = 3.7 Hz), 124.3, 124.0 (q, *J* = 271.3 Hz).

3n

1-Bromo-2-nitrobenzene (3n),^[9] yellow solid, 85.3 mg, 85% yield. mp: 44-45 °C; ¹H NMR (500 MHz, CDCl₃): δ 7.85 (d, *J* = 7.0 Hz, 1H), 7.75 (d, *J* = 7.0 Hz, 1H), 7.47 (t, *J* = 7.0 Hz, 2H); ¹³C NMR (125 MHz, CDCl₃): δ 150.0, 135.0, 133.1, 128.2, 125.5, 114.4.

3o

Methyl 4-nitrobenzoate (3o),^[10] white solid, 66.7 mg, 74% yield. mp: 98-99 °C; ¹H NMR (400 MHz, CDCl₃): δ 8.30 (d, *J* = 8.4 Hz, 2H), 8.22 (d, *J* = 8.4 Hz, 2H), 3.98 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 165.1, 150.5, 135.4, 130.6, 123.5, 52.8.

4. Synthesis of 4, 5 and 6

Synthesis of **4**^[13]

In Schlenk tube was charged with **2n** (0.100 g, 0.50 mmol) in air atmosphere, dissolved in DCM (5.0 mL) and followed with *m*-CPBA (441 mg, 1.8 mmol). The mixture was stirred vigorously at room temperature for 12 h. At this time, the DCM was removed under reduced pressure and crude product was purified by flash chromatography (dry loading with SiO₂) using eluents (1:10 ethyl acetate:petroleum ether) to provide product **4** as colorless oil (0.093 mg, 60% yield). ¹H NMR (400 MHz, CDCl₃): δ 8.05 (s, 1H), 7.97 (d, *J* = 7.6 Hz, 1H), 7.72 (d, *J* = 7.2 Hz, 1H), 7.66-7.60 (m, 2H), 7.49-7.41 (m, 2H), 7.27-7.23 (m, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 161.8, 135.1, 134.4, 133.5, 130.2, 130.0, 129.8, 129.4, 129.0, 127.8, 127.1, 121.7, 109.5; IR (thin film) 3074, 2958, 2856, 2160, 1764, 1569, 1424, 1216, 1012, 726 cm⁻¹.

Synthesis of **5**^[14]

In Schlenk tube was charged with **2n** (0.100 g, 0.50 mmol) in nitrogen atmosphere, dissolved in THF (5.0 mL) and cooled to 0 °C, followed dropwise slowly with PhMgBr (0.6 mmol, 3M in ether). Then, the mixture was stirred vigorously at room temperature for 12 h. At this time, the solvent was removed under reduced pressure and crude product was purified by flash chromatography (dry loading with SiO₂) using eluents (1:10 ethyl acetate:petroleum ether) to provide product **5** as yellow oil (0.098 g, 74% yield). ¹H NMR (400 MHz, CDCl₃): δ 7.57 (d, *J* = 8.0 Hz, 1H), 7.46 (d, *J* = 6.4 Hz, 2H), 7.41-7.37 (m, 3H), 7.16 (t, *J* = 7.6 Hz, 1H), 7.04-7.00 (m, 1H), 6.93 (d, *J* = 7.2 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 138.7, 133.4, 132.9, 132.8, 129.7, 129.6, 128.4, 127.7, 127.2, 123.0; IR (thin film) 3058, 2924, 2856, 1576, 1475, 1444, 1020, 745, 693 cm⁻¹.

Synthesis of **6**^[15]

In Schlenk tube was charged with 2-methylindole (0.066 g, 0.50 mmol) and **3n** (0.200 g, 1.0 mmol) in air atmosphere, dissolved in DMSO (2.0 mL) and followed with *t*-BuOK (0.113 g, 1.0 mmol). The mixture turned brown black immediately and was stirred vigorously at room temperature for 12 h. At this time, the solvent was removed under reduced pressure and crude product was purified by flash chromatography (dry loading with SiO₂) using eluents (1:20 ethyl acetate:petroleum ether to 1:5) to provide product **6** as yellow oil (0.107 g, 65% yield). ¹H NMR (400 MHz, CDCl₃): δ 8.12 (brs, 1H), 7.94 (d, *J* = 8.0 Hz, 1H), 7.63 (t, *J* = 7.2 Hz, 1H), 7.52 (d, *J* = 7.2 Hz, 1H), 7.48-7.44 (m, 1H), 7.29-7.24 (m, 1H), 7.16-7.12 (m, 1H), 7.08-7.04 (m, 1H), 2.28 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 150.3, 135.1, 133.6, 132.7, 132.1, 129.7, 127.7, 127.3, 124.3, 121.7, 120.2, 117.8, 110.5, 109.6, 12.1; IR (thin film) 3403, 3059, 2923, 2857, 1565, 1522, 1459, 1352, 744, 711 cm⁻¹.

5. Synthesis of diaryliodonium salts **1**

General Procedure C: Aryl boronic acid (10 mmol, 1.0 equiv) and CH₂Cl₂ (40 mL) were combined in a dried round-bottom flask. The mixture was cooled to 0 °C for 5 min, BF₃•OEt₂ (1.12 mL, 1.10 equiv) was added, and the mixture was stirred for 10 min. A solution of 2-(diacetoxyiodo)arene (1.05 equiv) in CH₂Cl₂ (20 mL) was added slowly for 10-15 min and stirred for additional 10 min. The mixture was warmed to room temperature and stirred for 1 h. the reaction was cooled to 0 °C again and TfOH (1.67 mL, 1.1 equiv) was dropped into the mixture. Then stirring the mixture for 10 min and warmed to room temperature for additional 10 min. At this time, removed the solvent under reduced pressure and ran through a short SiO₂ column (about 5 cm) with 5% of MeOH in CH₂Cl₂ quickly. Concentrated under vacuum and Et₂O (100 mL) was added to the residual to form the white solid. Filtrated and obtained the diaryliodonium salts **1** as white solid.

Diaryliodonium salts were reported before and their spectra data matched literature values: the data of **1a-1o**, please see our recent publications: (a) X. P. Ma, W. M. Shi, X. L. Mo, X. H. Li, L. G. Li, C. X. Pan, B. Chen, G. F. Su and D. L. Mo, *J. Org. Chem.* 2015, **80**, 10098; (b) W. M. Shi, X. P. Ma, C. X. Pan, G. F. Su and D. L. Mo, *J. Org. Chem.* 2015, **80**, 11175.

9. Reference

- [1] D. Zhu, D. Chang and L. Shi, *Chem. Commun.* 2015, **51**, 7180.
 [2] R. Frei, R. Courant, M. D. Wodrich and J. Waser, *Chem. Eur. J.* 2015, **21**, 2662.

- [3] F. Tang, J. T. Yu, H. T. Yang, Y. Jiang and J. Cheng, *Chem. Commun.* 2014, **50**, 12139.
- [4] N. Sun, H. Zhang, W. M. Mo, B. X. Hu, Z. L. Zhen and X. Q. Hu, *Synlett* 2013, **24**, 1443.
- [5] B. Exner, B. Bayarmagnai, F. Jia and L. J. Goossen, *Chem. Eur. J.* 2015, **21**, 17220.
- [6] A. Khazaei, A. Alizadeh, R. G. Vaghei, *Molecules* 2001, **6**, 253.
- [7] A. T. Rasschaert, G. J. Benoy, J. F. van Besauw, Assignee: Gevaert-Agfa N. V., Brit. GB 1099768, 28 Dec 1968.
- [8] P. Natarajan, R. Chaudhary, P. Venugopalan, *J. Org. Chem.* 2015, **80**, 10498.
- [9] J. Liu, J. Li, J. M. Ren and B. B. Zeng, *Tetrahedron Lett.* 2014, **55**, 1581.
- [10] S. Manna, S. Maity, S. Rana, S. Agasti and D. Maiti, *Org. Lett.* 2012, **14**, 1736.
- [11] N. Chatterjee, D. Bhatt and A. Goswami, *Org. Biomol. Chem.* 2015, **13**, 4828.
- [12] Y. F. Liu, X. X. Shao, P. P. Zhang, L. Lv, Q. L. Shen, *Org. Lett.* 2015, **17**, 2752.
- [13] B. Bhattarai, J. H. Tay, P. Nagorny, *Chem. Commun.* 2015, **51**, 5398.
- [14] X. M. Wu, G. L. Yan, *Synlett* 2015, **26**, 537.
- [15] S. Kumar, V. Rathore, A. Verma, C. D. Prasad, A. Kumar, A. Yadav, S. Jana, M. S. Meenakshi, S. Kumar, *Org. Lett.* 2015, **17**, 82.

2a

7.444
7.438
7.424
7.364
7.342
7.328
7.325

-0.001

7.476
 7.462
 7.454
 7.440
 7.259

1.320

0.072
 0.000

7.574
 7.566
 7.560
 7.552
 7.262
 7.169
 7.155
 7.141

0.071
 0.000

8.398
 8.295
 8.279
 7.897
 7.882
 7.707
 7.692
 7.675
 7.269

0.001

2h

7.621
7.612
7.338
7.324
7.295
7.283
7.268

2.475

-0.001

2h

2i

7.642
 7.628
 7.591
 7.577
 7.565
 7.553
 7.471
 7.458
 7.445
 7.404
 7.391
 7.379
 7.242

0.000

7.465
7.449
7.294
7.278
7.255

2.924

1.253
1.239

7.693
7.640
7.628
7.265

0.000

7.674
7.552
7.537
7.467
7.451
7.326
7.310
7.294
7.262

2m

1.00 1.04
1.03 1.05

132.649
 132.175
 131.358
 128.172
 126.291
 123.753

109.491

77.321
 77.000
 76.679

7.726
 7.713
 7.621
 7.608
 7.450
 7.437
 7.424
 7.270
 7.260
 7.245

0.072
 0.000

1.00
 0.99
 1.08
 1.34

3a

3a

3b

3d

3d

3f

8.278

7.266

7.224

7.214

3f

8.310
8.288
7.749
7.727
7.636
7.618
7.520
7.502
7.484
7.465
7.447
7.260

0.076
0.000

3j

2.00
2.15
2.09
3.15

3j

3I

3n

7.850
7.836
7.756
7.742
7.471
7.456
7.442
7.268

-0.000

3n

3o

4

8.054
7.972
7.953
7.729
7.711
7.660
7.640
7.624
7.604
7.496
7.476
7.456
7.436
7.417
7.274
7.259
7.237

-0.000

4

7.570
7.550
7.460
7.444
7.410
7.402
7.389
7.373
7.254
7.160
7.141
7.122
7.044
7.026
7.009
6.933
6.915

0.000

5

5

138.744
133.458
132.999
132.853
129.754
129.608
128.427
127.778
127.224
123.039

77.314
77.000
76.679

6