11 s ³ T ₁ LD/s GaAs/AlGaAs 2D 2017-10 4	Tim	ne	Coherence	Qubit	Material	Host	Date	Reference	Source	0
30	57	s	T_1	LD/e	GaAs/AlGaAs	2D	2018-08	1	p3 and Fig. 4a	1
11								2	~ -	2
10 S				LD/i	Si:P					3
9.8 s		s				2D	2017-10	4	Fig. 2 the lowest green point	4
9.3 s T ₁ LD/c Si/SiO ₂ 1D 2021-03 7 p3 and Fig. 3 at the leftmost blue point 7 6.5 s T ₁ LD/c Si/SiO ₂ 1D 2021-03 7 p3 and Fig. 3 at the leftmost blue point 7 6.5 s T ₁ LD/c Si/SiO ₂ 1D 2019-04 10 p4 10 p5 10		S				imp	2019-05	5		5
9 s T ₁ LD/c Si/SiO ₂ 1D 2021-03 7 Fig. 3a the leftmost blue point 7 fo.5 s T ₁ LD/c Si:P imp 2010-09 9 p2 9		s				imp		6	_	6
6.5 s	9	S		LD/e		1D	2021-03	7	-	7
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	6.5	s		LD/i		imp	2023-02	8		
5 sb T ₁ LD/s Si/SiGe 2D 2019-04 10 p4 10 4.2 s T ₁ LD/s Si/SiP imp 2019-01 11 p3 11 3.4 s T ₁ LD/s 28/SiP imp 2011-04 12 p6 and SFig. 3c 12 3.8 s T ₁ LD/s Si/SiGe 2D 2012-01 14 p4 44 2.6 s T ₁ LD/s Si/SiGe 2D 2013-06 16 p3 16 1.8 s T ₁ LD/s Si/SiGo 2D 2022-03 18 p4 and Fig. 3c 18 1.6 s T ₁ LD/s 28/Si/SiO ₂ 2D 2022-03 18 p4 and Fig. 3c 18 1.3 s T ₁ LD/s Si/Si/SiO ₂ 2D 2020-03 21 p6 and Fig. 3a 18 1.3 s T ₁ LD/s Si/Si/SiO ₂	6	S		LD/i	Si:P	imp	2010-09	9		9
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	5	s^b		LD/e	Si/SiGe	_	2019-04	10		10
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4.2	S		LD/i	Si:P	imp	2019-01	11	p3	11
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	3.4	s		LD/i	²⁸ Si:P	imp	2021-01	12	p6 and SFig. 3c	12
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	3	S	T_1	LD/i	²⁸ Si:P	imp	2016-10	13	p3	13
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	3	s		ST/e	Si/SiGe	2D	2012-01	14	p4	14
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2.8	S	T_1	LD/e	Si/SiGe	2D	2011-04	15	p3 and Fig. 3	15
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2.6	s		LD/e	Si/SiO ₂	2D	2013-06	16	p3	16
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.8	S	T_1	LD/i	Si:P	imp	2013-06	17		17
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.6	s	T_1	LD/e	²⁸ Si/SiO ₂	2D	2022-03	18	p4 and Fig. 3c	18
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.3	S	T_1	LD/ic	²⁸ Si:P	imp	2016-10	19	p4	19
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.3	s		LD/i	Si:P	imp	2018-11	20	p3 and Fig. 2b	20
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	1	S		LD/e	²⁸ Si/SiGe	2D	2020-03	21	p6 and Fig. 4a	21
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1	s	T_1	LD/e	²⁸ Si/SiO ₂	2D	2018-10	22	p2	22
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1	S	T_1	LD/e	GaAs/AlGaAs	2D	2008-01	23	p4 and Fig. 3c the leftmost blue point	23
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			T_1	LD/i	Si:P	imp	2012-09	24	p3	24
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.6	s^d	T_1	LD/e	Si/SiGe	2D	2009-08	25	Fig. 5	25
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.5	se	T_1	ST/e	²⁸ Si/SiO ₂	2D	2020-04	26	Fig. 4 the leftmost black point	26
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				LD/e	Si/SiGe	2D	2016-11	27	Fig. 6	27
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.16	s^f	T_1	LD/e		2D	2019-04	10		28
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.15	S^g	T_1	LD/e	²⁸ Si/SiO ₂	2D	2018-08	28	p2 and p4	29
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.14	S	T_1	ST/e	Si/SiGe	2D	2012-04		Fig. 2d	30
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	0.13	S	T_1	LD/e	²⁸ Si/SiGe	2D	2019-11	30	p4	31
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	90	ms	T_1	LD/e	Si/SiO ₂	2D	2020-06		Fig. 1c	32
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	85	ms	T_1		GaAs/AlGaAs	2D	2014-12	32	p2 and Fig. 3	33
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	50	ms	T_1	LD/e	Si/SiGe	2D	2018-02		p1 and ED Fig. 3b	34
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	40	ms		LD/e	Si/SiO ₂	2D	2010-03	34	p4 and Fig. 4 the leftmost red point	35
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		ms		ST/e	BLG		2023-04	35	p5 and Fig. 3a	36
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		ms				2D				37
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$										38
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		msh							p2 and ED Fig. 4b-d	39
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		ms								40
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	16	ms						40		41
8.4 ms T_1 LD/h BLG 2D 2022-05 42 p5 and Fig. 4 44 5 ms T_1 LD/i 28 Si:B imp 2020-07 43 p3 and Fig. 3b 45 5 ms ^k T_1 ST/e 28 Si/SiO ₂ 2D 2021-01 44 p4 and Fig. 1d 46 4.1 ms T_1 ST/i Si:P imp 2014-06 45 45 3.7 ms T_1 LD/e GaAs/AlGaAs 2D 2016-07 46 p3 and Fig. 2 48 3.7 ms T_1 LD/e ¹ 28 Si/SiO ₂ 2D 2020-04 47 p2 49		ms ^j				2D		26		42
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	10	ms		LD/e		1D		41		43
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		ms				2D				44
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$						imp		43		45
3.7 ms T_1 LD/e GaAs/AlGaAs 2D 2016-07 46 p3 and Fig. 2 48 3.7 ms T_1 LD/e ¹ 28 Si/SiO ₂ 2D 2020-04 47 p2 49		msk				2D			p4 and Fig. 1d	46
3.7 ms T_1 LD/e ¹ 28 Si/SiO ₂ 2D 2020-04 47 p2		ms				_				47
		ms	T_1	LD/e				46	p3 and Fig. 2	48
3.1 ms T. LD/i ²⁸ Si·P imp 2022-01 48 FD Fig 3 first column		ms				2D				49
5.1 mg 1 ₁ 2021 51.1 mp 2022-01 40 2011 ig. 5 mst column 50	3.1	ms	T_1	LD/i	²⁸ Si:P	imp	2022-01	48	ED Fig. 3 first column	50

TABLE I-1. Spin coherence times (part 1). Superscripts stand for the following. a : Dot D3. b : No micromagnet. c : Qubit defined in the rotating frame. d : (*estimated*) Fig. 5 the lowest point. e : At 0.04 kelvin. f : With micromagnet. g : At 0.1 kelvin. h : The average over the three qubits. i : EO qubit. j : At 1.5 kelvin. k : Lifetime of T_- state. 1 : At 1 kelvin.

- [1] Leon C. Camenzind, Liuqi Yu, Peter Stano, Jeramy D. Zimmerman, Arthur C. Gossard, Daniel Loss, and Dominik M. Zumbühl. Hyperfine-phonon spin relaxation in a single-electron GaAs quantum dot. *Nature Communications*, 9(1):3454, August 2018. ISSN 2041-1723. doi:10.1038/s41467-018-05879-x. URL http://www.nature.com/articles/s41467-018-05879-x.
- [2] Thomas F. Watson, Bent Weber, Yu-Ling Hsueh, Lloyd C. L. Hollenberg, Rajib Rahman, and Michelle Y. Simmons. Atomically engineered electron spin lifetimes of 30 s in silicon. *Science Advances*, 3(3):e1602811, March 2017. ISSN 2375-2548. doi: 10.1126/sciadv.1602811. URL http://advances.sciencemag.org/lookup/doi/10.1126/sciadv.1602811.
- [3] M.R. Hogg, P. Pakkiam, S.K. Gorman, A.V. Timofeev, Y. Chung, G.K. Gulati, M.G. House, and M.Y. Simmons. Single-Shot Readout of Multiple Donor Electron Spins with a Gate-Based Sensor. *PRX Quantum*, 4(1):010319, February 2023. ISSN 2691-3399. doi: 10.1103/PRXQuantum.4.010319. URL https://link.aps.org/doi/10.1103/PRXQuantum.4.010319.
- [4] A. Hofmann, V. F. Maisi, T. Krähenmann, C. Reichl, W. Wegscheider, K. Ensslin, and T. Ihn. Anisotropy and Suppression of Spin-Orbit Interaction in a GaAs Double Quantum Dot. *Physical Review Letters*, 119(17):176807, October 2017. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.119.176807. URL https://link.aps.org/doi/10.1103/PhysRevLett.119.176807.
- [5] Stefanie B. Tenberg, Serwan Asaad, Mateusz T. Mądzik, Mark A. I. Johnson, Benjamin Joecker, Arne Laucht, Fay E. Hudson, Kohei M. Itoh, A. Malwin Jakob, Brett C. Johnson, David N. Jamieson, Jeffrey C. McCallum, Andrew S. Dzurak, Robert Joynt, and Andrea Morello. Electron spin relaxation of single phosphorus donors in metal-oxide-semiconductor nanoscale devices. *Physical Review B*, 99 (20):205306, May 2019. ISSN 2469-9950, 2469-9969. doi:10.1103/PhysRevB.99.205306. URL https://link.aps.org/doi/10.1103/PhysRevB.99.205306.
- [6] M. A. Broome, S. K. Gorman, M. G. House, S. J. Hile, J. G. Keizer, D. Keith, C. D. Hill, T. F. Watson, W. J. Baker, L. C. L. Hollenberg, and M. Y. Simmons. Two-electron spin correlations in precision placed donors in silicon. *Nature Communications*, 9(1):980, March 2018. ISSN 2041-1723. doi:10.1038/s41467-018-02982-x. URL http://www.nature.com/articles/s41467-018-02982-x.
- [7] Virginia N. Ciriano-Tejel, Michael A. Fogarty, Simon Schaal, Louis Hutin, Benoit Bertrand, Lisa Ibberson, M. Fernando Gonzalez-Zalba, Jing Li, Yann-Michel Niquet, Maud Vinet, and John J.L. Morton. Spin Readout of a CMOS Quantum Dot by Gate Reflectometry and Spin-Dependent Tunneling. *PRX Quantum*, 2(1):010353, March 2021. ISSN 2691-3399. doi:10.1103/PRXQuantum.2.010353. URL https://link.aps.org/doi/10.1103/PRXQuantum.2.010353.
- [8] Rostyslav Savytskyy, Tim Botzem, Irene Fernandez De Fuentes, Benjamin Joecker, Jarryd J. Pla, Fay E. Hudson, Kohei M. Itoh, Alexander M. Jakob, Brett C. Johnson, David N. Jamieson, Andrew S. Dzurak, and Andrea Morello. An electrically driven single-atom "flip-flop" qubit. Science Advances, 9(6):eadd9408, February 2023. ISSN 2375-2548. doi:10.1126/sciadv.add9408. URL https://www.science.org/doi/10.1126/sciadv.add9408.
- [9] Andrea Morello, Jarryd J. Pla, Floris A. Zwanenburg, Kok W. Chan, Kuan Y. Tan, Hans Huebl, Mikko Möttönen, Christopher D. Nugroho, Changyi Yang, Jessica A. van Donkelaar, Andrew D. C. Alves, David N. Jamieson, Christopher C. Escott, Lloyd C. L. Hollenberg, Robert G. Clark, and Andrew S. Dzurak. Single-shot readout of an electron spin in silicon. *Nature*, 467(7316):687–691, September 2010. ISSN 0028-0836, 1476-4687. doi:10.1038/nature09392. URL http://www.nature.com/articles/nature09392.
- [10] F. Borjans, D.M. Zajac, T.M. Hazard, and J.R. Petta. Single-Spin Relaxation in a Synthetic Spin-Orbit Field. Physical Review Applied, 11(4):044063, April 2019. ISSN 2331-7019. doi:10.1103/PhysRevApplied.11.044063. URL https://link.aps.org/doi/10.1103/PhysRevApplied.11.044063.
- [11] Matthias Koch, Joris G. Keizer, Prasanna Pakkiam, Daniel Keith, Matthew G. House, Eldad Peretz, and Michelle Y. Simmons. Spin read-out in atomic qubits in an all-epitaxial three-dimensional transistor. *Nature Nanotechnology*, 14(2):137–140, January 2019. ISSN 1748-3387, 1748-3395. doi:10.1038/s41565-018-0338-1. URL http://www.nature.com/articles/s41565-018-0338-1.
- [12] Mateusz T. Mądzik, Arne Laucht, Fay E. Hudson, Alexander M. Jakob, Brett C. Johnson, David N. Jamieson, Kohei M. Itoh, Andrew S. Dzurak, and Andrea Morello. Conditional quantum operation of two exchange-coupled single-donor spin qubits in a MOS-compatible silicon device. *Nature Communications*, 12(1):181, January 2021. ISSN 2041-1723. doi:10.1038/s41467-020-20424-5. URL http://www.nature.com/articles/s41467-020-20424-5.
- [13] Juan P Dehollain, Juha T Muhonen, Robin Blume-Kohout, Kenneth M Rudinger, John King Gamble, Erik Nielsen, Arne Laucht, Stephanie Simmons, Rachpon Kalra, Andrew S Dzurak, and Andrea Morello. Optimization of a solid-state electron spin qubit using gate set tomography. New Journal of Physics, 18(10):103018, October 2016. ISSN 1367-2630. doi:10.1088/1367-2630/18/10/103018. URL https://doi.org/10.1088/1367-2630/18/10/103018.
- [14] J. R. Prance, Zhan Shi, C. B. Simmons, D. E. Savage, M. G. Lagally, L. R. Schreiber, L. M. K. Vandersypen, Mark Friesen, Robert Joynt, S. N. Coppersmith, and M. A. Eriksson. Single-Shot Measurement of Triplet-Singlet Relaxation in a Si / SiGe Double Quantum Dot. *Physical Review Letters*, 108(4):046808, January 2012. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.108.046808. URL https://link.aps.org/doi/10.1103/PhysRevLett.108.046808.
- [15] C. B. Simmons, J. R. Prance, B. J. Van Bael, Teck Seng Koh, Zhan Shi, D. E. Savage, M. G. Lagally, R. Joynt, Mark Friesen, S. N. Coppersmith, and M. A. Eriksson. Tunable Spin Loading and T 1 of a Silicon Spin Qubit Measured by Single-Shot Readout. *Physical Review Letters*, 106(15):156804, April 2011. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.106.156804. URL https://link.aps.org/doi/10.1103/PhysRevLett.106.156804.
- [16] C. H. Yang, A. Rossi, R. Ruskov, N. S. Lai, F. A. Mohiyaddin, S. Lee, C. Tahan, G. Klimeck, A. Morello, and A. S. Dzurak. Spin-valley lifetimes in a silicon quantum dot with tunable valley splitting. *Nature Communications*, 4:2069, June 2013. ISSN 2041-1723. doi:10.1038/ncomms3069. URL http://www.nature.com/doifinder/10.1038/ncomms3069.
- [17] H. Büch, S. Mahapatra, R. Rahman, A. Morello, and M. Y. Simmons. Spin readout and addressability of phosphorus-donor clusters in silicon. *Nature Communications*, 4(1):2017, June 2013. ISSN 2041-1723. doi:10.1038/ncomms3017. URL http://www.nature.com/articles/ncomms3017.
- [18] A. M. J. Zwerver, T. Krähenmann, T. F. Watson, L. Lampert, H. C. George, R. Pillarisetty, S. A. Bojarski, P. Amin, S. V. Amitonov,

- J. M. Boter, R. Caudillo, D. Correas-Serrano, J. P. Dehollain, G. Droulers, E. M. Henry, R. Kotlyar, M. Lodari, F. Lüthi, D. J. Michalak, B. K. Mueller, S. Neyens, J. Roberts, N. Samkharadze, G. Zheng, O. K. Zietz, G. Scappucci, M. Veldhorst, L. M. K. Vandersypen, and J. S. Clarke. Qubits made by advanced semiconductor manufacturing. *Nature Electronics*, 5(3):184–190, March 2022. ISSN 2520-1131. doi:10.1038/s41928-022-00727-9. URL https://www.nature.com/articles/s41928-022-00727-9.
- [19] Arne Laucht, Rachpon Kalra, Stephanie Simmons, Juan P. Dehollain, Juha T. Muhonen, Fahd A. Mohiyaddin, Solomon Freer, Fay E. Hudson, Kohei M. Itoh, David N. Jamieson, Jeffrey C. McCallum, Andrew S. Dzurak, and A. Morello. A dressed spin qubit in silicon. *Nature Nanotechnology*, 12(1):61-66, October 2016. ISSN 1748-3387, 1748-3395. doi:10.1038/nnano.2016.178. URL http://www.nature.com/doifinder/10.1038/nnano.2016.178.
- [20] Bent Weber, Yu-Ling Hsueh, Thomas F. Watson, Ruoyu Li, Alexander R. Hamilton, Lloyd C. L. Hollenberg, Rajib Rahman, and Michelle Y. Simmons. Spin-orbit coupling in silicon for electrons bound to donors. *npj Quantum Information*, 4(1):61, November 2018. ISSN 2056-6387. doi:10.1038/s41534-018-0111-1. URL http://www.nature.com/articles/s41534-018-0111-1.
- [21] Arne Hollmann, Tom Struck, Veit Langrock, Andreas Schmidbauer, Floyd Schauer, Tim Leonhardt, Kentarou Sawano, Helge Riemann, Nikolay V. Abrosimov, Dominique Bougeard, and Lars R. Schreiber. Large, Tunable Valley Splitting and Single-Spin Relaxation Mechanisms in a Si / Si x Ge 1 x Quantum Dot. *Physical Review Applied*, 13(3):034068, March 2020. ISSN 2331-7019. doi: 10.1103/PhysRevApplied.13.034068. URL https://link.aps.org/doi/10.1103/PhysRevApplied.13.034068.
- [22] K. W. Chan, W. Huang, C. H. Yang, J. C. C. Hwang, B. Hensen, T. Tanttu, F. E. Hudson, K. M. Itoh, A. Laucht, A. Morello, and A. S. Dzurak. Assessment of a Silicon Quantum Dot Spin Qubit Environment via Noise Spectroscopy. *Physical Review Applied*, 10 (4):044017, October 2018. ISSN 2331-7019. doi:10.1103/PhysRevApplied.10.044017. URL https://link.aps.org/doi/10.1103/PhysRevApplied.10.044017.
- [23] S. Amasha, K. MacLean, Iuliana P. Radu, D. M. Zumbühl, M. A. Kastner, M. P. Hanson, and A. C. Gossard. Electrical Control of Spin Relaxation in a Quantum Dot. *Physical Review Letters*, 100(4):046803, January 2008. ISSN 0031-9007, 1079-7114. doi: 10.1103/PhysRevLett.100.046803. URL http://link.aps.org/doi/10.1103/PhysRevLett.100.046803.
- [24] Jarryd J. Pla, Kuan Y. Tan, Juan P. Dehollain, Wee H. Lim, John J. L. Morton, David N. Jamieson, Andrew S. Dzurak, and Andrea Morello. A single-atom electron spin qubit in silicon. *Nature*, 489(7417):541-545, September 2012. ISSN 0028-0836, 1476-4687. doi:10.1038/nature11449. URL http://www.nature.com/doifinder/10.1038/nature11449.
- [25] Robert R. Hayes, Andrey A. Kiselev, Matthew G. Borselli, Steven S. Bui, Edward T. Croke III, Peter W. Deelman, Brett M. Maune, Ivan Milosavljevic, Jeong-Sun Moon, and Richard S. Ross. Lifetime measurements (T1) of electron spins in Si/SiGe quantum dots, August 2009. URL https://arxiv.org/abs/0908.0173. arXiv:0908.0173.
- [26] C. H. Yang, R. C. C. Leon, J. C. C. Hwang, A. Saraiva, T. Tanttu, W. Huang, J. Camirand Lemyre, K. W. Chan, K. Y. Tan, F. E. Hudson, K. M. Itoh, A. Morello, M. Pioro-Ladrière, A. Laucht, and A. S. Dzurak. Operation of a silicon quantum processor unit cell above one kelvin. *Nature*, 580(7803):350–354, April 2020. ISSN 0028-0836, 1476-4687. doi:10.1038/s41586-020-2171-6. URL http://www.nature.com/articles/s41586-020-2171-6.
- [27] D. M. Zajac, T. M. Hazard, X. Mi, E. Nielsen, and J. R. Petta. Scalable Gate Architecture for a One-Dimensional Array of Semiconductor Spin Qubits. *Physical Review Applied*, 6(5):054013, November 2016. ISSN 2331-7019. doi:10.1103/PhysRevApplied.6.054013. URL https://link.aps.org/doi/10.1103/PhysRevApplied.6.054013.
- [28] L. Petit, J. M. Boter, H. G. J. Eenink, G. Droulers, M. L. V. Tagliaferri, R. Li, D. P. Franke, K. J. Singh, J. S. Clarke, R. N. Schouten, V. V. Dobrovitski, L. M. K. Vandersypen, and M. Veldhorst. Spin Lifetime and Charge Noise in Hot Silicon Quantum Dot Qubits. Physical Review Letters, 121(7):076801, August 2018. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.121.076801. URL https://link.aps.org/doi/10.1103/PhysRevLett.121.076801.
- [29] Zhan Shi, C. B. Simmons, J. R. Prance, John King Gamble, Teck Seng Koh, Yun-Pil Shim, Xuedong Hu, D. E. Savage, M. G. Lagally, M. A. Eriksson, Mark Friesen, and S. N. Coppersmith. Fast Hybrid Silicon Double-Quantum-Dot Qubit. *Physical Review Letters*, 108 (14):140503, April 2012. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.108.140503. URL https://link.aps.org/doi/10.1103/PhysRevLett.108.140503.
- [30] A. J. Sigillito, M. J. Gullans, L. F. Edge, M. Borselli, and J. R. Petta. Coherent transfer of quantum information in a silicon double quantum dot using resonant SWAP gates. *npj Quantum Information*, 5(1):110, November 2019. ISSN 2056-6387. doi:10.1038/s41534-019-0225-0. URL http://www.nature.com/articles/s41534-019-0225-0.
- [31] Xin Zhang, Rui-Zi Hu, Hai-Ou Li, Fang-Ming Jing, Yuan Zhou, Rong-Long Ma, Ming Ni, Gang Luo, Gang Cao, Gui-Lei Wang, Xuedong Hu, Hong-Wen Jiang, Guang-Can Guo, and Guo-Ping Guo. Giant Anisotropy of Spin Relaxation and Spin-Valley Mixing in a Silicon Quantum Dot. *Physical Review Letters*, 124(25):257701, June 2020. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.124.257701. URL https://link.aps.org/doi/10.1103/PhysRevLett.124.257701.
- [32] P. Scarlino, E. Kawakami, P. Stano, M. Shafiei, C. Reichl, W. Wegscheider, and L. M. K. Vandersypen. Spin-Relaxation Anisotropy in a GaAs Quantum Dot. *Physical Review Letters*, 113(25):256802, December 2014. ISSN 0031-9007, 1079-7114. doi: 10.1103/PhysRevLett.113.256802. URL https://link.aps.org/doi/10.1103/PhysRevLett.113.256802.
- [33] T. F. Watson, S. G. J. Philips, E. Kawakami, D. R. Ward, P. Scarlino, M. Veldhorst, D. E. Savage, M. G. Lagally, Mark Friesen, S. N. Coppersmith, M. A. Eriksson, and L. M. K. Vandersypen. A programmable two-qubit quantum processor in silicon. *Nature*, 555(7698): 633–637, February 2018. ISSN 0028-0836, 1476-4687. doi:10.1038/nature25766. URL http://www.nature.com/doifinder/10.1038/nature25766.
- [34] M. Xiao, M. G. House, and H. W. Jiang. Measurement of the Spin Relaxation Time of Single Electrons in a Silicon Metal-Oxide-Semiconductor-Based Quantum Dot. *Physical Review Letters*, 104(9):096801, March 2010. ISSN 0031-9007, 1079-7114. doi: 10.1103/PhysRevLett.104.096801. URL https://link.aps.org/doi/10.1103/PhysRevLett.104.096801.
- [35] Rebekka Garreis, Chuyao Tong, Jocelyn Terle, Max Josef Ruckriegel, Jonas Daniel Gerber, Lisa Maria Gächter, Kenji Watanabe, Takashi Taniguchi, Thomas Ihn, Klaus Ensslin, and Wei Wister Huang. Long-lived valley states in bilayer graphene quantum dots, April 2023. URL http://arxiv.org/abs/2304.00980. arXiv:2304.00980 [cond-mat, physics:quant-ph].
- [36] W. I. L. Lawrie, N. W. Hendrickx, F. van Riggelen, M. Russ, L. Petit, A. Sammak, G. Scappucci, and M. Veldhorst. Spin relaxation

- benchmarks and individual qubit addressability for holes in quantum dots. *Nano Letters*, 20(10):7237–7242, August 2020. ISSN 1530-6984, 1530-6992. doi:10.1021/acs.nanolett.0c02589. URL http://arxiv.org/abs/2006.12563. arXiv: 2006.12563.
- [37] A.R. Mills, C.R. Guinn, M.M. Feldman, A.J. Sigillito, M.J. Gullans, M.T. Rakher, J. Kerckhoff, C.A.C. Jackson, and J.R. Petta. High-Fidelity State Preparation, Quantum Control, and Readout of an Isotopically Enriched Silicon Spin Qubit. *Physical Review Applied*, 18(6): 064028, December 2022. ISSN 2331-7019. doi:10.1103/PhysRevApplied.18.064028. URL https://link.aps.org/doi/10.1103/PhysRevApplied.18.064028.
- [38] Kenta Takeda, Akito Noiri, Takashi Nakajima, Takashi Kobayashi, and Seigo Tarucha. Quantum error correction with silicon spin qubits. *Nature*, 608(7924):682-686, August 2022. ISSN 0028-0836, 1476-4687. doi:10.1038/s41586-022-04986-6. URL https://www.nature.com/articles/s41586-022-04986-6.
- [39] Jacob Z. Blumoff, Andrew S. Pan, Tyler E. Keating, Reed W. Andrews, David W. Barnes, Teresa L. Brecht, Edward T. Croke, Larken E. Euliss, Jacob A. Fast, Clayton A.C. Jackson, Aaron M. Jones, Joseph Kerckhoff, Robert K. Lanza, Kate Raach, Bryan J. Thomas, Roland Velunta, Aaron J. Weinstein, Thaddeus D. Ladd, Kevin Eng, Matthew G. Borselli, Andrew T. Hunter, and Matthew T. Rakher. Fast and High-Fidelity State Preparation and Measurement in Triple-Quantum-Dot Spin Qubits. *PRX Quantum*, 3(1):010352, March 2022. ISSN 2691-3399. doi:10.1103/PRXQuantum.3.010352. URL https://link.aps.org/doi/10.1103/PRXQuantum.3.010352.
- [40] Nico W. Hendrickx, William I. L. Lawrie, Maximilian Russ, Floor van Riggelen, Sander L. de Snoo, Raymond N. Schouten, Amir Sammak, Giordano Scappucci, and Menno Veldhorst. A four-qubit germanium quantum processor. *Nature*, 591(7851):580-585, March 2021. ISSN 0028-0836, 1476-4687. doi:10.1038/s41586-021-03332-6. URL http://www.nature.com/articles/s41586-021-03332-6.
- [41] Cameron Spence, Bruna Cardoso Paz, Bernhard Klemt, Emmanuel Chanrion, David J. Niegemann, Baptiste Jadot, Vivien Thiney, Benoit Bertrand, Heimanu Niebojewski, Pierre-André Mortemousque, Xavier Jehl, Romain Maurand, Silvano De Franceschi, Maud Vinet, Franck Balestro, Christopher B äuerle, Yann-Michel Niquet, Tristan Meunier, and Matias Urdampilleta. Spin-valley coupling anisotropy and noise in CMOS quantum dots, September 2021. URL http://arxiv.org/abs/2109.13557. arXiv: 2109.13557.
- [42] Lisa Maria Gächter, Rebekka Garreis, Jonas Daniel Gerber, Max Josef Ruckriegel, Chuyao Tong, Benedikt Kratochwil, Folkert Kornelis de Vries, Annika Kurzmann, Kenji Watanabe, Takashi Taniguchi, Thomas Ihn, Klaus Ensslin, and Wister Wei Huang. Single-Shot Spin Readout in Graphene Quantum Dots. *PRX Quantum*, 3(2):020343, May 2022. ISSN 2691-3399. doi:10.1103/PRXQuantum.3.020343. URL https://link.aps.org/doi/10.1103/PRXQuantum.3.020343.
- [43] Takashi Kobayashi, Joseph Salfi, Cassandra Chua, Joost van der Heijden, Matthew G. House, Dimitrie Culcer, Wayne D. Hutchison, Brett C. Johnson, Jeff C. McCallum, Helge Riemann, Nikolay V. Abrosimov, Peter Becker, Hans-Joachim Pohl, Michelle Y. Simmons, and Sven Rogge. Engineering long spin coherence times of spin-orbit qubits in silicon. *Nature Materials*, 20(1):38–42, July 2020. ISSN 1476-1122, 1476-4660. doi:10.1038/s41563-020-0743-3. URL http://www.nature.com/articles/s41563-020-0743-3.
- [44] Amanda E. Seedhouse, Tuomo Tanttu, Ross C.C. Leon, Ruichen Zhao, Kuan Yen Tan, Bas Hensen, Fay E. Hudson, Kohei M. Itoh, Jun Yoneda, Chih Hwan Yang, Andrea Morello, Arne Laucht, Susan N. Coppersmith, Andre Saraiva, and Andrew S. Dzurak. Pauli Blockade in Silicon Quantum Dots with Spin-Orbit Control. *PRX Quantum*, 2(1):010303, January 2021. ISSN 2691-3399. doi: 10.1103/PRXQuantum.2.010303. URL https://link.aps.org/doi/10.1103/PRXQuantum.2.010303.
- [45] Juan P. Dehollain, Juha T. Muhonen, Kuan Y. Tan, Andre Saraiva, David N. Jamieson, Andrew S. Dzurak, and Andrea Morello. Single-Shot Readout and Relaxation of Singlet and Triplet States in Exchange-Coupled P 31 Electron Spins in Silicon. *Physical Review Letters*, 112(23):236801, June 2014. ISSN 0031-9007, 1079-7114. doi:10.1103/PhysRevLett.112.236801. URL https://link.aps.org/doi/10.1103/PhysRevLett.112.236801.
- [46] T. A. Baart, N. Jovanovic, C. Reichl, W. Wegscheider, and L. M. K. Vandersypen. Nanosecond-timescale spin transfer using individual electrons in a quadruple-quantum-dot device. *Applied Physics Letters*, 109(4):043101, July 2016. ISSN 0003-6951, 1077-3118. doi: 10.1063/1.4959183. URL http://aip.scitation.org/doi/10.1063/1.4959183.
- [47] L. Petit, H. G. J. Eenink, M. Russ, W. I. L. Lawrie, N. W. Hendrickx, S. G. J. Philips, J. S. Clarke, L. M. K. Vandersypen, and M. Veldhorst. Universal quantum logic in hot silicon qubits. *Nature*, 580(7803):355–359, April 2020. ISSN 0028-0836, 1476-4687. doi:10.1038/s41586-020-2170-7. URL http://www.nature.com/articles/s41586-020-2170-7.
- [48] Mateusz T. Mądzik, Serwan Asaad, Akram Youssry, Benjamin Joecker, Kenneth M. Rudinger, Erik Nielsen, Kevin C. Young, Timothy J. Proctor, Andrew D. Baczewski, Arne Laucht, Vivien Schmitt, Fay E. Hudson, Kohei M. Itoh, Alexander M. Jakob, Brett C. Johnson, David N. Jamieson, Andrew S. Dzurak, Christopher Ferrie, Robin Blume-Kohout, and Andrea Morello. Precision tomography of a three-qubit donor quantum processor in silicon. *Nature*, 601(7893):348–353, January 2022. ISSN 0028-0836, 1476-4687. doi:10.1038/s41586-021-04292-7. URL https://www.nature.com/articles/s41586-021-04292-7.