

Opening Quiz

Your answers to this quiz will not count towards the final grade, and will not be used for any other assessment of individual students. The sole purpose of the quiz is to help me map the background and interests of what seems to be an exceptionally diverse class, and to allow me to fine tune the course accordingly.

You are not supposed to know all the answers. In answering the technical questions please refrain from looking up the answers in Polchinski or elsewhere. The answers should be brief, please don't spend too much time on this assignment. Technical issues that appear in the questions will be discussed during the course of the semester.

Please bring your answers with you to the next class, Tue Jan 29.

Thank you.

– Petr Hořava

1. What is the direction of research you intend to pursue (or are pursuing) in your career?
2. What do you expect to learn in this course?
3. Do you have a favorite book or article on string theory? How much of Polchinski have you read so far?
4. Is there a particular aspect of string theory you would really want to learn about in this course? (You can be very specific.)
5. The first two lectures so far (the impressionistic “overview of an overview” of string theory) were: (a) too elementary (b) too difficult to understand (c) other (please explain).
6. Would you like the course to be very detailed and technical (at the cost of not covering too much ground and not discussing modern aspects of the theory) or would you prefer if the course covered more ground (at the cost of being somewhat schematic at times)?
7. What is your primary interest in studying string theory? What is, in your opinion, the most fascinating theoretical question in today's physics?
8. What is the difference between Neveu-Schwarz and Ramond fermions?
9. What is modular invariance?
10. What is M-theory?
11. What is a BRST operator?

12. List courses in quantum mechanics, quantum field theory, GR (and related subjects) that you have taken so far; what is your favorite book on quantum field theory? GR?
13. Give a definition of a Calabi-Yau manifold. What singles out Calabi-Yau manifolds as a particularly interesting class of string theory compactifications?
14. How many conserved supercharges are there in Type IIB theory on a Calabi-Yau 3-fold? Is the resulting theory chiral?
15. What is a G_2 holonomy manifold, and why is it of interest in string/M-theory?
16. Can you name a compactification of string theory that realizes an affine Lie algebra at level one as its symmetry? at level two?
17. Draw the Dynkin diagram of \widehat{E}_8 .
18. What is a D-brane? Can you think of more than two definitions? List all stable D-branes of Type IIA, Type IIB and Type I string theory in \mathbf{R}^{10} .
19. Write down the metric of the Schwarzschild black hole, in four spacetime dimensions. How is it different in five dimensions?
20. Draw the Penrose diagram of the Reissner-Nordstrom black hole.
21. What is the BPS condition? How is it related to supersymmetry? What are BPS states?