

Bohm's approach and individuality

Abstract. In their discussion of identity and individuality in quantum mechanics, Ladyman and Ross (2007) are sympathetic to the view that quantum particles are not individuals, (or, at most, are weakly discernible individuals). In a footnote they acknowledge that there is a version of quantum theory, namely the Bohm theory, according to which particles do have definite trajectories at all times (see e.g. Bohm and Hiley 1993). This would suggest that quantum particles are individuals after all, with position being the property in virtue of which particles are always different from one another. However, Ladyman and Ross go on to refer to the work of Brown et al. (1996), which they interpret as implying that the properties normally associated with particles (mass, charge, etc.) are inherent only in the quantum field and not in the particles. They conclude: "Since none of the physical properties ascribed to the particle will actually inhere in points of the trajectory, giving content to the claim that there is actually a 'particle' there would seem to require some notion of the raw stuff of the particle; in other words haecceities seem to be needed for the individuality of particles of Bohm theory too." (2007: 136)

In this paper we draw attention to the fact that Brown et al. elsewhere (1999) suggest that it is reasonable to assume that in the Bohm theory properties such as mass and charge *also* reside in the particles. It thus seems that whether or not particles are individuals in non-relativistic quantum theory is a genuinely open question, in a stronger sense than Ladyman and Ross imply. We also briefly consider the possible implications of recent advances in "weak measurement" to the question of individuality in quantum theory.

In the second part of the paper we note that Bohm and Hiley have since the 1960s also been engaged with a broader scheme they call "the implicate order", which goes beyond the Bohm theory (Bohm 1980, Bohm and Hiley 1993: ch15, Pylykänen 2007). We will point out that this framework has some relevant similarities to Ladyman and Ross's ontic structural realism, while we also highlight some of the differences. We will finally briefly discuss how individuality can be understood in the implicate order scheme.

References

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