### 24.111: Philosophy of Quantum Mechanics, Spring 2016

## Homework 7: Bohmian Mechanics

1. In a single drawing, reproduce the series of drawings, from the blackboard, from class on $4 / 20$, of the Bohmian account of the stern-gerlach experiment. (The initial Wavefunction was a " 90 -up" Wavefunction, the magnets were set at 0 degrees. Show in your single drawing where the Wavefunction is at several stages of the experiment: where it is initially, where it is as it passes through the magnets, where it is after it passes through the magnets. Also show in your drawing the trajectory of the particle.) [2 points.]
2. Produce a new drawing showing two sequential stern-gerlach experiments: the first set of magnets should be set at 0 degrees, the second, set at 90 degrees. Only particles and Wavefunctions that go up through the first set of magnets enter the second set. Suppose that the initial Wavefunction is a " $90-\mathrm{up}$ " Wavefunction. As in question 1, show where the Wavefunction is at several stages of the experiment, and show the trajectory of the particle. (The hard part of this question is: what does the part of the Wavefunction that passes through the second set of magnets do when it passes through?) [4 points.]
3. Regarding the drawing from question 2: assume I was right in what I said in class about which initial positions for the particle in question 1 lead to the particle's being deflected up, and that an analogous claim is right for " 0 -up" wavefunctions and 90 degree magnets; then (here is the question for you to answer): where does the particle have to be, at the beginning of the experimental set-up you drew in question 2 , if it is to be deflected "up" through both sets of magnets? (To answer this question, you need to think of the set of possible starting points not as a circle, but as a solid sphere; you need to remember that "up through 90 degrees" really means "to the right, if one is traveling with the particle"; so you need to say where inside that solid sphere it needs to start.) [3 points]
4. Draw the Bohmian account of what goes on, with both the Wavefunction and the particle, in the two path experiment. (Choose for yourself where exactly the particle starts the experiment.) [6 points]
