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CORRECTION

Correction to: A simple property of the Weyl tensor for a shear, vorticity and acceleration-free velocity field

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In our paper "A simple property of the Weyl tensor for a shear, vorticity and acceleration-free velocity field" [1] the sentence: " ... a contraction with u^i gives: $0 = u^i \nabla_i E_{km} + \varphi E_{km}$" in the end of the proof of Theorem 1.1 (page 4) is wrong (actually, it gives $0 = u^i \nabla_i E_{km} + (n-1)\varphi E_{km}$).

The error partly changes Theorem 1.1 (stated in page 2) but does not affect Theorem 1.2 and all the other propositions in the paper, as well as the long evaluation in the Appendix.

The correct statement is:

Theorem 1.1 *In a twisted space-time of dimension* $n > 3$*:*

$$\text{(i)} \quad u_m C_{jkl}{}^m = 0 \implies \nabla_m C_{jkl}{}^m = 0$$
$$\text{(ii)} \quad \nabla_m C_{jkl}{}^m = 0 \implies u^p \nabla_p (u_m C_{jkl}{}^m) = -\varphi(n-1) u_m C_{jkl}{}^m$$

Proof The proof of statement (i) remains as given in page 4 of [1]. The proof of statement (ii) is as follows.

Consider the identity (8) for the Weyl tensor $C_{jklm} u^m = u_k E_{jl} - u_j E_{kl}$, where $E_{kl} = u^j C_{jklm} u^m$. Then: $u^p \nabla_p (C_{jklm} u^m) = u_k u^p \nabla_p E_{jl} - u_j u^p \nabla_p E_{kl}$.

The original article can be found online at https://doi.org/10.1007/s10714-018-2398-9.

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If $\nabla^m C_{jklm} = 0$ Eq. (15) holds, i.e. $u^p \nabla_p E_{ij} = -\varphi(n-1) E_{ij}$. Then:

$$u^p \nabla_p (C_{jklm} u^m) = -\varphi(n-1)(u_k E_{jl} - u_j E_{kl}) = -\varphi(n-1) C_{jklm} u^m$$

□

In the special case of generalised Robertson–Walker space-times the original statement $u_m C_{jkl}{}^m = 0 \Longleftrightarrow \nabla_m C_{jkl}{}^m = 0$ remains true (Theorem 3.4 of Ref. [2]).

References

1. Molinari, L.G., Mantica, C.A.: A simple property of the Weyl tensor for a shear, vorticity and acceleration-free velocity field. Gen. Relativ. Gravit. **50**, 81 (2018)
2. Mantica, C.A., Molinari, L.G.: On the Weyl and Ricci tensors of generalized Robertson–Walker space-times. J. Math. Phys. **57**(10), 102502 (2016)