Publications

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Summary

220 publications (**49** in Nature/Science; **99** in Phys. Rev. Lett./Nature Physics/Phys. Rev. X/PNAS).
Google Scholar: **>93,100** citations; *h*-index **122**.

Preprints / In submission

- K. Srakaew; P. Weckesser; D. Adler; S. Agrawal; D. Gröters; I. Bloch; J. Zeiher *Single-qubit detection by collective phase imprinting.*
  arXiv:2608.06970
- O. Lib; S. Liu; M. Ammenwerth; H. Timme; S. Sun; Q. He; M. Huber; G. Vitagliano; I. Bloch; J. Zeiher *Qutrit entanglement and joint multi-parameter estimation in an optical clock platform.*
  arXiv:2608.05426
- A. Kumar; L. Festa; A. Grinberg; E. Reches; D. Tsevas; K. P. Mours; Z. Zhang; R. Eberhard; S. Blatt; A. Alberti; J. Zeiher; I. Bloch; M. Melchner *A cryogenic neutral-atom platform with full optical access and 2-hour trap lifetime.*
  arXiv:2607.12988
- F. Bippus; T. Chalopin; G. Bellomia; G. Roósz; T. Franz; A. Georges; A. Kauch; I. Bloch; K. Held *Emergence of spin entanglement with the pseudogap onset in the Fermi-Hubbard model.*
  arXiv:2605.31240
- S. Karch; M. Will; I. P. Rodriguez; N. Liebster; S. Huh; M. Knap; F. Pollmann; C. Kuhlenkamp; I. Bloch; M. Aidelsburger *Dynamical preparation of U(1) quantum spin liquids in an analogue quantum simulator.*
  arXiv:2604.24744
- S. Wang; T. G. Kiely; D. Tell; J. Obermeyer; M. Barendregt; P. Bojović; P. M. Preiss; A. Sarma; T. Franz; M. P. A. Fisher; C. Xu; I. Bloch *Observation of Strong-to-Weak Spontaneous Symmetry Breaking in a Dephased Fermi Gas.*
  arXiv:2604.16137
- R. Andrei; I. Morera; J. B. Curtis; I. Bloch; E. Demler *Universal magnetic energy scale in the doped Fermi-Hubbard model.*
  arXiv:2604.15234
- O. Lib; H. Timme; M. Ammenwerth; F. Gyger; R. Tao; S. Sun; I. Bloch; J. Zeiher *Velocity-Enabled Quantum Computing with Neutral Atoms.*
  arXiv:2603.15561
- H. Lange; L. Qiu; R. Groth; A. von Haaren; L. Muscarella; T. Franz; I. Bloch; F. Grusdt; P. M. Preiss; A. Bohrdt *Realizing the Emery Model in Optical Lattices for Quantum Simulation of Cuprates and Nickelates.*
  arXiv:2603.11037
- S. Biswas; S. Eppelt; W. Tian; W. Zhang; F. Deng; C. Frank; T. Shi; I. Bloch; X.-Y. Luo *Controlled symmetry breaking of the Fermi surface in ultracold polar molecules.*
  arXiv:2602.22447
- R. Ziv; D. Wei; A. Rubio-Abadal; D. Adler; A. Keselman; E. Lustig; R. Talmon; J. Zeiher; I. Bloch; M. Segev *Unsupervised Machine Learning for Experimental Detection of Quantum-Many-Body Phase Transitions.*
  arXiv:2512.01091
- S. Karch; S. Bandyopadhyay; Z.-H. Sun; A. Impertro; S. Huh; I. P. Rodriguez; J. F. Wienand; W. Ketterle; M. Heyl; A. Polkovnikov; I. Bloch; M. Aidelsburger *Probing quantum many-body dynamics using subsystem Loschmidt echos.*
  arXiv:2501.16995
- A. Bohrdt; D. Wei; D. Adler; K. Srakaew; S. Agrawal; P. Weckesser; I. Bloch; F. Grusdt; J. Zeiher *Microscopy of bosonic charge carriers in staggered magnetic fields.*
  arXiv:2410.19500

- Z. Zhang; L. Van Damme; M. Rossignolo; L. Festa; M. Melchner; R. Eberhard; D. Tsevas; K. Mours; E. Reches; J. Zeiher; S. Blatt; I. Bloch; S. J. Glaser; A. Alberti *Recoil-free Quantum Gates with Optical Qubits.* arXiv:2408.04622

List of Publications

220. T. C. Liebisch; P. Kaufmann; H. Schnatz; et al. (169 authors, incl. I. Bloch) *The QTF Backbone: proposal for a nationwide optical fibre backbone in Germany for quantum technology and time and frequency metrology.* Eur. Phys. J. Spec. Top. **235**, 3353–3387 (2026). DOI

219. R. Tao; O. Lib; F. Gyger; H. Timme; M. Ammenwerth; I. Bloch; J. Zeiher *Universal Global Gates for a Fine-Structure Qubit in Strontium-88.* Phys. Rev. Lett. **136**, 153602 (2026). DOI

218. P. Bojović; T. Hilker; S. Wang; J. Obermeyer; M. Barendregt; D. Tell; T. Chalopin; P. M. Preiss; I. Bloch; T. Franz *High-fidelity collisional quantum gates with fermionic atoms.* Nature **652**, 602–608 (2026). DOI

217. S. Biswas; S. Eppelt; Ch. Buchberger; X. Chen; A. Schindewolf; M. Hani; E. Biebl; I. Bloch; X. Luo *Generation of strong ultralow-phase-noise microwave fields with tunable ellipticity for ultracold polar molecules.* Rev. Sci. Instrum. **97**, 044706 (2026). DOI

216. T. Chalopin; P. Bojović; S. Wang; T. Franz; A. Sinha; Z. Wang; D. Bourgund; J. Obermeyer; F. Grusdt; A. Bohrdt; L. Pollet; A. Wietek; A. Georges; T. Hilker; I. Bloch *Observation of emergent scaling of spin–charge correlations at the onset of the pseudogap.* Proc. Natl. Acad. Sci. U.S.A. **123**(4), e2525539123 (2026). DOI

215. P. Weckesser; K. Srakaew; T. Blatz; D. Wei; D. Adler; S. Agrawal; A. Bohrdt; I. Bloch; J. Zeiher *Realisation of a Rydberg-dressed extended Bose-Hubbard model.* Science **390**, 6775, 849–853 (2025). DOI

214. M. Ammenwerth; H. Timme; F. Gyger; R. Tao; I. Bloch; J. Zeiher *Realization of a Fast Triple-Magic All-Optical Qutrit in ^{88}Sr.* Phys. Rev. Lett. **135**, 143401 (2025). DOI

213. M. Ammenwerth; H. Timme; V. Giardini; R. Tao; F. Gyger; O. Lib; D. Berndt; D. Kourkoulos; T. Rom; I. Bloch; J. Zeiher *Dynamical spatial light modulation in the ultraviolet spectral range.* Phys. Rev. Applied **24**, 034031 (2025). DOI

212. A. Impertro; S. Huh; S. Karch; J. F. Wienand; I. Bloch; M. Aidelsburger *Strongly interacting Meissner phases in large bosonic flux ladders.* Nat. Phys. **21**, 895–901 (2025). DOI

211. T. Chalopin; P. Bojović; D. Bourgund; S. Wang; T. Franz; I. Bloch; T. A. Hilker *Optical Superlattice for Engineering Hubbard Couplings in Quantum Simulation.* Phys. Rev. Lett. **134**, 053402 (2025). DOI

210. D. Bourgund; T. Chalopin; P. Bojovic; H. Schlömer; S. Wang; T. Franz; S. Hirthe; A. Bohrdt; F. Grusdt; I. Bloch; T. A. Hilker *Formation of individual stripes in a mixed-dimensional cold-atom Fermi-Hubbard system.* Nature **637**, 57–62 (2025). DOI

209. H. Schlömer; H. Lange; T. Franz; T. Chalopin; P. Bojovic; S. Wang; I. Bloch; T. A. Hilker; F. Grusdt; A. Bohrdt *Local Control and Mixed Dimensions: Exploring High-Temperature Superconductivity in Optical Lattices.* PRX Quantum **5**, 040341 (2024). DOI

208. D. Adler; D. Wei; M. Will; K. Srakaew; S. Agrawal; P. Weckesser; R. Moessner; F. Pollmann; I. Bloch; J. Zeiher *Observation of Hilbert space fragmentation and fractonic excitations in 2D.* Nature **636**, 80–85 (2024). DOI

207. S. Hollerith; V. Walther; K. Srakaew; D. Wei; D. Adler; S. Agrawal; P. Weckesser; I. Bloch; J. Zeiher *Rydberg molecules bound by strong light fields.* PRX Quantum **5**, 030335 (2024). DOI

206. A. Impertro; S. Karch; J. F. Wienand; S. Huh; C. Schweizer; I. Bloch; M. Aidelsburger *Local readout and control of current and kinetic energy operators in optical lattices.* Phys. Rev. Lett. **133**, 063401 (2024). DOI

205. F. J. Wienand; S. Karch; A. Impertro; C. Schweizer; E. McCulloch; R. Vasseur; S. Gopalakrishnan; M. Aidelsburger; I. Bloch *Emergence of fluctuating hydrodynamics in chaotic quantum systems.* Nat. Phys. **20**, 1732–1737 (2024). DOI

204. F. Gyger; M. Ammenwerth; R. Tao; H. Timme; S. Snigirev; I. Bloch; J. Zeiher *Continuous operation of large-scale atom arrays in optical lattices.*
Phys. Rev. Res. **6**, 033104 (2024). DOI

203. R. Tao; M. Ammenwerth; F. Gyger; I. Bloch; J. Zeiher *High-fidelity detection of large-scale atom arrays in an optical lattice.*
Phys. Rev. Lett. **133**, 013401 (2024). DOI

202. Ch. Braun; R. Saint-Jalm; A. Hesse; J. Arceri; I. Bloch; M. Aidelsburger *Real-space detection and manipulation of topological edge modes with ultracold atoms.*
Nat. Phys. **20**, 1306–1312 (2024). DOI

201. V. Klüsener; S. Pucher; D. Yankelev; J. Trautmann; F. Spriestersbach; D. Filin; S. G. Porsev; M. S. Safronova; I. Bloch; S. Blatt *Long-Lived Coherence on a μ Hz Scale Optical Magnetic Quadrupole Transition.*
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200. S. Pucher; V. Klüsener; F. Spriestersbach; J. Geiger; A. Schindewolf; I. Bloch; S. Blatt *Fine-Structure Qubit Encoded in Metastable Strontium Trapped in an Optical Lattice.*
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199. G. Pasqualetti; O. Bettermann; N. Darkwah Oppong; E. Ibarra-García-Padilla; S. Dasgupta; R. Scalettar; K. Hazzard; I. Bloch; S. Fölling *Equation of State and Thermometry of the 2D SU(N) Fermi-Hubbard Model.*
Phys. Rev. Lett. **132**, 083401 (2024). DOI

198. X. Chen; S. Biswas; S. Eppelt; A. Schindewolf; F. Deng; T. Shi; S. Yi; T. A. Hilker; I. Bloch; X. Luo *Ultracold field-linked tetratomic molecules.*
Nature **626**, 283–287 (2024). DOI

197. O. Bettermann; N. Darkwah Oppong; G. Pasqualetti; L. Riegger; I. Bloch; S. Fölling *Clock-line photoassociation of strongly bound dimers in a magic-wavelength lattice.*
Phys. Rev. A **108**, L041302 (2023). DOI

196. H. Schlömer; T. A. Hilker; I. Bloch; U. Schollwöck; F. Grusdt; A. Bohrdt *Quantifying hole-motion-induced frustration in doped antiferromagnets by Hamiltonian reconstruction.*
Commun. Mater. **4**, 64 (2023). DOI

195. E. Wybo; A. Bastianello; M. Aidelsburger; I. Bloch; M. Knap *Preparing and Analysing Solitons in the Sine-Gordon Model with Quantum Gas Microscopes.*
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194. A. Impertro; J. F. Wienand; S. Haefele; H. von Raven; S. Hubele; T. M. Klostermann; C. R. Cabrera; I. Bloch; M. Aidelsburger *An unsupervised deep learning algorithm for single-site reconstruction in quantum gas microscopes.*
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193. D. Wei; D. Adler; K. Srakaew; S. Agrawal; P. Weckesser; I. Bloch; J. Zeiher *Observation of Brane Parity Order in Programmable Optical Lattices.*
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192. I. Bloch *Editorial: Künstliche Quantenwelten im Labor.*
Phys. Unserer Zeit **54**, 54(5):211-211 (2023). DOI

191. M. Duda; X. Chen; R. Bause; A. Schindewolf; I. Bloch; X. Luo *Long-lived fermionic Feshbach molecules with tunable p-wave interactions.*
Phys. Rev. A **107**, 053322 (2023). DOI

190. J. Trautmann; D. Yankelev; V. Klüsener; A. J. Park; I. Bloch; S. Blatt *$^1S_0$–$^3P_2$ magnetic quadrupole transition in neutral strontium.*
Phys. Rev. Res. **5**, 013219 (2023). DOI

189. K. Srakaew; P. Weckesser; S. Hollerith; D. Wei; D. Adler; I. Bloch; J. Zeiher *A subwavelength atomic array switched by a single Rydberg atom.*
Nat. Phys. **19**, 714–719 (2023). DOI

188. M. Duda; X. Chen; A. Schindewolf; R. Bause; J. von Milczewski; R. Schmidt; I. Bloch; X. Luo *Transition from a polaronic condensate to a degenerate Fermi gas of heteronuclear molecules.*
Nat. Phys. **19**, 720–725 (2023). DOI

187. X. Chen; A. Schindewolf; S. Eppelt; R. Bause; M. Duda; S. Biswas; T. Karman; T. A. Hilker; I. Bloch; X. Luo *Field-linked resonances of polar molecules.*
Nature **614**, 59–63 (2023). DOI

186. S. Hirthe; T. Chalopin; D. Bourgund; P. Bojovic; A. Bohrdt; E. Demler; F. Grusdt; I. Bloch; T. A. Hilker *Magnetically mediated hole pairing in fermionic ladders of ultracold atoms.*
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185. R. Bause; A. Christianen; A. Schindewolf; I. Bloch; X. Luo *Ultracold sticky collisions: Theoretical and experimental status.*
J. Phys. Chem. A **127**, 729–741 (2023). DOI

184. T. Kohlert; S. Scherg; P. Sala; F. Pollmann; B. H. Madhusudhana; I. Bloch; M. Aidelsburger *Exploring the regime of fragmentation in strongly tilted Fermi-Hubbard chains.*
Phys. Rev. Lett. **130**, 010201 (2023). DOI

183. I. Bloch; M. Greiner *The superfluid-to-Mott insulator transition and the birth of experimental quantum simulation.*
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182. S. Flannigan; N. Pearson; G. Low; A. Buyskikh; I. Bloch; P. Zoller; M. Troyer; A. Daley *Propagation of errors and quantitative quantum simulation with quantum advantage.*
Quantum Sci. Technol. **7**(4), 045025 (2022). DOI

181. N. Darkwah Oppong; G. Pasqualetti; O. Bettermann; P. Zechmann; M. Knap; I. Bloch; S. Fölling *Probing transport and slow relaxation in the mass-imbalanced Fermi-Hubbard model.*
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180. A. J. Daley; I. Bloch; C. Kokail; S. Flannigan; N. Pearson; M. Troyer; P. Zoller *Practical quantum advantage in quantum simulation.*
Nature **607**, 667–676 (2022). DOI

179. A. J. Park; J. Trautmann; N. Šantić; V. Klüsener; A. Heinz; I. Bloch; S. Blatt *Cavity-Enhanced Optical Lattices for Scaling Neutral Atom Quantum Technologies to Higher Qubit Numbers.*
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178. A. Schindewolf; R. Bause; X. Chen; M. Duda; T. Karman; I. Bloch; X. Luo *Evaporation of microwave-shielded polar molecules to quantum degeneracy.*
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176. X. Chen; M. Duda; A. Schindewolf; R. Bause; I. Bloch; X. Luo *Suppression of Unitary Three-body Loss in a Degenerate Bose-Fermi Mixture.*
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175. T. Klostermann; C. R. Cabrera; H. von Raven; J. F. Wienand; C. Schweizer; I. Bloch; M. Aidelsburger *Fast long-distance transport of cold cesium atoms.*
Phys. Rev. A **105**(4), 043319 (2022). DOI

174. S. Hollerith; K. Srakaew; D. Wei; A. Rubio Abadal; D. Adler; P. Weckesser; A. Kruckenhauser; V. Walther; R. van Bijnen; J. Rui; C. Gross; I. Bloch; J. Zeiher *Realizing distance-selective interactions in a Rydberg-dressed atom array.*
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173. A. Bohrdt; L. Homeier; I. Bloch; E. A. Demler; F. Grusdt *Strong pairing in mixed-dimensional bilayer antiferromagnetic Mott insulators.*
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172. P. Sompet; S. Hirthe; D. Bourgund; T. Chalopin; J. Bibo; J. Koepsell; P. Bojović; R. Verresen; F. Pollmann; G. Salomon; C. Gross; T. A. Hilker; I. Bloch *Realizing the symmetry-protected Haldane phase in Fermi–Hubbard ladders.*
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171. B. H. Madhusudhana; S. Scherg; T. Kohlert; I. Bloch; M. Aidelsburger *Benchmarking a Novel Efficient Numerical Method for Localized 1D Fermi–Hubbard Systems on a Quantum Simulator.*
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170. R. Bause; A. Kamijo; X. Chen; M. Duda; A. Schindewolf; I. Bloch; X. Luo *Efficient conversion of closed-channel-dominated Feshbach molecules of 23Na40K to their absolute ground state.*
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169. J. M. S. Koepsell; D. Bourgund; P. Sompet; S. Hirthe; A. Bohrdt; Y. Wang; F. Grusdt; E. A. Demler; G. Salomon; C. Groß; I. Bloch *Microscopic evolution of doped Mott insulators from polaronic metal to Fermi liquid.*
Science **374**, 82–86 (2021). DOI

168. S. Scherg; T. Kohlert; P. Sala; F. Pollmann; B. H. Madhusudhana; I. Bloch; M. Aidelsburger *Observing non-ergodicity due to kinetic constraints in tilted Fermi-Hubbard chains.*
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167. R. Bause; A. Schindewolf; R. Tao; M. Duda; X. Chen; G. Quemener; T. Karman; A. Christianen; I. Bloch; X. Luo *Collisions of ultracold molecules in bright and dark optical dipole traps.*
Phys. Rev. Res. **3**, 033013 (2021). DOI

166. S. Hollerith; A. Rubio-Abadal; K. Srakaew; D. Wei; J. Zeiher; C. Groß; I. Bloch *Microscopic electronic structure tomography of Rydberg macrodimers.*
Phys. Rev. Res. **3**, 013252 (2021). DOI

165. A. Heinz; J. Trautmann; N. Santic; A. J. Park; I. Bloch; S. Blatt *Crossed optical cavities with large mode diameters.*
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164. J. Rui; D. Wei; A. Rubio-Abadal; S. Hollerith; J. Zeiher; D. M. Stamper-Kurn; C. Groß; I. Bloch *A subradiant optical mirror formed by a single structured atomic layer.*
Nature **583**, 369–374 (2020). DOI

163. A. Rubio-Abadal; N. Ippoliti; S. Hollerith; D. Wei; J. Rui; S. L. Sondhi; V. Khemani; C. Groß; I. Bloch *Floquet prethermalization in a Bose–Hubbard system.*
Phys. Rev. X **10**, 021044 (2020). DOI

162. J. Koepsell; S. Hirthe; D. Bourgund; P. Sompet; J. Vijayan; G. Salomon; C. Groß; I. Bloch *Robust bilayer charge-pumping for spin- and density-resolved quantum gas microscopy.*
Phys. Rev. Lett. **125**, 010403 (2020). DOI

161. K. Wintersperger; C. Braun; F. N. Ünal; A. Eckardt; M. Di Liberti; N. Goldman; I. Bloch; M. Aidelsburger *Realization of an anomalous Floquet topological system with ultracold atoms.*
Nat. Phys. **16**, 1058–1063 (2020). DOI

160. R. Bause; M. Li; A. Schindewolf; X. -Y. Chen; M. Duda; S. Kotochigova; I. Bloch; X. -Y. Luo *Tune-out and magic wavelengths for ground-state $^{23}Na^{40}K$ molecules.*
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159. A. Heinz; A. J. Park; N. Santic; J. Trautmann; S. G. Porsev; M. S. Safronova; I. Bloch; S. Blatt *State-dependent optical lattices for the strontium optical qubit.*
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158. K. Wintersperger; M. Bukov; J. Näger; S. Lellouch; E. A. Demler; U. Schneider; I. Bloch; N. Goldman; M. Aidelsburger *Parametric instabilities of interacting bosons in periodically driven 1D optical lattices.*
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157. J. Vijayan; P. Sompet; G. Salomon; J. Koepsell; S. Hirthe; A. Bohrdt; F. Grusdt; I. Bloch; C. Groß *Time-resolved observation of spin–charge deconfinement in fermionic Hubbard chains.*
Science **367**, 186–189 (2020). DOI

156. J. Koepsell; J. Vijayan; P. Sompet; F. Grusdt; T. A. Hilker; E. Demler; G. Salomon; I. Bloch; C. Gross *Imaging magnetic polarons in the doped Fermi–Hubbard model.*
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155. D. A. Abanin; E. Altman; I. Bloch; M. Serbyn *Colloquium: Many-body localization, thermalization, and entanglement.*
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154. C. Schweizer; F. Grusdt; M. Berngruber; L. Barbiero; E. Demler; N. Goldman; I. Bloch; M. Aidelsburger *Floquet approach to $\mathbb{Z}_2$ lattice gauge theories with ultracold atoms in optical lattices.*
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153. A. Rubio-Abadal; J.-Y. Choi; J. Zeiher; S. Hollerith; J. Rui; I. Bloch; C. Groß *Many-Body Delocalization in the Presence of a Quantum Bath.*
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150. N. Darkwah Oppong; L. Riegger; O. Bettermann; M. Höfer; J. Levinsen; M. M. Parish; I. Bloch; S. Fölling *Observation of coherent multi-orbital polarons in a two-dimensional Fermi gas.*
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149. G. Salomon; J. Koepsell; J. Vijayan; T. A. Hilker; J. Nespolo; L. Pollet; I. Bloch; C. Gross *Direct observation of incommensurate magnetism in Hubbard chains.*
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148. T. Kohlert; S. Scherg; X. Li; H. P. Lüschen; S. Das Sarma; I. Bloch; M. Aidelsburger *Observation of many-body localization in a one-dimensional system with single-particle mobility edge.*
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146. F. Seeßelberg; X.-Y. Luo; M. Li; R. Bause; S. Kotochigova; I. Bloch; C. Gohle *Extending rotational coherence of interacting polar molecules in a spin-decoupled magic trap.*
Phys. Rev. Lett. **121**, 253401 (2018). DOI

145. S. Scherg; T. Kohlert; J. Herbrych; J. Stolpp; P. Bordia; U. Schneider; F. Heidrich-Meisner; I. Bloch; M. Aidelsburger *Non-Equilibrium Mass Transport in the 1D Fermi-Hubbard Model.*
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144. A. Acín; I. Bloch; H. Buhrman; T. Calarco; C. Eichler; J. Eisert; D. Esteve; N. Gisin; S. J. Glaser; F. Jelezko; S. Kuhr; M. Lewenstein; M. F. Riedel; P. O. Schmidt; R. Thew; A. Wallraff; I. Walmsley; F. K. Wilhelm *The quantum technologies roadmap: a European community view.*
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143. M. Lohse; Ch. Schweizer; H. M. Price; O. Zilberberg; I. Bloch *Exploring 4D Quantum Hall Physics with a 2D Topological Charge Pump.*
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142. H. P. Lüschen; S. Scherg; T. Kohlert; M. Schreiber; P. Bordia; X. Li; S. Das Sarma; I. Bloch *Single-Particle Mobility Edge in a One-Dimensional Quasiperiodic Optical Lattice.*
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Phys. Rev. A **97**, 013405 (2018). DOI

140. F. Grusdt; T. Li; I. Bloch; E. Demler *Tunable spin-orbit coupling for ultracold atoms in two-dimensional optical lattices.*
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