

# Publications of Kirk T. McDonald

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## Publications in Refereed Journals

1. (with C.Y. Prescott *et al.*) *Wire Orbit Ray Tracing of Magnets Using Magnetostrictive Wire Chamber Techniques*, Nucl. Instr. and Meth. **76**, 173 (1969), [physics.princeton.edu/~mcdonald/papers/prescott\\_nim\\_76\\_173\\_69.pdf](http://physics.princeton.edu/~mcdonald/papers/prescott_nim_76_173_69.pdf)
2. (with K. Eggert *et al.*) *A Streamer Chamber Detector at the CERN Intersecting Storage Rings*, Nucl. Instr. and Meth. **126**, 477 (1975), [physics.princeton.edu/~mcdonald/papers/eggert\\_nim\\_126\\_477\\_75.pdf](http://physics.princeton.edu/~mcdonald/papers/eggert_nim_126_477_75.pdf)
3. (with K. Eggert *et al.*) *Angular Correlations Between the Charged Particles Produced in  $pp$  Collisions at ISR Energies*, Nucl. Phys. **B86**, 201 (1975), [physics.princeton.edu/~mcdonald/papers/eggert\\_np\\_b86\\_201\\_75.pdf](http://physics.princeton.edu/~mcdonald/papers/eggert_np_b86_201_75.pdf)
4. (with P. Darriulat *et al.*) *Conversion Efficiency of Lead for 30-200 MeV Photons*, Nucl. Instr. and Meth. **129**, 105 (1975), [physics.princeton.edu/~mcdonald/papers/darriulat\\_nim\\_129\\_105\\_75.pdf](http://physics.princeton.edu/~mcdonald/papers/darriulat_nim_129_105_75.pdf)
5. (with K. Eggert *et al.*) *A Study of High Transverse Momentum  $\pi^0$ 's at ISR Energies*, Nucl. Phys. **B98**, 49 (1975), [physics.princeton.edu/~mcdonald/papers/eggert\\_np\\_b98\\_49\\_75.pdf](http://physics.princeton.edu/~mcdonald/papers/eggert_np_b98_49_75.pdf)
6. (with K. Eggert *et al.*) *Angular Correlations in Proton-Proton Collisions Producing a High Transverse Momentum  $\pi^0$* , Nucl. Phys. **B98**, 73 (1975), [physics.princeton.edu/~mcdonald/papers/eggert\\_np\\_b98\\_73\\_75.pdf](http://physics.princeton.edu/~mcdonald/papers/eggert_np_b98_73_75.pdf)
7. (with K. Eggert *et al.*) *A Measurement of the Proton-Proton Cross Section at the CERN ISR*, Nucl. Phys. **B98**, 93 (1975), [physics.princeton.edu/~mcdonald/papers/eggert\\_np\\_b98\\_93\\_75.pdf](http://physics.princeton.edu/~mcdonald/papers/eggert_np_b98_93_75.pdf)
8. (with C.A. Heusch *et al.*) *Two-Body Photodisintegration of  $^3\text{He}$  and a New Test of Time-Reversal Invariance in the Electromagnetic Interaction*, Phys. Rev. Lett. **37**, 405 (1976), [physics.princeton.edu/~mcdonald/papers/heusch\\_pr1\\_37\\_405\\_76.pdf](http://physics.princeton.edu/~mcdonald/papers/heusch_pr1_37_405_76.pdf)
9. (with C.A. Heusch *et al.*) *Radiative Formation of  $^3\text{He}$  and a New Test of Time-Reversal Invariance in the Electromagnetic Interaction*, Phys. Rev. Lett. **37**, 409 (1976), [physics.princeton.edu/~mcdonald/papers/heusch\\_pr1\\_37\\_409\\_76.pdf](http://physics.princeton.edu/~mcdonald/papers/heusch_pr1_37_409_76.pdf)
10. (with P. Darriulat *et al.*) *Structure of Final States with a High Transverse Momentum  $\pi^0$  in Proton-Proton Collisions*, Nucl. Phys. **B107**, 429 (1976), [physics.princeton.edu/~mcdonald/papers/darriulat\\_np\\_b107\\_429\\_76.pdf](http://physics.princeton.edu/~mcdonald/papers/darriulat_np_b107_429_76.pdf)

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12. (with K.J. Anderson *et al.*) *Production of Muon Pairs by 150-GeV/c  $\pi^+$  and Protons*, Phys. Rev. Lett. **36**, 237 (1976),  
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17. (with J.G. Branson *et al.*) *Production of the  $J/\psi$  and  $\psi'(3.7)$  by 225-GeV/c  $\pi^\pm$  and Proton Beams on C and Sn Targets*, Phys. Rev. Lett. **38**, 1331 (1977),  
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22. (with K.J. Anderson *et al.*) *Production of Muon Pairs by 225-GeV/c  $\pi^\pm$ ,  $K^+$ ,  $p^\pm$  Beams on Nuclear Targets*, Phys. Rev. Lett. **42**, 944 (1979),  
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1382. *Ph205 Lecture 3: Development of a General Method, Lagrange's Equations,*  
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### **Ph304: Advanced Electromagnetism**

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1421. *Ph304 Problem Set 3*,  
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1422. *Ph304 Problem Set 4*,  
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1423. *Ph304 Problem Set 5*,  
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1424. *Ph304 Problem Set 6*,  
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1425. *Ph304 Problem Set 7*,  
[physics.princeton.edu/~mcdonald/examples/ph304set8.pdf](http://physics.princeton.edu/~mcdonald/examples/ph304set8.pdf)
1426. *Ph304 Problem Set 8*,  
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[physics.princeton.edu/~mcdonald/examples/ph304set1.pdf](http://physics.princeton.edu/~mcdonald/examples/ph304set1.pdf)
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1433. *Ph304 Final Exam (2002)*,  
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## Ph308: Quantum Mechanics

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## Ph406: Nuclear and Elementary Particle Physics

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1437. *Ph406 Problem Set 2* (Feb. 1993),  
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1438. *Ph406 Problem Set 3* (Feb. 1993),  
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1445. *Ph406 Problem Set 10* (March 1993),  
[physics.princeton.edu/~mcdonald/examples/ph406/ph406\\_set10.pdf](http://physics.princeton.edu/~mcdonald/examples/ph406/ph406_set10.pdf)
1446. *Ph406 Final Exam* (May 1992),  
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[physics.princeton.edu/~mcdonald/examples/ph405ph406\\_final\\_sol.pdf](http://physics.princeton.edu/~mcdonald/examples/ph405ph406_final_sol.pdf)
1447. *Ph406 Problem Set 1* (2014),  
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1449. *Ph406 Problem Set 3* (2014),  
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1450. *Ph406 Problem Set 4* (2014),  
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1451. *Ph406 Problem Set 5* (2014),  
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1452. *Ph406 Problem Set 6* (2014),  
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1454. *Ph406 Problem Set 8* (2014),  
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1455. *Ph406 Problem Set 9* (2014),  
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1456. *Ph406 Problem Set 10* (2014),  
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1457. *Ph406 Problem Set 11* (2014),  
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1458. *Ph406 Problem Set 12* (2014),  
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### **Ph410: Physics of Quantum Computation**

1459. *Problem Sets (2005-2006)*,  
[physics.princeton.edu/~mcdonald/examples/ph410problems.pdf](http://physics.princeton.edu/~mcdonald/examples/ph410problems.pdf)
1460. *Reflections of a (Skeptical) Experimental High-Energy Physicist after Teaching a Course on Quantum Computation* (Feb. 24, 2006),  
[physics.princeton.edu/~mcdonald/examples/QMtrans1.pdf](http://physics.princeton.edu/~mcdonald/examples/QMtrans1.pdf)

### **Ph501: Electricity and Magnetism**

1461. *Ph501 Lecture 1: Overview of Maxwell's Equations; Electrostatics*,  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture1.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture1.pdf)
1462. *Ph501 Lecture 2: Conductors and Dielectrics*,  
[physics.princeton.edu/~mcdonald/examples/ph501ph501lecture2.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501ph501lecture2.pdf)

1463. *Ph501 Lecture 3: Electrostatic Energy, Maxwell Stress Tensor,*  
[physics.princeton.edu/~mcdonald/examples/ph501ph501lecture3.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501ph501lecture3.pdf)
1464. *Ph501 Lecture 4: Potential Theory: Image Methods, 2-D Problems with Rectangular Boundaries,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture4.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture4.pdf)
1465. *Ph501 Lecture 5: Potential Theory: 2-D Problems with Cylindrical and Spherical Boundaries,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture5.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture5.pdf)
1466. *Ph501 Lecture 6: Potential Theory: 3-D Problems with Cylindrical Boundaries; Conducting Needles, Spheroids, Disks; Use of Conjugate Functions,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture6.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture6.pdf)
1467. *Ph501 Lecture 7: Steady Currents; Magnetostatics,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture7.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture7.pdf)
1468. *Ph501 Lecture 8: Sources of the Magnetic field; Magnetic Materials,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture8.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture8.pdf)
1469. *Ph501 Lecture 9: Faraday's Law,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture9.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture9.pdf)
1470. *Ph501 Lecture 10: Electromagnetic Energy, Momentum and Angular Momentum; Inductance,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture10.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture10.pdf)
1471. *Ph501 Lecture 11: Introduction to Electromagnetic Waves,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture11.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture11.pdf)
1472. *Ph501 Lecture 12: Plane Waves in Dielectric Media,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture12.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture12.pdf)
1473. *Ph501 Lecture 13: Plane Waves in Conducting Media,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture13.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture13.pdf)
1474. *Ph501 Lecture 14: Waves in Boxes and Pipes,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture14.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture14.pdf)
1475. *Ph501 Lecture 15: Sources of the Waves – The Retarded Potentials,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture15.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture15.pdf)
1476. *Ph501 Lecture 16: Multipole Radiation; Antennas; Scattering,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture16.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture16.pdf)
1477. *Ph501 Lecture 17: Optics and Diffraction; Gaussian Laser Beams,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture17.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture17.pdf)

1478. *Ph501 Lecture 18: Special Relativity; The 4-Potential of a Moving Charge,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture18.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture18.pdf)
1479. *Ph501 Lecture 19: Other Force Fields; Significance of Gauge Invariance; Fields of a Moving Charge,*  
[physics.princeton.edu/~mcdonald/examples/ph501ph501lecture19.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501ph501lecture19.pdf)
1480. *Ph501 Lecture 20: Relativistic Radiation Effects: Bremsstrahlung, Synchrotron Radiation,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture20.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture20.pdf)
1481. *Ph501 Lecture 21: Relativistic Radiation Effects: Čerenkov Radiation, Transition Radiation,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture21.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture21.pdf)
1482. *Ph501 Lecture 22: Electromagnetic Mass; Radiation Reaction,*  
[physics.princeton.edu/~mcdonald/examples/ph501ph501lecture22.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501ph501lecture22.pdf)
1483. *Ph501 Lecture 23: Interaction of Radiation with Matter – Microscopic View,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture23.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture23.pdf)
1484. *Ph501 Lecture 24: Mechanics and Electromagnetism,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture24.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture24.pdf)
1485. *Ph501 Lecture 25: Lasers from a Classical Perspective,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture25.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture25.pdf)
1486. *Ph501 Lecture 26: Solitons,*  
[physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture26.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501/ph501lecture26.pdf)
1487. *Ph501 Problem Set 1,*  
[physics.princeton.edu/~mcdonald/examples/ph501set1.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set1.pdf)
1488. *Ph501 Problem Set 2,*  
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1489. *Ph501 Problem Set 3,*  
[physics.princeton.edu/~mcdonald/examples/ph501set3.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set3.pdf)
1490. *Ph501 Problem Set 4,*  
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1491. *Ph501 Problem Set 5,*  
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1493. *Ph501 Problem Set 7*,  
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1494. *Ph501 Problem Set 8*,  
[physics.princeton.edu/~mcdonald/examples/ph501set8.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set8.pdf)
1495. *Ph501 Problem Set 9*,  
[physics.princeton.edu/~mcdonald/examples/ph501set9.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set9.pdf)
1496. *Ph501 Problem Set 10*,  
[physics.princeton.edu/~mcdonald/examples/ph501set10.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set10.pdf)
1497. *Ph501 Problem Set 11*,  
[physics.princeton.edu/~mcdonald/examples/ph501set11.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set11.pdf)
1498. *Ph501 Problem Set 12*,  
[physics.princeton.edu/~mcdonald/examples/ph501set12.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501set12.pdf)
1499. *Ph501 Midterm Exam (October 2000)*,  
[physics.princeton.edu/~mcdonald/examples/ph501midterm\\_102300.pdf](http://physics.princeton.edu/~mcdonald/examples/ph501midterm_102300.pdf)

### **Physics 529: Elementary Particle Physics**

These lectures, written in the 1980's, give a sense of how the Standard Model came to be.

1500. *Ph529 Lecture 1: Why High Energy?*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52911.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52911.pdf)
1501. *Ph529 Lecture 2: History: The Strong Interaction*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52912.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52912.pdf)
1502. *Ph529 Lecture 3: History: Electromagnetic and Weak Interactions*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52913.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52913.pdf)
1503. *Ph529 Lecture 4: Detecting Elementary Particles*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52914.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52914.pdf)
1504. *Ph529 Lecture 5: The Electromagnetic Structure of Matter*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52915.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52915.pdf)
1505. *Ph529 Lecture 6: Elastic Scatterin fo Electrons and Hadrons*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52916.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52916.pdf)
1506. *Ph529 Lecture 7: Elastic Scatterin fo Electrons and Hadrons, II*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52917.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52917.pdf)
1507. *Ph529 Lecture 8: Inetastic Electron Scattering*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52918.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52918.pdf)

1508. *Ph529 Lecture 9: Invariance Principles and Conservation Laws*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52919.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52919.pdf)
1509. *Ph529 Lecture 10: Charge Conjugation, Isospin, etc.*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529110.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529110.pdf)
1510. *Ph529 Lecture 11: 3-Body Decays, Partial-Wave Analysis*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529111.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529111.pdf)
1511. *Ph529 Lecture 12: Phenomenology of the Strong Interaction at High Energies*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529112.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529112.pdf)
1512. *Ph529 Lecture 13: The Quark Model*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529113.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529113.pdf)
1513. *Ph529 Lecture 14: The Quark Model, II*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529114.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529114.pdf)
1514. *Ph529 Lecture 15: Heavy Quark States*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529115.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529115.pdf)
1515. *Ph529 Lecture 16: The Weak Interaction*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529116.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529116.pdf)
1516. *Ph529 Lecture 17: Weak Interactions, II*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529117.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529117.pdf)
1517. *Ph529 Lecture 18: CP Violation*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529118.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529118.pdf)
1518. *Ph529 Lecture 19: Neutrino Interactions*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529119.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529119.pdf)
1519. *Ph529 Lecture 20: The Need for a Better Theory*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529120.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529120.pdf)
1520. *Ph529 Lecture 21: The Glashow-Weinberg-Salam Model*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529121.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529121.pdf)
1521. *Ph529 Lecture 22: Test of the Glashow-Salam-Weinberg Model*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529122.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529122.pdf)
1522. *Ph529 Lecture 23: Quantum Chromodynamics*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph52923.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph52923.pdf)
1523. *Ph529 Lecture 24: Speculations*  
[physics.princeton.edu/~mcdonald/examples/ph529/ph529124.pdf](http://physics.princeton.edu/~mcdonald/examples/ph529/ph529124.pdf)

## Short Course on Astroparticle Physics (1988)

1524. *Lecture 1. Techniques of Astroparticle Physics*,  
[physics.princeton.edu/~mcdonald/papers/schladming1.pdf](http://physics.princeton.edu/~mcdonald/papers/schladming1.pdf)
1525. *Lecture 2. Gamma-Ray Protons and Photons*,  
[physics.princeton.edu/~mcdonald/papers/schladming2.pdf](http://physics.princeton.edu/~mcdonald/papers/schladming2.pdf)
1526. *Lecture 3. Solar and Supernova Neutrinos*,  
[physics.princeton.edu/~mcdonald/papers/schladming3.pdf](http://physics.princeton.edu/~mcdonald/papers/schladming3.pdf)
1527. *Lecture 4. Detectors for the Rest of the Universe*,  
[physics.princeton.edu/~mcdonald/papers/schladming4.pdf](http://physics.princeton.edu/~mcdonald/papers/schladming4.pdf)

## Short Courses on Accelerator Physics

1528. *A Short Course on Targetry for a Neutrino Factory and Muon Collider* (June 4, 2003)  
[physics.princeton.edu/~mcdonald/mumu/target/targettrans38.pdf](http://physics.princeton.edu/~mcdonald/mumu/target/targettrans38.pdf)
1529. *A Short Course on Targetry for Neutrino Superbeams, Neutrino Factories and Muon Colliders* (NuFACT06 Summer Institute, Aug 21, 2006),  
[physics.princeton.edu/~mcdonald/mumu/target/targettrans53.pdf](http://physics.princeton.edu/~mcdonald/mumu/target/targettrans53.pdf)