Erratum: Scattering theory of spin-orbit active adatoms on graphene [Phys. Rev. B **90**, 035444 (2014)]

Alexandre Pachoud, Aires Ferreira, B. Özyilmaz, and A. H. Castro Neto
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Recently, we discovered some mistakes in our article, which have led us to erroneously identify the type of transverse Hall current induced by top-position adatoms on graphene as the “charge Hall effect,” instead of a combination of valley Hall effect and spin Hall effect. These errors concern Sec. III C where we investigate the symmetry relations satisfied by coefficients $\mathcal{M}_{s\tau, s\tau}$ and phases $\varphi_{s\tau, s\tau}$ with $s = \uparrow, \downarrow$ and $\tau = K, K'$ characterizing the differential cross sections for spin- and valley-preserving scatterings with top-position adatoms. With the notations introduced just above Eqs. (75)–(78) in the original paper, the correct relations are

$$\mathcal{M}_2 = \mathcal{M}_{\uparrow K, \uparrow K}^A = -\mathcal{M}_{\downarrow K', \downarrow K'}^A, \quad (1)$$

$$\mathcal{M}_0 = \mathcal{M}_{\downarrow K, \downarrow K}^A = -\mathcal{M}_{\uparrow K', \uparrow K'}^A, \quad (2)$$

$$\varphi_2 = \varphi_{\uparrow K, \uparrow K}^A = \pi - \varphi_{\downarrow K', \downarrow K'}^A, \quad (3)$$

$$\varphi_0 = \varphi_{\downarrow K, \downarrow K}^A = \pi - \varphi_{\uparrow K', \uparrow K'}^A. \quad (4)$$

These relations directly result from Eqs. (25) and (26) of the original paper and are similar to Eqs. (40) and (41) of our paper derived for scattering with hollow-position adatoms in Sec. III B. However, the minus signs and π constants were omitted in Sec. III C where the top-position case is addressed. Relations (1)–(4) imply the following symmetries between transverse currents generated by a top-position adatom on sublattice site $\sigma = A(+1), B(-1)$:

$$J_{\uparrow K, \uparrow K}^{\sigma \perp} = -J_{\downarrow K', \downarrow K'}^{\sigma \perp}, \quad (5)$$

$$J_{\downarrow K, \downarrow K}^{\sigma \perp} = -J_{\uparrow K', \uparrow K'}^{\sigma \perp}, \quad (6)$$

which in turn imply the existence of charge-*neutral* transverse *valley* and *spin* currents,

$$J_V^{\sigma \perp} = \sum_{s, \tau} \tau J_{s\tau, s\tau}^{\sigma \perp} = -\sigma \frac{k_S v_F}{4} (\mathcal{M}_0 \sin \varphi_0 + \mathcal{M}_2 \sin \varphi_2), \quad (7)$$

$$J_S^{\sigma \perp} = \sum_{s, \tau} s J_{s\tau, s\tau}^{\sigma \perp} = -\sigma \frac{k_S v_F}{4} (\mathcal{M}_2 \sin \varphi_2 - \mathcal{M}_0 \sin \varphi_0). \quad (8)$$

respectively, and not a transverse charge current as suggested by Eq. (81) of our paper. We note that for the particular case of top-position adatoms without spin-orbit coupling (i.e., $\mathcal{M}_2 = \mathcal{M}_0$ and $\varphi_2 = \varphi_0$), the transverse spin current (8) is identically zero, but a nonzero transverse valley current (7) will be induced in general. The remaining equations of Sec. III C and Fig. 8 together with respective conclusions remain valid upon identification $J_C^{\sigma \perp} \rightarrow J_V^{\sigma \perp}$.

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