

Graduate Problem Solving

In preparation for the written part of the physics PhD qualifying exam

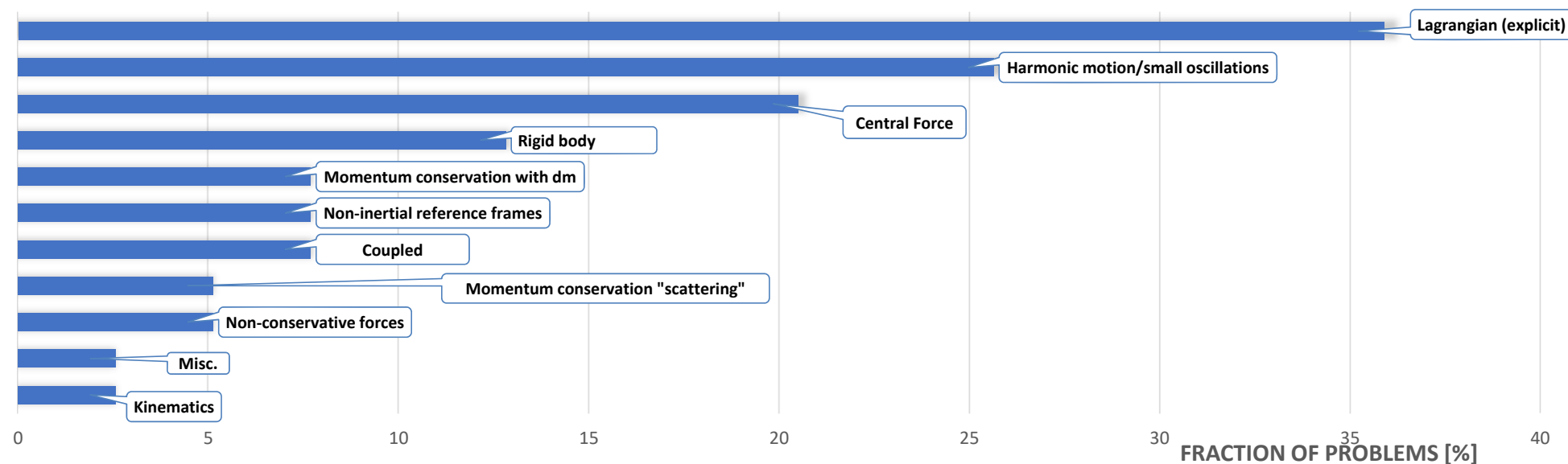
Written part of the Ph.D Qualifying exam

- Passing Qualifying exam required to advance to PhD candidacy
 - Written exam: administered early in the program, in two sessions each 4 hours long week before classes begin every year. Must pass before start of 3rd year in program.
 - Oral exam: administered mid program, 5 page writeup with hour long presentation of dissertation proposal.
- Analysis of all FIU: (by B. Raue, G. Potvin, R. Laird)
 - Focus on describing what topics covered, when and questions posed on the written part of the exam.
 - Exams explored are from 2009 through 2018 (First PhD awarded in 2004)
 - Data on topics covered, when per section
- Two sections:
 - Classical Physics: Classical Mechanics, Electromagnetism, Statistical Mechanics and Thermodynamics
 - Modern Physics: Quantum Mechanics, Special Relativity, Laboratory Practices and Modern Physics
 - Old Exams and information: <https://faculty.fiu.edu/~jrodrig/special-topics-qualifier-prep/>

Exam specifics, creation grading etc.

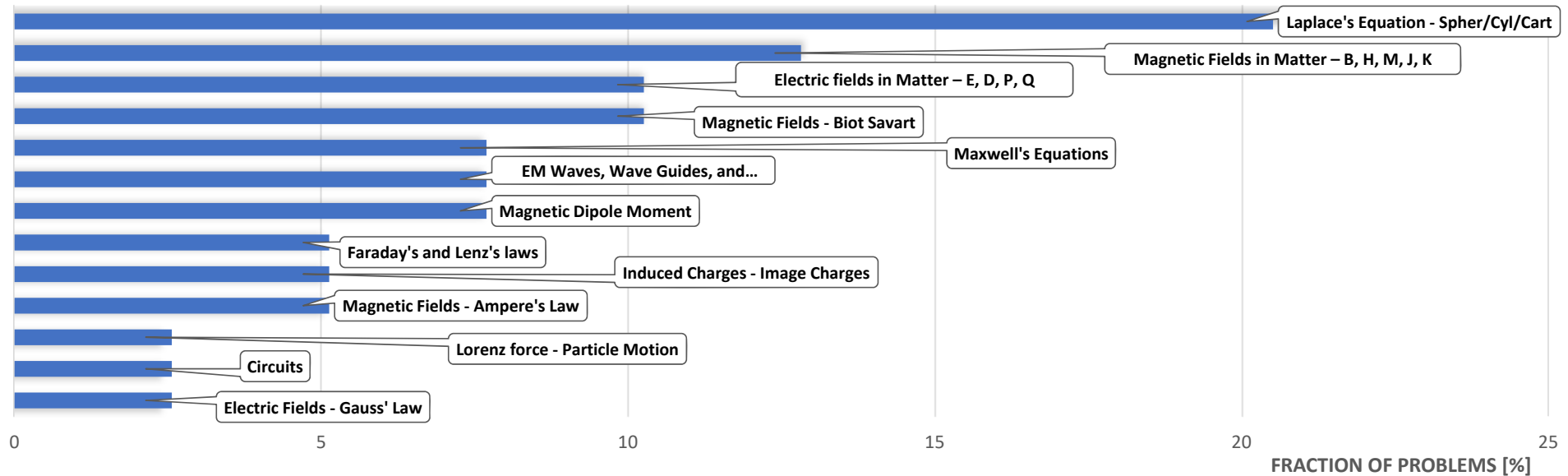
- Questions collected from FIU faculty (see table on website)
- GPC review, select and format questions
- Exam details: 9 total questions, 6 are turned in for grading
 - Classical Physics: 4 or 3 from mechanics, 3 or 4 from E&M and 2 from statistical mechanics and thermodynamics
 - Modern Physics: 4 or 5 from quantum mechanics, 5 or 4 from general modern physics
- Exams are graded on a strict pass or fail criteria
 - The pass/fail criteria varies each year per exam but is about $\sim 50\%$ - 60%
 - Each questions is graded by the faculty member who submitted question
 - Procedures are in place to check that grading is fair and equitable throughout.

Classical Mechanics (Classical Physics)



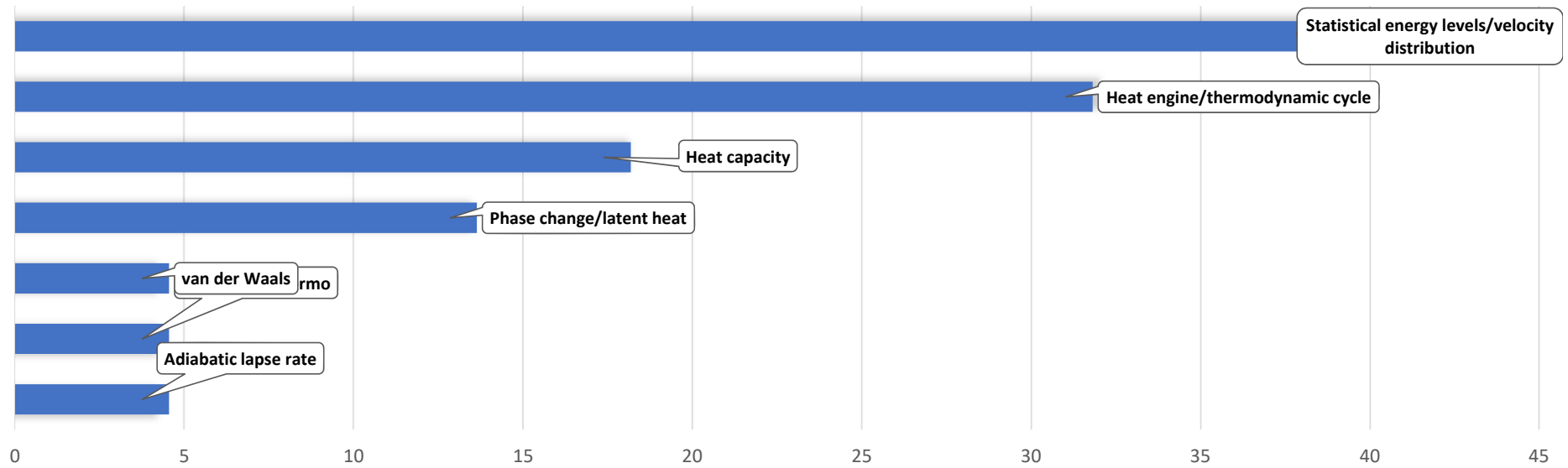
Topics	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	total
Lagrangian (explicit)	1	1	2	1	1	1	1	1	2	1	2	13
Harmonic motion/small oscillations		1		2	1		2		1	1	2	10
Central Force	1	1		1			3	1			1	7
Rigid body motion		1	1						1	1	1	5
Coupled oscillators			1		1					1		3
Non-inertial reference frames						1		1	1			3
Non-conservative forces						1				1		2
Momentum conservation "scattering"								1			1	2
Momentum conservation with dm	1	1	1									2
Kinematics				1								1
Misc.						1						1
Angular momentum conservation	1											0
Number of problems this year	4	3	4	3	3	3	4	4	4	3	4	35

Electromagnetism (Classical Physics)



Topics	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	total
Laplace's Equation - Spher/Cyl/Cart	1		1	1	1	1	1		1	1		7
Magnetic Fields in Matter - B, H , M, J, K		1			1			1	1		1	5
Magnetic Fields - Biot Savart		1	1							1	1	4
Electric fields in Matter - E,D, P, Q	1	1						1	1			3
Magnetic Dipole Moment		1							1	1		3
EM Waves, Wave Guides, and Radiation					1	1				1		3
Magnetic Fields - Ampere's Law							1				1	2
Maxwell's Equations	1			1		1						2
Induced Charges - Image Charges				1			1					2
Faraday's and Lenz's laws					1		1					2
Electric Fields - Gauss' Law			1									1
Circuits				1								1
Lorenz force - Particle Motion								1				1
Number of problems this year	3	4	3	4	4	3	4	3	4	4	3	36

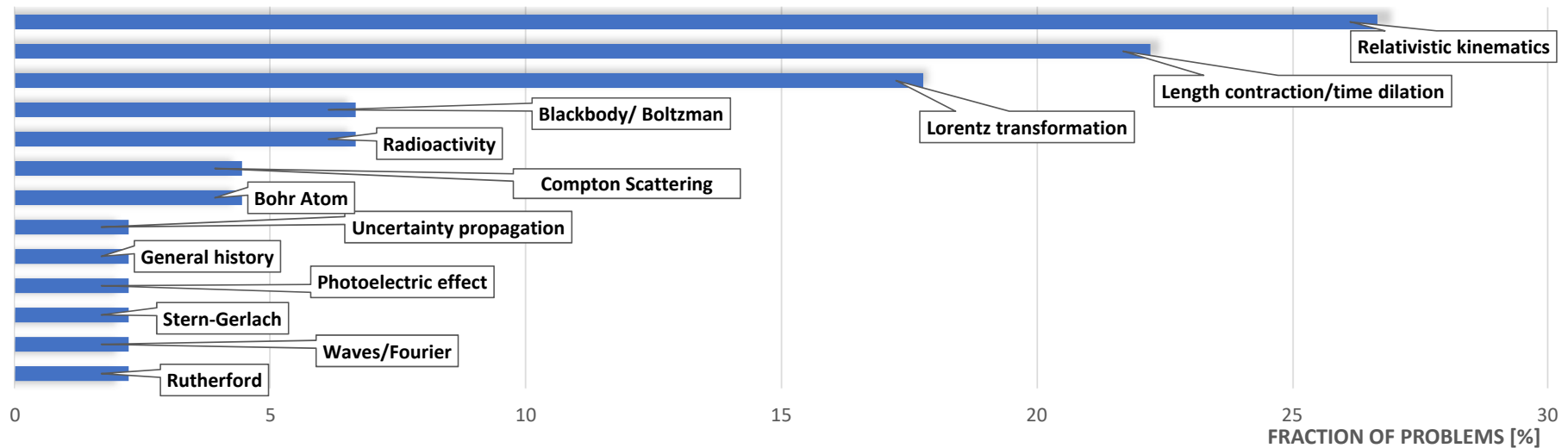
Statistical Mechanics & Thermodynamics (Classical Physics)



FRACTION OF PROBLEMS [%]

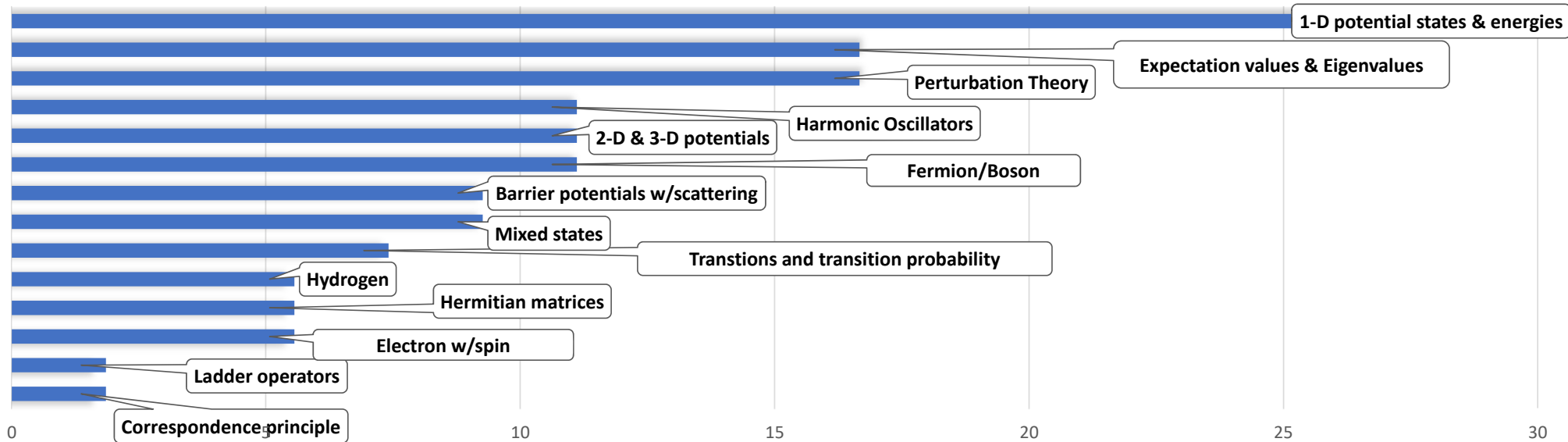
[illegible]

General Modern Physics (Modern Physics)



Topic	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	total
Relativistic kinematics	1	1	1	1	1	1	1	1	2	1	1	11
Length contraction/time dilation	1	1	1			1	2	2	1		1	9
Lorentz transformation		1		2	1			1	1	2		8
Radioactivity		1						1	1			3
Blackbody/Boltzman				1			1			1		3
Bohr Atom								1			1	2
Rutherford			1									1
Waves/Fourier											1	1
Stern-Gerlach									1			1
Photoelectric effect						1						1
General history						1						1
Compton					1							1
Uncertainty propagation	1		1									1
Total	3	4	4	4	4	4	4	5	5	4	4	42

Quantum Mechanics (Modern Physics)



Topic	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	total	FRACTION OF PROBLEMS [%]
1-D potential states & energies	1		1	2	2	2	1	1	2	1	2	14	
Perturbation	1	1	2	1	1	1				1	1	8	
Expectation values & Eigenvalues	1	2	2	1			1	1	1			8	
Fermion/Boson		1	1		1		1	1		1		6	
2-D & 3-D potentials		2	1					1		1	1	6	
Mixed states		1		2	1		1					5	
Barrier potentials w/scattering			1	1		1	1				1	5	
Quantum Harmonic Oscillator	1					1		1	2		1	5	
Transitions and transition probability					1		1		1	1		4	
Electron w/spin			1	1		1						3	
Hermitian matrices	1	1						1				2	
Hydrogen	2				1							1	
Correspondence principle											1	1	
Ladder operators									1			1	
Number of problems this year	6	5	5	5	5	5	5	4	4	5	5	48	