The Schwarzschild Solution:
A Reply to C. Corda's Rebuttal

Stephen J. Crothers
steve@plasmaresources.com
18th March 2016

In 2011 a paper by C. Corda was published in the Electronic Journal of Theoretical Physics (*A Clarification on the Debate on "the Original Schwarzschild Solution"*, *EJTP* 8, **No. 25** (2011) 65-82). On the 18th February 2016 my paper titled 'On Corda's 'Clarification' of Schwarzschild's Solution' was received by all editors of *EJTP*. C. Corda has written a rebuttal, titled '*Confusion and crackpottery by Mr. Stephen J. Crothers*'. In his rebuttal Corda attempts to justify his reproduction in his paper, without reference, of the bulk of the original paper by K. Schwarzschild (1916), by his mere relabelling, renumbering and rearrangement of Schwarzschild's equations, and contends that I have only emphasised his reproduction of Schwarzschild's derivation. That Corda reproduced twenty-five of the equations in Schwarzschild's paper is evident by comparison, as revealed in my paper. Moreover, I did not address only this in my paper, but also Corda's 'deformation of circumferences' and his alleged 'Schwarzschild sphere', along with the issues of general covariance and coordinate transformations.

After Eq.(30) in his paper Corda [1] states:

"Historically, the line-element (30) represents 'the original Schwarzschild solution' to Einstein field equations as it has been derived for the first time by Karl Schwarzschild in [3] with a slight different analysis."

As I have explained in my paper [2], Corda's derivation is not different from Schwarzschild's at all because it is in fact Schwarzschild's. Readers can consult [1], [2] and [3] to verify this for themselves.

In his rebuttal Corda [4] raised a number of points, claiming that I did not stress them in my paper. This is incorrect, as sections of my paper deal with each and every point Corda has listed in his 'rebuttal'.

1. Corda's deformed circumference is treated in Section 4 of my paper, titled, '*Corda's deformed circumference*' [2]. There it is revealed that Corda's 'generic' function *m* for deforming circumferences is just a renaming of Schwarzschild's function *G*. It is the ratio of the Gaussian curvatures of two different spherical surfaces and therefore has nothing to do with deformation of circumferences.

2. Using his deformed circumference, which he also calls an "*apparently different physical hypothesis*" Corda [4] says he "*clarified that this apparently different physical hypothesis permits to apparently circumnavigate the Birkhoff Theorem [4] which guarantees the unicity of the 'standard Schwarzschild solution'*". The 'standard Schwarzschild solution' is nothing but Hilbert's extension [5] of Droste's solution [6], the latter being a direct consequence of Schwarzschild's solution because Schwarzschild [3] could have selected it merely by setting his integration constant ρ to zero. This issue is treated in detail in Section 6 of my paper, titled '*The infinite equivalence class*' [2].

3. In his rebuttal Corda [4] states,

"*I showed that the origin of the coordinate system in Schwarzschild's original metric is NOT a single point, but it is the surface of a sphere having the gravitational radius, i.e. the surface of the Schwarzschild sphere [3]. This was realized NEITHER by Schwarzschild in [2], NOR by Mr. Crothers in [1], who insists in his ridiculous crackpottery.*"

In Section 6 of my paper I explained in detail that Corda's contention is false, because when a sphere initially centred at the origin of coordinates is moved away to some other place in the same space, it takes its centre with it. Hilbert however, unwittingly moved a sphere from the origin of coordinates, leaving its centre behind. As is standard for cosmology, Corda has also committed Hilbert's error. Schwarzschild did not make this error, as explained in [2]. Corda has confounded the term R in Schwarzschild's equation and the term r in Hilbert's equation with the radius, when in fact these terms are neither radii nor even distances in the respective equations.

4. Corda's arguments on 'gravitational collapse' I addressed in Section 5 of my paper, titled, '*Gravitational collapse*'.

5. Concerning general covariance and coordinate transformations, I addressed them in detail in Sections 6, 7 and 8 of my paper, the latter two sections titled, '*Isotropic coordinates*', and '*Other black holes*' respectively. In these sections of my paper I emphasized that satisfaction of Einstein's field equations is a necessary but insufficient condition for a solution for his 'gravitational field'. I even gave the example of replacing r in Hilbert's solution with e^r: the resulting equation violates neither Einstein's relevant field equations nor spherical symmetry, and has only one singularity, at $r = \ln(2m)$; nothing remarkable happens at $r = 0$.

In his 'rebuttal' Corda has not addressed any of my arguments in [2]. All he has done in [4] is briefly reiterated what is contained in his paper [1], proven false in paper [2].

References
[1] Corda, C., A Clarification of the Debate on "the Original Schwarzschild Solution", *EJTP*, **8**. No. 25, (2011) 65-82, http://arxiv.org/pdf/1010.6031v5
[2] Crothers, S.J., On Corda's 'Clarification' of Schwarzschild's Solution, *Hadronic Journal*, Vol. 39, 2016, http://vixra.org/abs/1602.0221
[3] Schwarzschild, K., On the gravitational field of a mass point according to Einstein's theory. *Sitzungsber. Preuss. Akad. Wiss., Phys. Math. Kl.*, 189, (1916)
[4] Corda, C., Confusion and crackpottery by Mr. Stephen J. Crothers, http://vixra.org/abs/1603.0235
[5] Hilbert, D., *Nachr. Ges. Wiss. Göttingen, Math. Phys. Kl.*, 53, (1917)
[6] Droste, J., The field of a single centre in Einstein's theory of gravitation, and the motion of a particle in that field, *Ned. Acad. Wet.*, S.A., v.19, 197, (1917)