Comparison of Bohm's Quantum Potential hidden variable "lambdas" with Bell's "lambdas” and Joy Christian's (arxiv 0904.4259)"lambdas":

Peter Holland, in his book "The Quantum Theory of Motion, an Account of the de Broglie - Bohm Causal Interpretation of Quantum Mechanics" (Cambridge 1993) said:

"... 11.5.1 Bell's Inequality ... In discussing the EPR spin experiment Bell supposed that the results of the two spin measurements are determined completely by a set of hidden variables lambda and made two assumptions which he claimed should be satisfied by a local hidden-variables theory:

(i) The result A of measuring sigma1 . a on particle 1 is determined solely by a and lambda, and the result B of measuring sigma2 . b on particle 2 is determined solely by b and lambda , where a and b are unit vectors with a . b = cos(delta).
Thus A = A(a , lambda) = +/- 1 and B = B(b , lambda) = +/- 1
Possibilities such as A = A(a , b , lambda) and B = B(a , b , lambda) are excluded.

(ii) The normalized probability distribution of the hidden variables depends only on lambda : rho = rho(lambda).
Possibilities such as rho = rho(lambda , a , b) are excluded.
...
We now consider to what extent assumptions (i) and (ii) are valid in the causal [Bohm Potential] interpretation ... The hidden variables are then the particle positions x1 , x2 (the internal orientation spin vectors s1 , s2 along the trajectories are determined by the positions and the wavefunction ...) … the eventual results ... for each of sz1 and sz2 is determined by the intial positions of both particles and by delta , i.e., A = A (x1 , x2 , a . b) ,
B = B(x1 , x2 , a . b) Thus assumption (i) is not valid ...
Neither is assumption (ii) satisfied. ...
In reproducing ... the quantum mechanical correlation function ...
Ppsi(a , b) = ... = - cos(delta) ... the causal [Bohm Potential] interpretation disobeys both of Bell's basic assumptions. ...".

So, Bell's "lambdas" obey (i) and (ii) and so obey Bell's inequality
and
Bohm's "lambdas" violate (i) and (ii) and so violate Bell's Inequality
but obey the quantum experimentally observed correlation function.

Joy Christian (see arxiv 0904.4259) explicitly violates (i) by replacing
A = A(a , lambda) = +/- 1 and B = B(b , lambda) = +/- 1
with
A = A(a , lambda) in S2 and B = B(b , lambda) in S2.

However, Joy does not violate (ii). Joy says: "... once the state lambda is specified and the two particles have separated, measurements of A can depend only on lambda and a, but not b, and likewise measurements of B can depend only on lambda and b, but not a ...[compare the (ii)-violation by Bohm's lamdbas as stated above]... Assuming ... that the distribution rho(lambda) is normalized on the space /\, .we finally arrive at the inequalities ... exactly what is predicted by quantum mechanics ... we have been able to derive these results without specifying what the complete state lambda is or the distribution rho(lambda) is, and without employing any averaging procedure ... the correlations [for the examples of 0904.4259] … are simply the local, realistic, and deterministic correlations among certain points of ... S3 and S7 ... This implies that the violations of Bell inequalities ... have nothing to do with quantum mechanics per se ...".

So, even though Joy's lambdas do not violate (ii), when Joy "... derive[s] ... the exact quantum mechanical expectation value ... - a . b " Joy's result is consistent with that of Bohm's "lambdas".

Joy's "lambdas" are classical and local (in Joy's sense).

Bohm's "lambdas" are quantum and, since Joy does not change Bell’s (ii), nonlocal (in Joy's sense).

Joy's "lambdas" and Bohm's "lambdas" are consistent with each other with respect to their calculated quantum expectation values.

Could Joy's "lambdas" be considered as a Classical Limit of Bohm's "lambdas" ?

Consider again Peter Holland's book in which he says:
"... 6.9 Remarks on the path integral approach ... Feynman['s] ... route to quantum mechanics ... rests on the trajectory concept and so may be expected to have some connection with the causal [Bohm Potential]

formulation. ... Feynman provides a technique for computing ... the transition amplitude (Green function or propagator) ... from the classical Lagrangian ... One considers all the paths ... and associates with each an amplitude ... These tracks are ... called 'classical paths' ... one sums (integrates) over all the paths ... the solution .. is given by ... Huygens' principle ... of all the paths ... one of them will be the actual trajectory pursued by the quantum particle according to the [Bohm Potential] guidance formula ... We shall refer to ... it ... as the 'quantum path' ... For an infinitesimal time interval ... the propagator is just the classical wavefunction ... a finite path may be decomposed into many such infinitesimal steps, the net propagator being obtained by successive applications of Huygens' construction ... We may view the Feynman procedure as a method of obtaining the quantum action from the set of all classical actions. ...".

If Joy Christian's classical "lambdas" are identified with Feynman path Lagrangian / Green function propagators, and if their Huygens' sums can be seen to produce the Bohm "lambdas",
then Joy's work will show a nice smooth classical limit (as opposed to Bell's discordant classical limit) for the Bohm Quantum Potential.

If the Bohm Quantum Potential can then be used as a basis for a construction of a realistic AQFT (Algebraic Quantum Field Theory)
then maybe Joy Christian's work will help show a useful connection (and philosphical reconciliation) between
the Classical Lagrangian physics so useful in detailed understanding of the Standard Model
and
AQFT along the lines of the generalization of the Hyperfinite II1 von Neumann factor algebra used in my E8 physics model.

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