Erratum to: Effects of Coulomb interactions and disorder in triple-Weyl semimetals^{*}

Eur. Phys. J. B (2017) 90: 204, <https://doi.org/10.1140/epjb/e2017-80090-y>

Aditya Banerjee^{1,2,a}

¹ Harish-Chandra Research Institute, Chhatnag Road, Jhansi, Allahabad, Uttar Pradesh 211019, India

² Homi Bhabha National Institute, Training School Complex, Anushakti Nagar, Mumbai, Maharashtra 400085, India

Received 27 August 2018

Published online 19 November 2018

© EDP Sciences / Società Italiana di Fisica / Springer-Verlag GmbH Germany, part of Springer Nature, 2018

The article was published with an important mistake in Section 5. The section deals with the effect of disorder on triple-Weyl semimetal (TWSM) through a simple renormalization group (RG) calculation. I recently realised that my equations and the consequent conclusion hold only for the case of ‘scalar’ disorder and not for vector disorder as considered in the original manuscript. Below, I present a corrected presentation of this section.

1 Model with disorder

We will now present a short study of the effect of weak (Gaussian) scalar disorder on TWSM. To the non-interacting action of the TWSM, we add the following disorder term

$$S_{dis} = \int d^4x V(x) \Psi^\dagger \sigma_0 \Psi, \quad (1)$$

where $V(x)$ is a white-noise Gaussian disorder potential with zero mean,

$$\langle V(x)V(x') \rangle = \lambda \delta^3(x - x'). \quad (2)$$

After applying the standard replica-averaging (labelled by indices i and j), the disorder term generates a four-fermion interaction term

$$S_{dis} = -\frac{\lambda}{2} \int d^3x d\tau d\tau' (\Psi_i^\dagger \sigma_0 \Psi_i)_{\vec{x},\tau} (\Psi_j^\dagger \sigma_0 \Psi_j)_{\vec{x}',\tau'}. \quad (3)$$

We can choose to carry out the RG calculations either on the four-fermion terms or on the disorder vertex terms. Making the latter choice, a simple one-loop calculation at zero external frequency (static disorder) for the disorder vertex obtains the following RG equation,

$$\frac{d \ln \lambda}{d\ell} = \frac{1}{3} + \frac{m\lambda}{4\pi v_z \Lambda^2}. \quad (4)$$

It is clear from the above equation that $\lambda = 0$ is the only fixed point and it is unstable, which means that the TWSM is unstable to weak scalar disorder in general and likely flows to a diffusive metal phase, as argued in [45] in which the authors also study the effects of vector disorders. We note that the normal Weyl semimetal also flows to a diffusive metal phase but only when the disorder strength is strong enough [25–35].

The reference numbers above are as in the original article.

^{*} The online version of the original article can be found at <https://doi.org/10.1140/epjb/e2017-80090-y>.

^a e-mail: adityabphyiitk@gmail.com